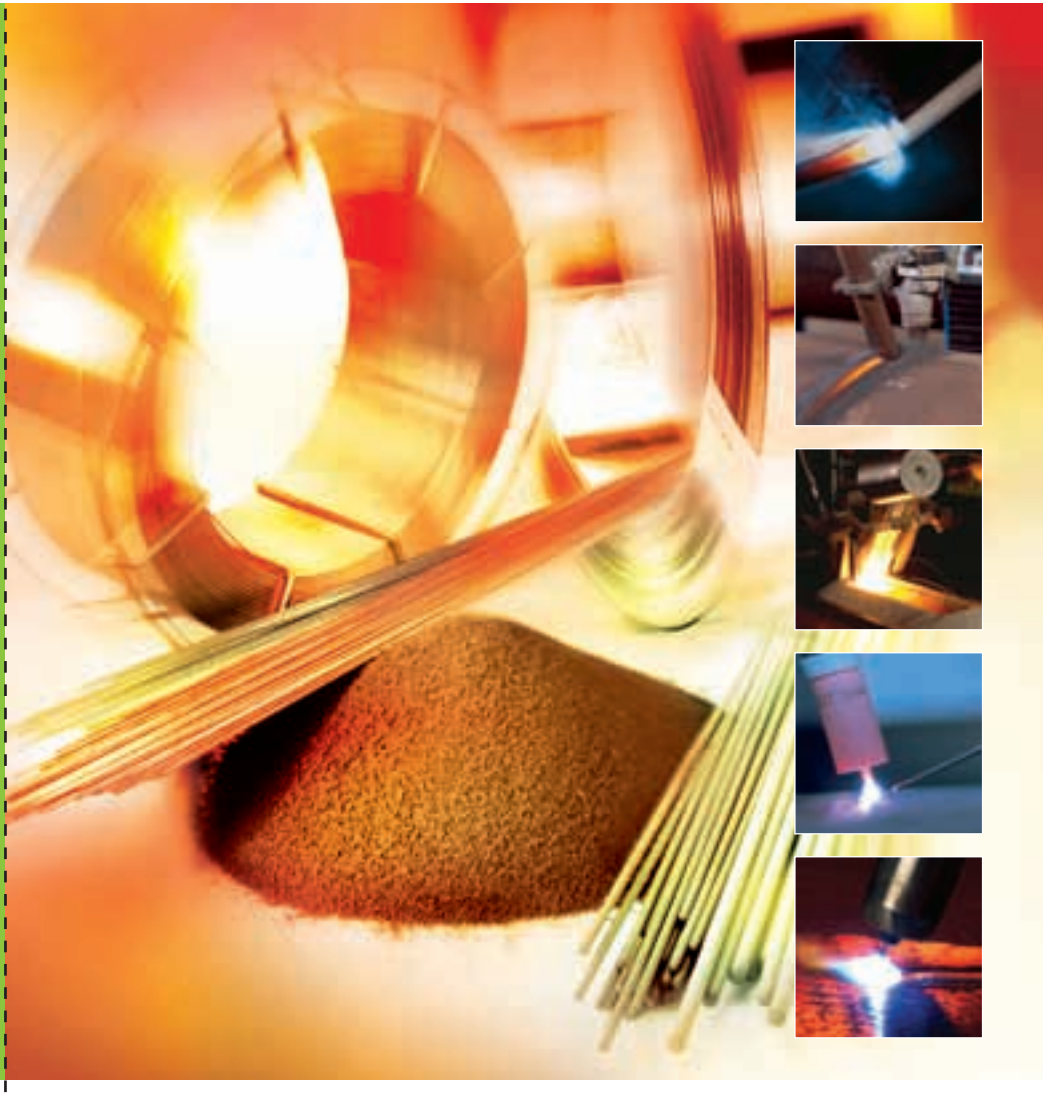
OERLIKON

Welding consumables catalogue



www.oerlikon.it

AIR LIQUIDE WELDING

OERLIKON

Welding Consumables









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.



Content presentation

General Advice

	Product Data Sheets	page 11
	Welding positions	page 13
General information	Batches	page 14
	Approvals and homologations	page 15
	CE marking, approvals and homologations	page 16
Steel grade designation	EN Standards	page 19
Steel designation	Most common steel equivalence table	page 21
General advice	Standard suggested consumable choices	page 34
	Materials testing certificate	page 36
	Standard comparison gases	page 37
Cross reference	Brinell, Vickers, Rockwell & Shore hardnesses	page 39
	Fracture energy conversions	page 41
Metallurgy reminders	Corrosion	page 42
	Ferritic steels: determination of hot cracking sensiti...	page 43
	Diagrams for stainless, austenitic & refractory steels	page 44
	Equivalent carbon and preheating temperature	page 47
	Welding of low alloyed construction steels	page 48
	The basicity index	page 49
	Nickel & alloys, alloys sensitive to hot oxidation	page 50
Efficiency	Metal desposited per meter of weld	page 51

1

MMA Electrodes

Overview of MMA Electrodes		page 55
Notes on MMA electrodes	EN Standards	page 59
	Storage and handling	page 71
Product Data Sheets	C-Mn and low-alloy steels	page 73
	Weathering steels	page 106
	High-strength steels	page 108
	Chromium-Molybdenum steels	page 112
	Stainless and Heat resistant steels	page 134
	Nickel and Copper alloys	page 177
	Cast-iron	page 188
	Aluminum alloys	page 191
	Hardfacing	page 194
	Cutting	page 205

2

Content presentation

3 MIG/MAG Solid Wires-TIG rods

Overview of MIG/MAG Solid Wires-TIG rods		page 209
Notes on MIG, MAG, TIG wires	EN Standards	page 211
	Operating and performance parameters	page 217
Product Data Sheets	C-Mn and low-alloy steels	page 219
	Weathering steels	page 241
	High strength steels	page 243
	Stainless and Heat resistant steels	page 248
	Nickel and Copper alloys	page 268
	Aluminum alloys	page 281
	Hardfacing	page 287

4 TIG Rods

Overview of TIG Rods		page 291
Product Data Sheets	C-Mn steels and low-alloy steels	page 293
	Stainless and Heat resistant steels	page 313
	Nickel and Copper alloys	page 331
	Aluminum alloys	page 340

5 MIG/MAG Cored Wires

Overview of MIG/MAG Cored Wires		page 347
Information : Flux Cored Wires	FLUXOFIL process	page 349
	EN Standards	page 350
	Structure of tubular cored wires	page 358
	Operating and performance parameters	page 359
Product Data Sheets	C-Mn and low-alloy steels	page 373
	Weathering steels	page 406
	High-strength steels	page 409
	Chromium-Molybdenum steels	page 419
	Stainless and Heat resistant steels	page 424
	Hardfacing	page 452

Content presentation

6 Submerged Arc Welding

Notes	for submerged arc welding	page 465
	for strip cladding	page 468
	for submerged arc welding	page 465
	EN Standards	page 471

7 SAW Fluxes

Overview of SAW Fluxes		page 477
Product Data Sheets	SAW Rutile-Acid Fluxes	page 478
	SAW Basic and Semi-basic Fluxes	page 497
	SAW Basic Fluxes	page 524
	Stainless and Heat resistant steels	page 527
	Hardfacing	page 536
	Backing	page 540
	Cladding	page 541

8 Electroslag Fluxes

Overview of Electroslag Fluxes		page 549
Product Data Sheets	Cladding Fluxes	page 550

9 SAW Solid Wires

Overview of SAW Solid Wires		page 559
Product Data Sheets	C-Mn and low-alloy steels	page 560
	Stainless and Heat resistant steels	page 565
	Nickel and Copper alloys	page 568

10 SAW Cored Wires

Overview of SAW Cored Wires		page 571
Product Data Sheets	C-Mn and low-alloy steels	page 572
	Hardfacing	page 578

Content presentation

11

Cladding Strips

Overview of Cladding Strips page 591
Product Data Sheets page 592

Notes for the user

General information	Rules for welding aluminium and aluminium alloys	page 597
Appendix-Notes for the user	Types of cast iron	page 598
	Heterogeneous welding of cast iron	page 599
	Assignment of welding consumables	page 600
	Consumables choice for hardfacing	page 601
	Position of welding consumables	page 602
	Welding of austenitic stainless and heat resisting steels	page 605
Appendix-Notes for the user	Rules for welding aluminium and aluminium alloys	page 597

12

Standard forms of delivery	Electrodes	page 609
	Wire for MIG/MAG Welding	page 610
	Wire for Submerged Arc	page 613
	Wire for MIG/MAG Welding	page 614
	Wire for Submerged Arc Welding	page 615

Alphabetical Index page 617

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.

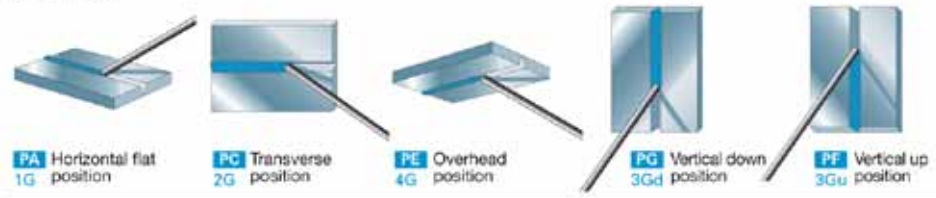
The packaging of the welding-consumables must not be stored in direct contact with the floor or walls and storage should be on pallets or shelves.

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.

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

Butt welds



Fillet welds



Pipe welds



Pipe welds



Standard product batches

Our welding product batches according to UNI EN ISO 14344:2010.

This standard defines the different classes of batches possible for each category of welding products (coated electrodes, flux cored wires, solid wires and fluxes).

UNI EN ISO 14344: Welding consumables -Procurement of filler materials and fluxes

- Welding and allied
- Process of electric welding gas-shielded and flux
- Guidelines for the supply of consumables

This standard provides the classification of batches:

- Solid wires, rods and strip: class S1, S2, S3, S4
- Flux cored wires: Class T1, T2, T3, T4
- Covered electrodes: C1, C2, C3, C4, C5
- Flux: Class F1, F2

Depending on requirements, most of our products can be manufactured to Nuclear Quality Assurance standards. These are known as "Nuc" products.

Contact us for details.

General

In Italy and abroad, a certain number of public and private Organisms and Establishments give approvals, qualifications or homologations on the basis of specific technical specifications or according to the standards in force. Some others "certify" or "accredit" the production sites which themselves supply products meeting Standards or specific specifications.

Among the main Organisms or Establishments we must mention:

The Maritime classification and/or control Companies:
* BUREAU VERITAS (B.V.).
* LLOYD'S REGISTER OF SHIPPING (L.R.S.).
* AMERICAN BUREAU OF SHIPPING (A.B.S.).
* DET NORSKE VERITAS (D.N.V.).
* CONTROLAS (C.L.).
* GERMANISCHER LLOYD (G.L.).
* TECHNISCHER ÜBERWACHUNGSVEREIN (T.Ü.V.).
* FORCE INSTITUTE.

Reminders of terminology

- ACCREDITATION: act of giving backing to the application of a regulation or of a system (e.g.: Quality Assurance system).
- APPROVAL: recognition of the quality of a product by an administrative authority.
- CERTIFICATION: written assurance from a qualified organism concerning the respecting of specific procedures.
- HOMOLOGATION: approval of the utilization of a product by an administrative authority.
- QUALIFICATION: act of satisfying a set of technical conditions to be able to satisfy a regulation.
- CLASSIFICATION: A product is said to be "classified" according to a standard or a code when its characteristics have been verified and conform to the requirements of the considered standard or code.

1 - BUREAU VERITAS

Mechanical characteristics corresponding to approval grade:			
Grade	Rm (MPa)	Re 5 (MPa)	A % 5 d
1, 2, 3	400-560	≥ 305	≥ 22
1Y, 2Y, 3Y	490-640	≥ 355	≥ 21

Impact resistance level CVN(J)			
Grade	Manual welding	Automatic welding	T °C
1, 1Y	≥ 47	≥ (34)	+ 20
2, 2Y	≥ 47	≥ (34)	0
3, 3Y	≥ 47	≥ (34)	- 20

2 - LLOYD'S REGISTER OF SHIPPING (LRS)

Mechanical characteristics corresponding to approval grade:			
Grade	Rm (MPa)	Re (MPa)	A % 5 d
1, 2, 3	400-560	≥ 305	≥ 22
1Y, 2Y, 3Y	490-660	≥ 375	≥ 22

Impact resistance level CVN(J)			
Grade	Manual welding	Automatic welding	
1, 1Y	≥ 47	≥ (34)	+ 20
2, 2Y	≥ 47	≥ (34)	0
3, 3Y	≥ 47	≥ (34)	- 20

3 - AMERICAN BUREAU OF SHIPPING (ABS)

Mechanical characteristics corresponding to approval grade:			
Grade	Rm/UTS (MPa)	Re/Ys (MPa)	A/E % 5 d
1, 2, 3	400-560	≥ 305	≥ 22
1Y, 2Y, 3Y	490-655	≥ 370	≥ 20

Impact resistance level CVN(J)			
Grade	Automatic welding	Manual and semi-auto welding	T °C
1	34	47	+ 20
1Y	40	54	+ 20
2	34	47	0
2Y	40	54	0
3	34	47	- 20
3Y	40	54	-20

4 - DET NORSKE VERITAS (DNV)

Mechanical characteristics corresponding to approval grade:				
Grade : wire/flux	Grade : electrodes	Rm/UTS (MPa)	Re/Ys (MPa)	A/E % 5 d
I, II, III				
IY, IIY, IIIY, 1, 2,	1, 2, 3	400-490	> 305	≥ 22
1Y, 2Y, 3Y	1Y, 2Y, 3Y	490-560	≥ 375	≥ 22

Impact resistance level CVN(J)			
Grade	Manual welding	Automatic welding	T °C
1, I	≥ 47	≥ (34)	+ 20
2, II	≥ 47	≥ (34)	0
3, III	≥ 47	≥ (34)	- 20
2Y, IIY	≥ 47		0
3Y, IIIY	≥ 47		- 20
DP : High penetration electrode			
HH : Very low hydrogen content			

CE Marking

Guidelines on construction's products (CPD) (89/106/EEC).
When the conditions of UNI EN 13479:2006 are met and once the notify body established the certification, the manufacturer or its agent is authorized to affixed the CE marking.

Approvals by the maritime classification or control societies

(Bureau Veritas, Lloyd's Register of Shipping, American Bureau of Shipping, Det Norske Veritas, Germanischer Lloyd).
The Classification Societies have, over the years, established a "common platform" called the "Unified Rules" for the homologation of welding products for ship's hull quality steel. However, each of them has additional specific requirements.

There are two main product classes for ship's hull steels:
- those for steels comparable to AFNOR S235 J2G3 (E 24 grade).
- those for steels comparable to AFNOR S355 K2G3 (E 36 grade).

In each class, there are several grades according to the strength and temperature requirements. For the wire/flux combinations, different levels may be required depending on whether they are used for semi-automatic or automatic welding.

In addition, for low alloyed and stainless steels, some Classification Societies give Approvals or operating authorizations, on the basis of tests to specific specifications. For example, for B.V., they are designated U.P. (Special Purpose); for A.B.S. they are designated according to the A.W.S. system.

5 - GERMANISCHER LLOYD (GL)

German organisation. Their monitoring system is based as the DNV, LRS and ABS on the respect of mechanical characteristics corresponding to the grade of the approval.

6 - SOCIETIES CLASSIFICATIONS

All this data managed by the T.Ü.V. administration is published in specific files per product.

Quality assurance

Quality assurance is designed to give confidence to users by obtaining a required quality by the implementation of prior, systematic measures. These measures are formalized into procedures written in the Quality Assurance Manuals.

These manuals describe a Quality Assurance System (or quality organization) in conformity particularly with the Quality Assurance requirements generally required in the Construction of Nuclear Power stations and other high technology structures (International Atomic Energy Agency (IAEA) code of working practices n° 50-C-QA - Standards ISO 9000 and EN 12074standards).

Through our Quality Assurance systems, our plants have been regularly audited since 1973 by the main users of welding products destined for the Construction of Nuclear Powerstations, but also by representatives of the main Administrations (Armaments, SNCF).

This experience in matters of Quality Assurance benefits all our production: the CE (EN 13479) approval for all our Establishments and the accreditation of our plants in conformity with ISO 9000 are proof of this.

All our products are now manufactured to a Quality Assurance program. The terms of this program can be modified according to well-defined models.

- Final conformity inspection
- Supplied product production technical inspection
- Production and organization inspection.

The choice of the Quality Assurance measures applied to the supply and manufacture of a welding product is guided by the evaluation of the risks inherent in the consequences of a non conformity of the product. This is to take account of the very great diversity of constructions produced using the welding product we supply, these are:

- standard products
- products manufactured with Technical Inspection of the production of the supplied items
- “nuclear” products which are differentiated from the first products by the application of more complete and more stringent Quality Assurance measures, particularly concerning order processing, archiving, production monitoring and inspection.

Certification

- by a notify body according to guidelines on construction products
- by the armaments services
- by the railroads

On the ISO 9000 Standards model, the Armaments services have set up a quality assurance system.
The SNCF has also set up a quality assurance system on the same bases. The coated electrode production plant is certified AQF 2.
The sales departments, as well as logistic organization are also approved according to ISO so as to complete the Quality chain.

Extract from UNI EN 10027-1:2006

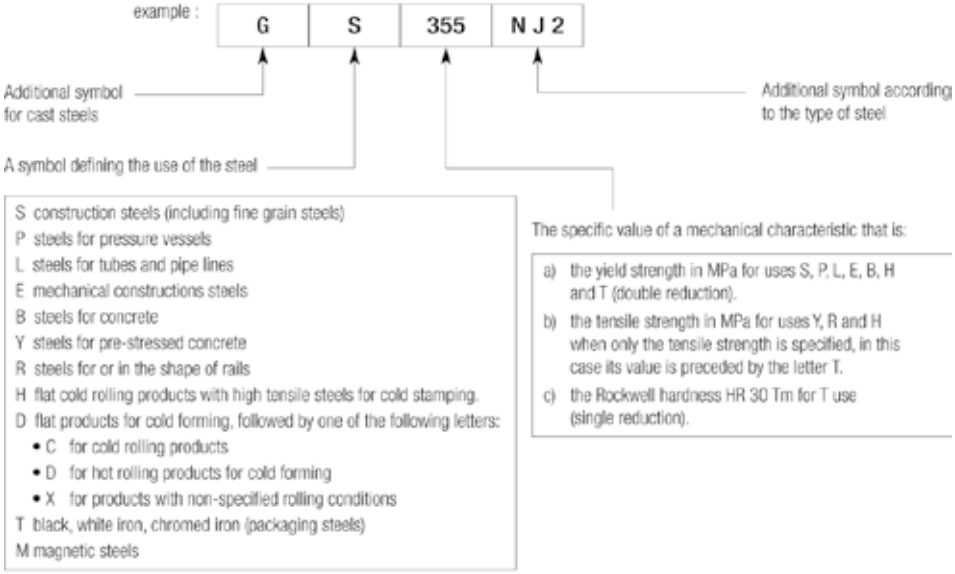
This standard is a steel material designation system based on names consisting of alpha numerical characters that define two main groups of steels:

Group 1- steels designated on the basis of their use and their mechanical properties.

Group 2- steels designated on the basis of their chemical composition

Group 1

Steels described starting from their use and their mechanical or physical characteristics.



Note :

• Pages "Steels designation system" show and complete the symbolic description rules of UNI EN 10027-1:2006.

• So as not to overload the chart, we did not present the symbol elements referring to steels particularly rarely used in welding.

Group 2

Steels described starting from their chemical composition are divided into four categories:

1- Non alloyed steels (excluding free machining steels) with an average manganese content < 1 %. The letter C followed by one hundred times the average content specified in percentage (e.g. C35 is a mild steel with 0,35% C)

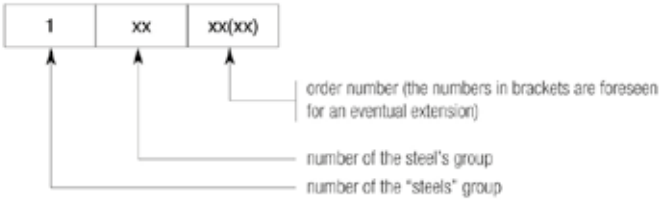
2- Non alloyed steels with a manganese content < 1 %, non alloyed free machining steels and alloyed steels (excluding high speed steels) of which the content of each alloy element is < 5 %. The relevant coding consists of 100 x Carbon % content then chemical symbols indicating most important alloys then number indicating the associated % contents multiplied by a specific factor. (e.g. 13CrMo4-5 is a 0,13% C, 1%Cr (4/4) e 0,5% Mo (5/10)steel).

3- Alloyed steels (excluding high speed steels) of which the content of at least one alloy element is < 5 %.Same principle by using the letter X instead of Z and the chemical symbols of the alloy elements (X4CrNiMo17.12.2 stainless steel 0,04%C, 17 % Cr, 12Ni, 2% Mo).

4- High-speed steel: HS followed by %W-%Mo- %V-%Co (e.g. HS 18-0-1, W=17.5–18.5 %; Mo=max 0.6%, V=1–1.2 %)

Extract from UNI EN 10027-2:1993

This standard is based on a numerical system. The steel numbers consist of 1 followed by a point and 4 figures. The steel numbers are allocated by a European Registering Office. The registering authority has been given to VDEh in Dusseldorf.



Each number must refer to a single grade.

The numbers are issued by the European Registration Office on request:

- of Technical Committees at the time of establishment of the European Standards
- of national standardisation organisations at the time of establishment of national Standards or for trademark steels on request of the manufacturers.

Some number ranges identifying the general number trends are listed below
Note: XX numbers (01-99)are allocated sequentially

Carbon Steels
Number = 1.00XX (& 1.90XX)..Base Steels
Number = 1.01XX(& 1.91XX)..Quality Steel (General structural steels with Rm < 500MPa)
Number = 1.02XX(& 1.92XX)..Other Structural Steels (Not intended for heat treatment with Rm < 500MPa)
Number = 1.03XX(& 1.93XX)..Steels with average C< 0,12% or Rm < 400 MPa
Number = 1.93XX..Steels with average C< 0,12% or Rm < 400 MPa
Number = 1.04XX(& 1.94XX)..Steels with average C >= 0,12% < 0,25% or Rm ≥ 500 MPa
Number = 1.06XX(& 1.96XX)..Steels with average C > 0,55% or Rm ≥ 700 MPa
Number = 1.07XX (& 1.97XX)..Steels with higher P or S content

Special Carbon Steels
Number = 1.10XX (& 1.90XX) ..Special steels (Steels with special physical properties)
Number = 1.11XX ..Special steels (Structural Pressure vessel and engineering steels with C < 0,5%)
Number = 1.12XX(& 1.90XX) ..Special steels (Structural Pressure vessel and engineering steels with C ≥ 0,5%)
Number = 1.13XX ..Special steels (Structural Pressure vessel and engineering steels with special requirements
Number = 1.14XX..Special steels

Alloy Steels
Number = 1.08XX(& 1.98XX)..Steels with special physical properties
Number = 1.09XX(& 1.99XX)..Steels for other applications
Number = 1.2000-1.2999-..Tool Steels

Generally encountered in construction

The equivalence tables have been compiled from old national standards to compare most common steel grades;

Each of the tables corresponds to a steel category:

1 - Steels for metal and mechanical construction.
2 - Steels for boilers and pressure vessels.
3 - Special steels for heat treatment.
4 - Stainless and refractory steels.

Each table gives the equivalent steel grades for Germany, United Kingdom, United States, Italy, Sweden, Japan, and Spain.

At the publishing date of this guide, the Standardisation of Steels is in full evolution; it is therefore difficult to place in equivalence the EN standards (published up to now), with the national standards taken in reference beings that some of them will disappear.

Steels for metallic and mechanical construction

The cross references are given for information only, since the standard descriptions are not all totally equivalent.
See table next pages

Steel designation

Most common steel equivalence table

Equivalent FRANCE (NF A 35 - 501) (NF A 36 203)	EU 25-72	NF EN 10 025 : 1990		GERMANY (DIN 17 100) (DIN 17 102)	UNITED KINGDOM (BS 4360)
		designation NF EN 10 027-1	according NF EN 10 027-2		
A33	Fe 310 0	S 185	1.0035	St 33 (1.0035)	
A 34-2					
A 50-2	Fe 490-2	E 295	1.0050	St 50-2 (1.0050)	
A 60-2	Fe 590-2	E 335	1.0060	St 60-2 (1.0060)	
A 70-2	Fe 690-2	E 360	1.0070	St 70-2 (1.0070)	
E 24-2	Fe 360 BFU	S 235 JRG 1	1.0036	U St 37-2 (1.0036)	40 B
E 24-2 (NE)	Fe 360 BFN	S 235 JRG 2	1.0038	R St 37-2 (1.0038)	
E 24-3	Fe 360 C	S 235 JO	1.0114	St 37-3 U (1.0116)	40 C
E 24-4	Fe 360 D 1 Fe 360 D 2	S 235 J 2 G 3 S 235 J 2 G 4	1.0116 1.0117	St 37-3 N (1.0116)	40 D
E 28-2	Fe 430 B	S 275 JR	1.0044	St 44-2 (1.0044)	43 B
E 28-3	Fe 430 C	S 275 JO	1.0143	St 44-3 U (1.0144)	43 C
E 28-4	Fe 430 D 1 Fe 430 D 2	S 275 J 2 G 3 S 275 J 2 G 4	1.0144 1.0145	St 44-3 N (1.0144)	43 D
E 34-2					
E 36-2		S 355 JR	1.0045		50 B
E 36-3	Fe 510 C	S 355 JO	1.0553	St 52-3 U (1.0570)	50 C
E 36-4	Fe 510 DD 1	S 355 K 2 G 3	1.0595		50 D
E 275 D					
E 355					
E 355 D		S 355 MC	1.0976	Q St E 340 TM (1.0974)	
E 355 FP	Fe E 355 KT N	S 355 NL	1.0566	T St E 355	50 EE
E 355 R	Fe E 355 KG N	S 355 N	1.0562	St E 355	
E 420					
E 420 FP				St E 43 (T.T.)	
E 420 R				St E 420	
E 420 TR		S 420 MC	1.0980		
E 430 D				Q St E 420 TM (1.0980)	
E 460	Fe E 460 KT N	S 460 NL	1.8915		
E 460 FP				T St E 460	55 EE
E 460 R				St E 460	
E 460 TFP		S 500 MC	1.0984		
E 490 D				Q St E 500 TM (1.0984)	
E 500 TFP					
E 550 FP					
E 650 R					
E 650 TFP					
E 650 TR					
E 650 FP					
E 690 R					
E 690 TR					

Steel designation

Most common steel equivalence table

UNITED STATES (ASTM)	ITALY (UNI 7070) (UNI 7382)	SWEDEN (MNC 810) (MNC 850)	JAPAN (JIS G 3101) (JIS G 3106)	SPAIN (UNE 36080) (UNE 36081)
	Fe 320	13 00 00		A 310-0
A 570 gr 30	Fe 330 B		55 34	
	Fe 480		SS 50	A 490
	Fe 580			A 590
	Fe 650			A 690
A 570 gr 33	Fe 360 B	13 12 00		AE 235 BFU
A 284 gr D - A 283 gr C et D				AE 235 BFN
A 573 gr 8 - A 284 gr D	Fe 360 C			AE 235 C
	Fe 360 D			AE 235 D
A 570 gr 40		14 12 00		AE 275 B
A 573 gr 70	Fe 430 B et C			AE 275 C
	Fe 430 D	14 14 00 et 01		AE 275 D
A 570 gr 50 - A 283 gr B				
A 709 gr 50 - A 570 gr 50	Fe 510 B		Class 3 A SM 50 YA	AE 355 B
A 709 gr 50	Fe 510 C	21 32 01	Class 3 B SM 50 YB Class 4 B SM 53 B	AE 355 C
	FE 510 D	21 34 01 - 21 35 01	Class A C SM 53 C	AE 355 D
	Fe E 355			
A 633 gr C	Fe E 355 KT N	14 21 35		
A 441 - A 588 - A 572 gr 50	Fe E 355 KG N	14 21 35		
A 633 gr E	Fe E 420			
A 572 gr 60				
A 678 gr B				
	Fe E 460			
A 572 gr 65	KG			
A 710 gr A Cl 2	Fe E 460 KG N			
A 710 gr A Cl 3		26 14 03 - 26 15 03		
A 710 gr A Cl 1				
		26 25 03		
		26 24 03		
A 709 gr 100				
A 514				
A 709 gr 100				

Steels for boilers and pressure vessels (Part. 1)

The cross references are given for information only, since the standard descriptions are not all totally equivalent.

Equivalent FRANCE (NF A 36 205) (NF A 36 206) (NF A 36 208) (NF A 36 210)	NF EN according		GERMANY (DIN 17 155) (DIN 17 135) (DIN 17 280)	UNITED KINGDOM (BS 1501)
	EN 10 207	EN 10 208		
A 37 AC				
A 37 AP	SPH 235		HI	
A 37 CP			HI	1/gr 360-161
A 37 FP		P 235 GH	A St 35	
A 42 AC				
A 42 AP	SIPH 265	P 265 GH	H II	gr 360-164/gr 400-164
A 42 CP			H II	gr 400-161/gr 430-161
A 42 FP		P 265 GH	A St 41	gr 400-224
A 47 FP				
A 48 AP		P 295 GH	17 Mn 4	gr 400-164
A 48 CP			17 Mn 4	
A 48 FP		P 295 GH	A St 45	gr 460-224
A 52 AP		P 355 GH	19 Mn 6	
A 52 CP			19 Mn 6	
A 52 FP			A St 52	gr 460-224/gr 490-224
A 510				
A 510 AP				gr 490-223
A 510 CP				gr 490-223
A 510 FD				gr 490-225
A 550				
A 460 TFP				
E 460 TR				
E 500 TFP				
E 550 TFP				
E 690 FP				
16 Mo 3			15 Mo 3	243
15 CD 2.05				
13 Cr Mo 4.5			13 Cr Mo 4.4	620
11 Cr Mo 9.10			10 Cr Mo 9.10	622/515
12 CD 9.10				
18 MD 4.05				
15 MDV 4.05				
16 MND 5				
20 MND 5			20 Mn-Mo Ni 5.5	
0.5 Ni 285				
0.5 Ni 355				
1.5 Ni 355				
1.5 Ni 285			14 Ni 6	
3.5 Ni 285				503
12 Ni 14			10 Ni 14	
5 Ni				
X 12 Ni 5			12 Ni 19	
9 Ni 480				
X 8 Ni 9			X 8 Ni 9	9% Ni-509
X 7 Ni 9				510

Main steel grades

Most common steel equivalence table

UNITED STATES (ASTM)	SWEDEN (MNC 830)	JAPAN (JIS G 3103) (G 3127) (JIS G 3118) (G 3119) (JIS G 3115) (JIS G 3126) (G 4109)	SPAIN (UNE 36087)	ITALY (UNI 5869) (UNI 5920)
A 442 gr 55/A516 gr 55/A 516 gr 55	14 32 01		A 37 RA II	Fe 360 2 KW et 2 KG
A 285 gr C/A 414 gr C/A 515 g 55 et 65	13 30 01 / 13 30 31		A 37 RC I	Fe 360 1 KW et 1 KG
		SPV 235	A 37 RB II	
A 442 gr 60 / A 516 gr 60	14 32 01	SLA 235 A	A 42 RA II	Fe 410 2 KW et 2 KG
A 414 gr D et E / A 515 gr 60	14 30 01 / 14 30 31	SB 410 / SGV 410	A 42 RC I	Fe 410 1 KW et 1 KG
A 662 gr A			A 42 RB II	
A 516 gr 70 / A 537 cl 1	21 03 01	SPV 315 / SLA 325 A	A 47 RA II	Fe 460 2 KW et 2 KG
A 299/A 414 gr F / A 515 gr 70 A 662 gr C / A 738	21 01 00	SB 450 / SB 480 / SCA 325 B SGV 450 / SGV 480	A 47 RC I	Fe 460 1 KW et 1 KG
A 537 cl 1 / A 612			A 47 RB II	
A 285 gr D / A 299 / A 414 gr G / A 612	21 06 01	SPV 355 / SLA 360	A 52 RA II	Fe 510 2 KW et 2 KG
A 537 cl 1 - A 738 - A 612			A 52 RC I	Fe 510 1 KW et 1 KG
A 737 gr B	21 07 01		A 52 RB II	
A 737 gr C				
A 735 cl 1				
A 734 type B				
A 735 cl 3 / A 736 cl 3				
A 735 cl 4				
A 517				
A 204 gr A				
A 387 gr 2	29 12 01	SB 480 M	16 Mo 3	15 Mo 3
A 387 gr 12 cl 2		Classe / Class 1 SCMV 1		
A 387 gr 22 cl 2	22 16 04	Classe / Class 2 SCMV 2	14 Cr Mo 4.5	14 Cr Mo 4.5
A 542 cl 4	22 18 04	Classe / Class 4 SCMV 4	12 Cr Mo 9.10	12 Cr Mo 9.10
A 302 gr A				
		SBV A / SBV 1 B		14 Kh Mo 5.5
A 302 gr C / A 533 type B cl 1			14 Mn Mo 5.5	
A 533 type B cl 2				
				Fe E 285 Ni 2
				Fe 355 Ni 2
			15 Ni Mn 6	Fe E 355 Ni 6
A 203 gr E			15 Ni 6	Fe E 285 Ni 6
A 203 gr E		SLN 3 N 275 / Cl 3 A / L 3 N 26	12 Ni 14	Fe E 285 Ni 14
A 645		Cl 3 B / SL 3 N 28	15 Ni 14	Fe E 355 Ni 14
A 353				Fe E 390 Ni 30
A 353				
A 553 type 1		SLN 9 N 520	X 8 Ni 9	Fe E 490 Ni 36
		SLN 9 N 590		Fe E 585 Ni 36

Steels for boilers and pressure vessels (Part.2)

The cross references are given for information only, since the standard descriptions are not all totally equivalent.

Equivalent FRANCE NF 36-209	GERMANY	UNITED KINGDOM (BS 1501 part 3)	UNITED STATES
Z 2 CN 18.10		304 S 11	304 L
Z 6 CN 18.09	X 6 Cr Ni 18.10	304 S 15	304 H
Z 6 CNNb 18.10	X 6 Cr Ni Nb 18.10	347 S 17	347
Z 6 CNT 18.10	X 6 Cr Ni Ti 18.10	321 S 12	321
Z 2 CN 18.10 AZ	X 2 Cr Ni N 18.10	304 S 62	304 LN
Z 5 CN 18.10 AZ		304 S 65	
Z 6 CND 17.11			316 L
Z 2 CND 17.11.02	X 2 Cr Ni Mo 17.13.3		316 L
Z 2 CND 17.13			
Z 6 CND 18.12.03	X 5 Cr Ni Mo 17.13.3	316 S 12	316
Z 6 CND 18.13		316 S 16	
Z 2 CND 19.15			
Z 6 CNDT 17.12	X 6 Cr Ni Mo Ti 17.12.2		316 Ti
Z 3 CND 17.12. AZ	X 2 Cr Ni Mo N 17.13.3		
Z 10 CD 5.05			

ITALY (UNI 7500)	SWEDEN	JAPAN (JIS G 4109)	SPAIN (UNE 36087 part 4)
X 2 Cr-Ni 18.11	23 52 28		X 2 Cr-Ni 18.10
X 5 Cr-Ni 18.10	23 33 28		X 5 Cr-Ni 18.10
X 6 Cr-Ni-Nb 18.11	23 38 28		X 6 Cr-Ni-Nb 18.10
X 6 Cr-Ni-Ti 18.11	23 37 28		X 6 Cr-Ni-Ti 18.10
X 2 Cr-Ni-N 18.11	23 71 28		2 Cr Ni N 18.10
X 5 Cr-Ni-N 18.10			
X 5 Cr-Ni-Mo 17.12			X 6 Cr-Ni-Mo 17.12.03
X 2 Cr-Ni-Mo 17.12	23 48 28		X 2 Cr-Ni-Mo 17.13.02
	23 53 28		X 2 Cr-Ni-Mo 17.13.03
			X 5 Cr-Ni-Mo 17.13.03
			X 6 Cr-Ni-Mo 17.12.03
X 2 Cr-Ni-Mo 18.15	23 67 28		
X 6 Cr-Ni-Mo-Ti 17.12	23 50 28		X 6 Cr Ni Mo Ti 17.12.2
X 2 Cr-Ni-Mo-N 17.12			X 2 Cr Ni Mo Ni 17.13.3
		Class 6 SCMV 6	

Non-alloyed steels for heat treatment

The cross references are given for information only, since the standard descriptions are not all totally equivalent.

Equivalent FRANCE (NF A 35-551) (NF A 35-552)	GERMANY (DIN 17200) (DIN 17210) (DIN 17211)	UNITED KINGDOM (BS 970 Part 1) (BS 970 Part 2) (BS 970 Part 3)	UNITED STATES (AISI série 100) (5100) (AISI série 1100) (8600) (AISI série 1500) (AISI série 4100)
XC 6		040 A 10	1006
XC 10	CK 10		1010
XC 12		040 A 12	1012
XC 18	CK 15	050 A 17	1017
C 25	CK 25	070 M 26	1025
C 30	CK 30	080 M 30	1030
C 35	CK 35	080 M 36	1035
C 40	CK 40	080 M 40	1038
C 45	CK 45	080 M 46	1045
C 55	CK 55	070 M 55	1055
20 M 5		120 M 19	1522
35 M 5		120 M 36	
40 M 6		150 M 36	1541
16 Mn Cr 5	16 Mn-Cr 5		
20 Mn Cr 5	20 Mn-Cr 5		
13 MF 4		210 A 15	
35 MF 6			1137
45 MF 4			1146
45 MF 6		225 M 4	1144
38 Cr 2	38 Cr 2		
46 Cr 2	46 Cr 2		5046
55 C 3			5155
34 Cr 4	34 Cr 4	530 M 32	5132
37 Cr 4	37 Cr 4	530 M 36	5135
41 Cr 4	41 Cr 4	530 M 40	5140
45 C 4			5147
100 C 6		534 A 99	
18 CD 4			4118
25 Cr Mo 4	25 Cr-Mo 4	708 M 25	
30 CD 4			4130
34 Cr Mo 4	34 Cr-Mo 4	708 M 32	4135
38 CD 4		708 A 37	
42 Cr Mo 4	42 Cr-Mo 4	708 M 40	4142
30 CD 12	31 Cr-Mo 12	722 M 24	
51 Cr-V 4	51 Cr-V 4		6150
16 NC 6	15 Cr-Ni 6		
14 NC 11			
30 NC 11			
18 NC D 4			4720
18 NC D 6	17 Cr-Ni-Mo 6	815 A 16	4317

Steel grade designation

Most common steel equivalence table

ITALY (UNI 10-1) (UNI 7848)	SWEDEN (MNC 851) (MNC 852)	JAPAN (JIS G 4051) (G-4106) (JIS G-4102) (G-4202) (JIS G-4103) (JIS G-4104) (JIS G-4105)	ESPAGNE / SPAIN (UNE 36011) (UNE 36012) (UNE 36013) (UNE 36014)
C 10		S 10 C	C 10 K
C 15	13 70 00	S 12 C	C 16 K
		S 17 C	
C 25	C 25	S 25 C	C 25
C 30	C 30	S 30 C	C 30
C 35	15 72 / C 35	S 35 C	C 35
C 40	C 40	S 40 C	C 40
C45	16 72 / C 45	S 45 C	C 45
C 55	C 55	S 55 C	C 55
		S Mn 420	20 Mn 6
		S Mn 433	36 Mn 6
	21 20 00	S Mn 438	
16 Mn-Cr 5	21 27 00		16 Mn-Cr 5
20 Mn-Cr 5			
38 Cr 2	38 Cr 2		38 Cr 2
46 Cr 2	46 Cr 2		46 Cr 2
34 Cr 4	34 Cr 4	S Cr 430	34 Cr 4
37 Cr 4	37 Cr 4	S Cr 435	37 Cr 4
41 Cr 4	41 Cr 4	S Cr 440	41 Cr 4
100 Cr 6	22 58 00		
18 Cr-Mo 4		SCM 420	18 Cr-Mo 4
25 Cr-Mo 4	25 Cr-Mo 4		25 Cr-Mo 4
30 Cr-Mo 4		SCM 430	
34 Cr-Mo 4	34 Cr-Mo 4	SSCM 435	34 Cr-Mo 4
35-Cr-Mo 4			
42 Cr-Mo 4	42 Cr-Mo 4	SCM 440 / SNB 22	42 Cr-Mo 4
31 Cr-Mo 12			
51 Cr-V 4 - 50 Cr-V 4			
16 Ni-Cr 11		SNC 415	15 Ni Cr 11
		SNC 631	
	25 23 02		
18 Ni-Cr-Mo 5			

Steel grade designation

Most common steel equivalence table

	Equivalent FRANCE (NF A 35-573) (NF A 35-574) (NF A 35-575) (NF A 35-576)	Equivalent for EN 10088-1 according to		GERMANY (DIN 17440) (Werkstoff 470)	UNITED KINGDOM (BS 1449) (BS 970 part 4) (BS 1559)
		NF EN 10.027-1	NF EN 10.027-2		
MARTENSITIC AND FERRITIC STEELS	Z 3 CT 12	X 2 Cr Ti 12	1 - 4512	X 6 Cr Ti 12	409 S 19
	Z 8 C 12	X 6 Cr 13	1 - 4000	X 6 Cr 13	403 S 17
	Z 6 CA 12	X 6 Cr Al 13	1 - 4002	X 6 Cr-Al 13	405 S 17
	Z 10 C 13	X 12 Cr 13	1 - 4006	X 10 Cr 13	410 S 21
	Z 20 C 13	X 20 Cr 13	1 - 4021	X 20 Cr 13	420 S 29 et 37
	Z 33 C 13	X 30 Cr 13	1 - 4028	X 30 Cr 13	A 20 S 45
	Z 40 C 14	X 39 Cr 13	1 - 4031	X 38 Cr 13	
	Z 44 C 14	X 46 Cr 13	1 - 4034	X 46 Cr 13	
	Z 8 C 17		1 - 4016	X 6 Cr 17	430 S 17 / S 15
	Z 4 CT 17	X 3 Cr Ti 17	1 - 4510	X 6 Cr-Ti 17	
	Z 4 C Nb 17	X 3 Cr Nb 17	1 - 4511	X 6 Cr Nb 17	
	Z 8 CF 17	X 6 Cr Mo S 17	1 - 4105	X 4 Cr-Mo-S 18	
	Z 8 CD 17-01	X 6 Cr Mo 17-1	1 - 4113	X 6 Cr Mo 17-1	434 S 17
AUSTENITIC STEELS	Z 3 CN 19-11	X 2 Cr Ni 19-11	1 - 4306	X 2 Cr Ni 19-11	305 S 11/304 S 11/S 12
	Z 7 CN 18-09	X 4 Cr Ni 18-10	1 - 4301	X 5 Cr Ni 18-10	304 S 15/S 31
	Z 5 CN 18 11 FF	X 4 Cr Ni 18-12	1 - 4303	X 5 Cr Ni 18-12	
	Z 6 CNT 18-10	X 6 Cr Ni Ti 18-10	1 - 4541	X 6 Cr Ni Ti 18-10	321 S 12/S 31
	Z 6 CN Nb 18-10	X 6 Cr Ni Nb 18-10	1 - 4550	X 6 Cr Ni Nb 18-10	347 S 17
	Z 8 CNF 18-09	X 8 Cr Ni S 18-9	1 - 4305	X 10 Cr Ni 9 18-9	303 S 21
	Z 3 CN 18-10 AZ	X 2 Cr Ni N 18-10	1 - 4311	X 2 Cr Ni N 18-10	
	Z 3 CND 17-12-02	X 2 Cr Ni Mo 17-12-2	1 - 4404	X 2 Cr Ni Mo 17-13-2	316 S 11/S 12
	Z 3 CND 17-11-03	X 2 Cr Ni Mo 17-12-3	1 - 4432	X 2 Cr Ni Mo 17-13-3	316 S 13
	Z 7 CND 17-11-02	X 4 Cr Ni Mo 17-12-2	1 - 4401	X 5 Cr Ni Mo 17-12-2	316 S 16/S 19
	Z 6 CND 18-12-03	X 4 Cr Ni Mo 17-3-3	1 - 4436	X 5 Cr Ni Mo 17-13-3	316 S 33
	Z 3 CND 17-13-03	X 2 Cr Ni Mo 18-14-3	1 - 4435	X 2 Cr Ni Mo 18-14-3	
	Z 3 CND 19-15-04	X 2 Cr Ni Mo 18-15-4	1 - 4438	X 2 Cr Ni Mo 18-16-4	317 S 12
	Z 6 CNDT 17-12	X 6 Cr Ni Mo Ti 17-12-2	1 - 4571	X 6 Cr Ni Mo Ti 17-12-2	320 S 17/S31
	Z 6 CND Nb 18-12	X 6 Cr Ni Mo Nb 17-12-2	1 - 4580	X 6 Cr Ni Mo Nb 17-12-2	318 S 17
	Z 3 CND 17-12 AZ	X 2 Cr Ni Mo N 17-13-3	1 - 4429	X 2 Cr Ni Mo N 17-13-3	
	Z 3 CND 17-11 AZ	X 2 Cr Ni Mo N 17-11-2	1 - 4406	X 2 Cr Ni Mo N 17-12-2	
	Z 3 CND 18-14-05 AZ	X 2 Cr Ni Mo N 17-13-5	1 - 4439	X 2 Cr Ni Mo N 17-13-5	
	Z 2 NCDU 25-20	X 1 Ni Cr Mo Cu 25-20-5	1 - 4539		904 S 14
	Z 3 CN 23-04 AZ	X 2 Cr Ni N 23-4	1 - 4362		
	Z 3 CND 22-05 AZ	X 2 Cr Ni Mo N 22-5-3	1 - 4462		
	Z 3 CND 19-14 AZ	X 2 Cr Ni Mo N 17-12-3	1 - 4434		
	Z 2 NCDU 25-26-05 AZ	X 1 Cr Ni Mo Cu N 25-25-5	1 - 4537		

Steel grade designation

Most common steel equivalence table

UNITED STATES (AISI)		ITALY (UNI 6901) (UNI 8317)	SWEDEN (MNC 900) (MNC 905) (MNC 901)	JAPAN (JIS G 4303) (JIS G-4304) (JIS G-4311) (JIS G-4312) (JIS G-4316)	SPAIN (UNE 36016)
(+ ASTM A 693)	No UNS				
409	S 40900	X 2 Cr-Ti 12	23 01		X 2 Cr Ti 12
410 S	S 41008	X 6 Cr 13		SUS 410 S	X 6 Cr 13
405	S 40500	X 6 Cr-Al 13	23 02	SUS 405	X 6 Cr-Al 13
410	S 41000	X 12 Cr 13	23 03	SUS 410	X 10 Cr 13
420	S 42000	X 20 Cr 13	23 04	SUS 420 J 1	X 20 Cr 13
420	S 42000	X 30 Cr 13	23 80 03	SUS 420 J 2	X 30 Cr 13
420	S 42000	X 40 Cr 4		SUS 416	X 40 Cr 13
420	S 42000			SUS 420 F	X 45 Cr 13
				SUS Y 410	
					X 40 Cr 13
430	S 43000	X 8 Cr 17	23 20	SUS 430 / SUS Y 430	X 8 Cr 17
439/430 Ti	S 43035/S 43036	X 6 Cr-Ti 17			X 5 Cr Ti 17
		X 6 Cr-Nb 17		SUS 430 LX	X 5 Cr Nb 17
430 F	S 43020	X 10 Cr-S 17	23 83	SUS 430 F	X 6 Cr Mo S 17
434	S 43400	X 8 Cr Mo 17		SUS 434	X 8 Cr Mo 17-1
304 L	S 30403	X 2 Cr Ni 18-11	23 52	SUS 304 L	X 2 Cr Ni 18-10
304	S 30400	X 5 Cr Ni 18-10	23 33	SUS 304	X 5 Cr Ni 18-10
305	S 30500	X 8 Cr Ni 18-12			X 8 Cr Ni 18-12
321	S 32100	X 6 Cr Ni Ti 18-11	23 37	SUS 321	X 6 Cr Ni Ti 18-10
347	S 34700	X 6 Cr Ni Nb 18-11	23 38	SUS 347	X 6 Cr Ni Nb 18-10
		X 10 Cr Ni S 18-09		SUS 303 Se	X 10 Cr Ni S 18-9
304 LN	S 30453	x 2 Cr Ni N 18-11	23 71	SUS 304 LN	X 2 Cr Ni N 18-10
316 L	S 31603	X 2 Cr Ni Mo 17-12	23 48		X 2 Cr Ni Mo 17-13-2
316 L	S 31603	X 2 Cr Ni Mo 17-13	23 53		X 2 Cr Ni Mo 17-13-3
316	S 31600	X 5 Cr Ni Mo 17-2	23 47	SUS 316	X 5 Cr Ni Mo 17-12-2
316	S 31600		23 43		X 5 Cr Ni Mo 17-13-3
				SUS 316	
317 L	S 31703	X 6 Cr Ni Mo Ti 17-12	23 67	SUS 317 L	X 2 Cr Ni Mo 18-16-4
316 Ti	S 31635	X 6 Cr Ni Mo Ti 17-12	23 50		X 6 Cr Ni Mo Ti 17-12-2
316 Cb	S 31640	X 6 Cr Ni Mo Nb 17-12			X 6 Cr Ni Mo Nb 17-12-2
316 LN	S 31653	X 2 Cr Ni Mo N 17-11-2	23 75	SUS 316 LN	X 2 Cr Ni Mo N 17-13-3
316 LN	S 31653				X 2 Cr Ni Mo N 17-12-2
317 L4	S 31726				X 2 Cr Ni Mo N 17-13-5
904 L	N 08904		25 62		
SAF-FRO 2304	S 32304		23 27		
2205	S 31803		23 77		
317 LN	S 31753				
URS B8	N 08932				

Stainless and refractory steels (Part 2)

The cross references are given for information only, since the standard descriptions are not all totally equivalent.

	Equivalent FRANCE	GERMANY (DIN 17440) (Werkstoff 470)	UNITED KINGDOM (BS 1449) (BS 970 Part 4) (BS 1554)	UNITED STATES (AISI) (+ ASTM A 176)
REFRACTORY STEELS	Z 12 CAS 18	X 10 Cr Al 18		
	Z 12 CAS 24	X 10 Cr Al 24		
	Z 6 CNT 18-10	X 12 Cr Ni Ti 18-9		
	Z 17 CNS 20-12	X 15 Cr Ni Si 20-12		
	Z 15 CN 23-13	X 7 Cr Ni 23-14		S 309 00
	Z 12 CN 25-21	X 12 Cr Ni 25-21		
	Z 8 CN 25-20	X 8 Cr Ni 25-20		
	Z 15 CNS 25 20	X 15 Cr Ni Si 25 20		
	Z 20 NCS 33 16	X 12 Ni Cr Si 36-16		
	Z 10 NC 32 21	X 10 Cr Ni Al Ti 32 20		
HIGH TEMP. AUSTENIC STEELS	Z 3 CN 18-10 AZ	X 3 Cr Ni N 18-11		
	Z 6 CNT 18-10 B	X 8 Cr Ni Ti 18-10	321 S 12	
	Z 6 CND 17-13 B	X 6 Cr Ni Mo 17-13		
	Z 3 CND 17-12 AZ	X 3 Cr Ni Mo N 17-13		
	Z 6 CN Nb 18-12 B	X 8 Cr Ni Nb 16-13		
	Z 10 NC 32 21	X 5 Ni Cr Al Ti 31-20		
	Z 8 NC 33-21	X 8 Ni Cr Al Ti 32-21		

Steel grade designation

Most common steel equivalence table

ITALY (UNI 6901) (UNI 8317)	SWEDEN (MNC 900) (MNC 905) (MNC 901)	JAPAN (JIS G 4303) (JIS G 4304) (JIS G 4311) (JIS G 4312) (JIS G 4316)	SPAIN (UNE 36016)
X 16 Cr Ni 23 14			
X 6 CR NI SI 23 14		SUS 310 S	
X 16 CR NI SI 25 20			

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	EN ISO 14171:2011	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	EN ISO 26304:2009	
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						
specificatio	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						

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

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.

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.

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.

Cross reference

Brinell, Vickers, Rockwell & Shore hardnesses

EURONORM 8.55 of July 1955 - Valid for non-alloyed and annealed steels

Ultimate tensile strength (kg/mm²)	BRINELL hardness (P=30 D2)	ROCKWELL hardness		VICKERS hardness HV (P=30 kg)	ROCKWELL DIAMOND		SHORE
		HRB	HRC		Charge 30 kg (N)	Charge 15 kg (N)	
28	80	36.4		80			
30	85	42.4		85			
32	90	47.4		90			
33	95	52.0		95			
35	100	56.4		100			
37	105	60.0		105			
39	110	63.4		110			15
40	115	66.4		115			18
42	120	69.4		120			19
43	125	72.0		125			20
45	130	74.4		130			-
47	135	76.4		135			-
48	140	78.4		140			21
50	145	80.4		145			22
51	150	82.2		150			23
53	155	83.8		155			-
55	160	85.4		160			25
56	165	86.8		165			-
58	170	88.2		170			26
60	175	89.6		175			-
62	180	90.8		180			28
63	185	91.8		185			-
65	190	93.0		190			29
67	195	94.0		195			30
68	200	95.0		200			31
70	205	95.8		205			32
72	210	96.6		210			-
73	215	97.6		215			33
75	220	98.2		220			-
77	225	99.0		225			-
78	230		19.2	230	41.9	69.7	34
80	235		20.2	235	42.9	70.3	35
82	240		21.2		43.9	70.9	36
84	245		22.1				
85	250		23.0		45.1	71.7	37
87	255		23.8		46.2	72.5	38
89	260		24.6	260			
90	265		25.4	265	47.3	73.1	39
92	270		26.2	270	48.3	73.7	40
94	275		26.9	275			
96	280		27.6	280	49.3	74.4	41
97	285		28.3	285			
99	290		29.0	290	50.3	75.0	42
101	295		29.6	295			
103	300		30.3	300	51.2	75.5	43
106	310		31.5	310	52.2	76.1	45
110	320		32.7	320	53.3	76.7	46
113	330		33.8	330	54.3	77.3	47
117	340		34.9	340	55.4	78.0	48
120	350		36.0	350	56.4	78.6	50

Cross reference

Brinell, Vickers, Rockwell & Shore hardnesses

Ultimate tensile strength (kg/mm²)	BRINELL hardness (P=30 D2)	ROCKWELL hardness		VICKERS hardness HV (P=30 kg)	ROCKWELL DIAMOND		SHORE
		HRB	HRC		Charge 30 kg (N)	Charge 15 kg (N)	
123	359		37.0	360	57.6	79.3	51
126	368		38.0	370			
129	376		38.9	380	58.7	80.0	52
132	385		39.8	390	59.9	80.6	54
135	392		40.7	400			
138	400		41.5	410	61.1	81.4	56
141	408		42.4	420	62.3	82.0	58
144	415		43.2	430			
146	423		44.0	440	63.5	82.8	59
149	430		44.8	450			
153	429		45.5	460	64.6	83.4	61
159	444		46.3	470	65.8	84.0	63
160			47.0	480	66.0	84.1	-
165	461		47.7	490	67.2	84.7	65
167			48.3	500	67.4	84.9	-
171	477		49.0	510	68.2	85.3	66
174			49.7	520	68.7	85.6	-
178	495		50.3	530	69.4	85.9	68
182			50.9	540	69.9	86.3	-
185	514		51.5	550	70.3	86.5	70
192	534		52.1	560	71.6	87.2	71
200	555		52.8	570	72.7	87.8	73
208	578		53.3	580	73.9	88.4	75
217			53.8	590	75.1	89.0	77
227			54.4	600	76.3	89.6	79
228			54.9	610	76.4	89.7	-
231			55.4	620	76.8	89.8	80
			55.9	630			
			56.4	640			
			56.9	650			
			57.4	660			
			57.9	670	77.2	90.1	
			58.4	680	77.5	90.2	81
			58.9	690	77.6	90.3	-
			59.3	700	78.4	90.7	83
			60.2	720	79.0	91.0	84
			61.1	740	79.1	91.0	-
			61.9	760	79.7	91.2	86
			62.8	780	80.4	91.5	87
			63.5	800	81.1	91.8	88
			64.3	820	81.7	92.0	90
			65.0	840	82.2	92.1	91
			65.7	860	82.7	92.3	92
			66.3	880	83.1	92.5	93
			66.9	900	83.6	92.7	95
			67.5	920	84.0	92.9	96
			68.0	940	84.4	93.0	97
				970	84.8	93.4	
				1000	85.3	93.6	
				1050	85.8	93.9	
				1100	86.4	94.1	
				1200	87.2	94.5	

Resilience test (Test on a CHARPY tup) or bending test on notched double resting point specimen

It consists in measuring, by the CHARPY impact test (pendulum striking a test specimen), the energy necessary to break a square bar with 1 cm2 cross-section and a central notch. The unit of impact represents the resilience. The resilience strength is thus J/cm2.

Depending on the shape and depth of the notch, one should differentiate between:

The UF resilience test bar

- U notch, depth 5 mm
- Remaining cross section: 0.5 cm2
- Symbol: KCU

The results are usually expressed, with respect to the cross-section unit: this is the resilience itself: KCU in J/cm2 or daJ/cm2

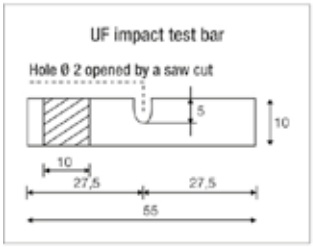
CHARPY V resilience test

- V notch, depth: 2 mm
- Remaining cross-section: 0.8 cm2
- Symbol KCV expressed in J/cm2 or daJ/cm2

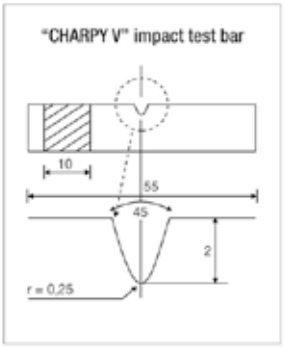
The results are usually expressed in units of energy, symbol KV in J or in daJ.

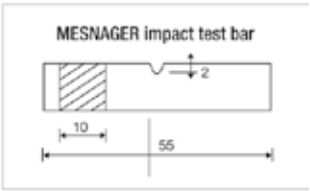
MESNAGER resilience test bar

- U notch, depth: 2 mm
- Remaining cross-section: 0.8 cm2
- Symbol KCM expressed in J/cm2 or daJ/cm2



Value KCV = (in J/cm²) = value of KV (in J) / 0.8





Reminder
1 J/cm² = 0.102 kgm/cm²
1 joule = 0.74 ft-lb
1 ft-lb = 1.35 joules

1. STAINLESS STEELS INDEX of RESISTANCE to CORROSION by PITTING

$$PREN = \% Cr + 3.3 \% Mo + 16 \% N$$

PREN > 35 (DUPLEX steels)
PREN > 40 (SUPERDUPLEX steels)

2. STAINLESS STEELS BEHAVIOUR to CORROSION

$$Cr + 3 Mo > 30$$

Aim 32 (values in percent)

$$Cr \geq 80\ C\ (\%) + 16.8$$

(T.Ü.V.)

3. CHROMIUM STEELS SIGMA PHASE

$$\frac{Cr + 4 Mo + 3 (Si-1) - 16 C}{Ni + \frac{Mn - 1}{3}} < 1.8$$

Gan and Marder formula (values in percent)

1. TRADITIONAL FORMULA

$$UCS = 230\,C + 190\,S + 75\,P + 45\,Nb - 12.3\,Si - 5.4\,Mn - 1$$

Elements: % in weight
If C% real < 0.08 ' C = 0.08 is retained in the calculation
UCS > 30 ' bad resistance to heat cracking
UCS < 10 ' good resistance to heat cracking

2. THE HULL INDEX

$$Si + 3Nb + 2\,Ti + 200\,B + 30\,Zr + 0.5\,Cu - \left(\frac{Mn}{3} + \frac{Mo}{2}\right)$$

The smallest possible (values in percent)

Schaeffler, Delong & WRC diagrams

The Schaeffler diagram (see next) is used to predict the structure of an as-solidified weld when its chemical composition is known. This structure is determined by the figurative point resulting from the alpha-forming element (equivalent chromium) and gamma-forming element (equivalent nickel) content.

One of the basic reasons for finding out the structure of the deposits is to anticipate the metallurgical risks run (domains 1-2-3-4), whether they be linked with the welding operation or whether they be linked with the domain of application (e.g.: sigmatization of the ferrite).

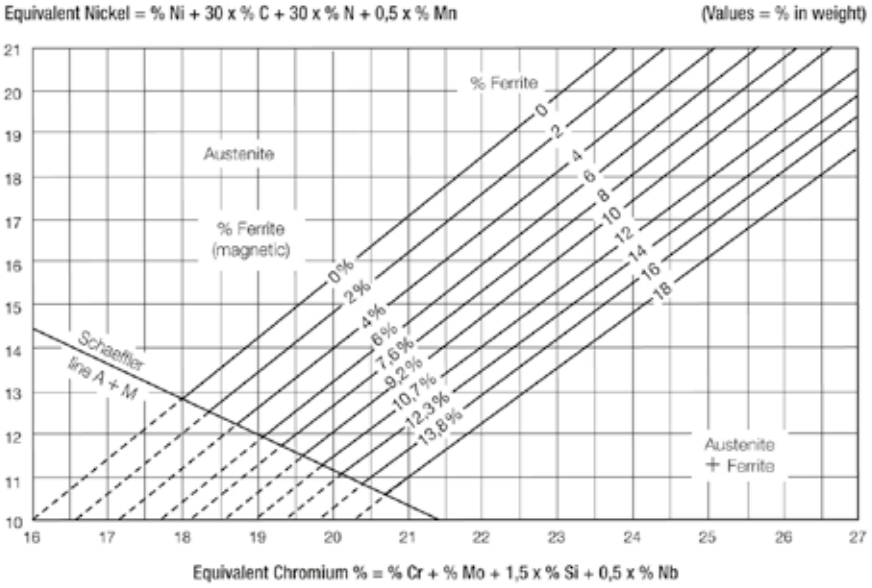
On the practical level, the Schaeffler diagram allows us to select a filler material so that the ferritic trend of the deposit is sufficient to resist cracking at high temperatures: generally, we must try to obtain a ferritic, trend of 3 to 10 %. In addition, we must take account of the dilution of part of the base metal. In the case of coated electrode welding, the dilution level varies from 25 to 40 % approx. and can reach 50 % for root passes.

With developments in materials, and particularly the voluntary introduction of elements such as nitrogen (N2=gamma-forming element) in stainless steels, the Schaeffler diagram is no longer totally appropriate. A slightly different diagram, the Delong diagram, takes account of the effect of the nitrogen.

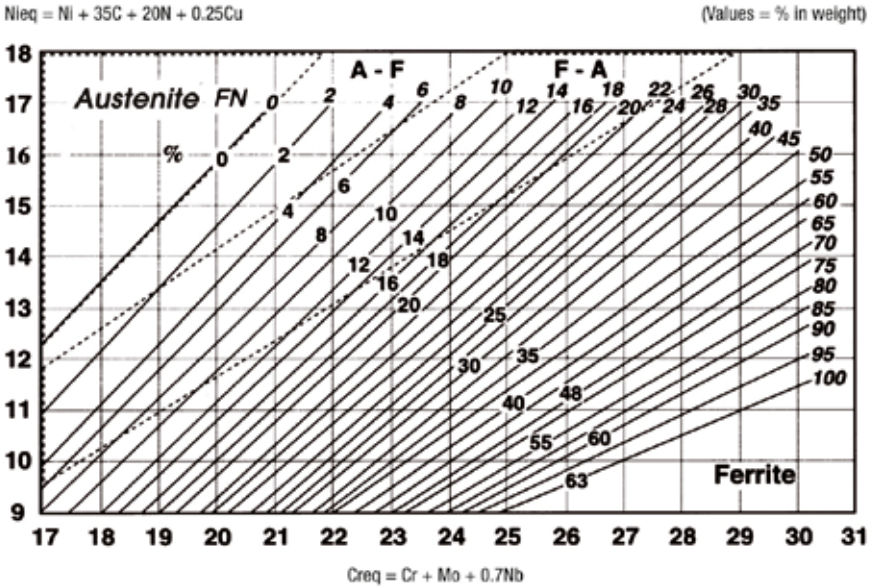
In this continuous development, new-generation stainless steels, with austeno-ferritic structures (Duplex steels) no longer fit into the Schaeffler diagram. Therefore, the WRC diagram must be used to take into consideration the effect of the nitrogen and the copper.

Delong diagram

The Delong diagram is identical in form to the Schaeffler diagram, but it takes into account the effect of nitrogen.



WRC 92 diagram



WELDABILITY of NON-ALLOYED and/or LOW ALLOYED STEELS

The metallurgical weldability of a steel can be relatively quantified by the "Equivalent Carbon" calculation which is used to determine a preheating temperature for this steel. This method limits the risks when welding non-alloyed or low alloyed steels. However, the technical literature proposes a certain number of different formulas which are more or less equivalent (according to the authors). A reminder of these is given below.

- **DARDEN and O'NEIL FORMULA**

  - Equivalent carbon chemically C_e:

$$C_e = C + \frac{Mn}{6} + \frac{Cr + V}{5} + \frac{Mo}{4} + \frac{Ni}{15} + \frac{Cu}{13}$$

  - Preheating temperature: Tp

$C_e < 0.45$	T_p: as you wish
$0.45 < C_e < 0.6$	T_p: from 100 to 200 °C
$C_e > 0.6$	T_p: from 200 to 370 °C

- **SEFERIAN FORMULA**

  This formula consists in calculating the preheating temperature T_p which is a function of the total equivalent carbon C:

$$T_p = 350 \sqrt{C - 0,25}$$

- The total equivalent carbon C is the sum of the chemical equivalent carbon C_e and the thickness equivalent carbon C_e

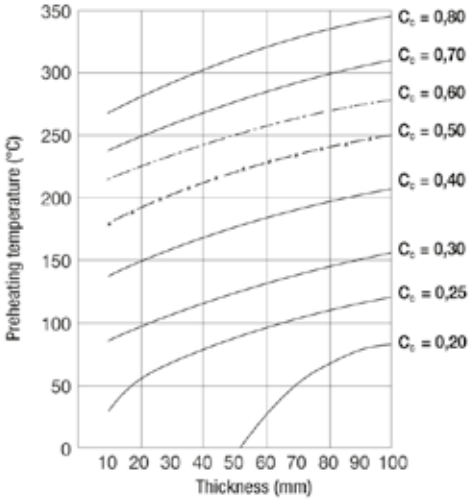
$$C = C_c + C_e$$

  - the chemical equivalent carbon C_c is calculated in the following manner:

$$C_c = \frac{360\,C + 40\,(Mn + Cr) + 20\,Ni + 28\,Mo}{360}$$

  - the thickness equivalent carbon C_e is obtained through this formula: $C_e = 0,005 \times \text{thickness (mm)} \times C_c$

The various preheating temperature values according to the thickness of the sheets to be welded and to the chemical equivalent Carbon C_c are shown in the graph on the right.



C_c : compensated carbon equivalent

- **FORMULA according to IIS DOC. IX 646-69**

$$C_e = C + \frac{Mn}{6} + \frac{Cr + Mo + V}{5} + \frac{Cu + Ni}{15}$$

$C_c C = C_c + 0.0254\,e$

e : thickness of part in cm

The notion of the welding ability of steel is very complex and depends on the function of the welded joint considered. However, the main factor is the chemical composition of the steel, related to its elaboration mode.

Description of the steels	Carbone Equivalent (typical calculated values)	Advised preheating range 200 °C	250 °C	300 °C	350 °C	400 °C	450 °C	Assemblies slightly solicited	highly solicited
25 CD 4	0.61							1	2
30 NC 6	0.64							1	2
35 CD 4	0.71							1	2
35 NC 6	0.75							2	2
42 CD 4	0.78							2	2
30 NCD 3	0.87							2	3
30 NC 11	0.90							2	3
40 NCD 2	0.91							2	3
40 NCD 3	0.92							3	3
35 NCD 6	0.95							3	3
30 NCD 16	0.99							3	3
35 NC 15	0.99							3	3
35 NCD 16	1.02							3	3
30 CD 12	1.06							3	3
34 CND 6	1.13							3	3
50 CV 4	1.32							3	3

Non-alloyed basic electrodes: 1

Lightly alloyed basic electrodes: 2

Austenitic electrodes with high ferritic rate: 3

General recommendations for the welding of construction steels

The main factors favouring the success of welding operations are characterised by:

- The cleanliness of the surfaces to assemble (suppress all traces of rust, grease, humidity…),
- The use of dry electrodes (furnace drying recommended at 300 °C or DRY version) for all security assemblies,
- Preheating is all the more necessary when the sizes of the parts to assemble are important and when the equivalent carbon is important,
- The control of preheating temperatures (during the welding operation), in difficult cases, with thermal sensors or temperature indicating pencils.

One should not forget that each welding problem could lead to different solutions and that the above table allows orienting one's choice without giving a unique solution. The aim of the table is that of defining, for a given grade, the most favourable conditions for the success of the welding operation (the grades of steel are given in descending order of welding capability).

A distinction can be made between two types of welded joints:

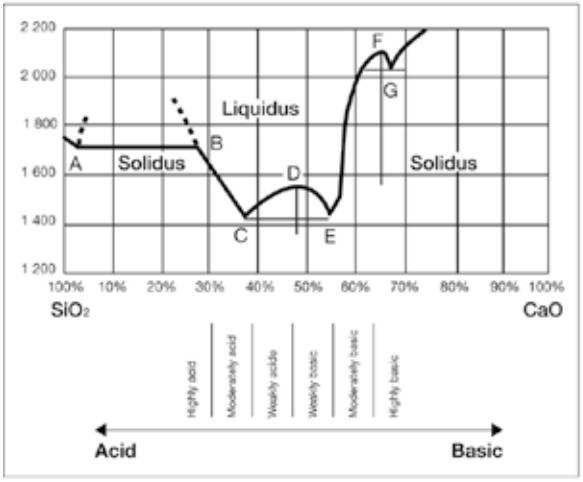
- on the one hand, those that have a simple role of parts attachment, without having to answer to high mechanical characteristics, this is true in most cases,
- on the other hand, those that will be particularly solicited during the service of the part and that will have to be treated differently.

Generally, for "welding capacity" or "average welding capacity" steels, one should use basic coated electrodes non-or lightly alloyed (according to the case). In the case of steels that are difficult to weld, one shall prefer to use austenitic electrodes having a high ferritic ratio allowing the deposit of a ductile metal while affecting the base metal at a minimum. In all cases, the coating should be perfectly dry.

The relation of the sum of basic constituents of a slag (lime CaO, magnesia MgO) to the sum of its acid constituents (silica $Si O_2$, alumina Al_2O_3, phosphoric anhydride P_2O_5).
The simplest form uses the contents relation in lime (basic constituent) and in silica (acid constituent).

- **according to Back :** $b = \dfrac{\% \text{ Ca O}}{\% \text{ Si O}_2}$

By supposing that in a liquid state the two constituents exist in part combined in a metasilicate state of lime SiO_2 CaO and for the rest in a non combined free state.
It is thus the proportion of free lime or of free silic indicated by this relation, which gives the slag its acid or basic character.



If we take into account the combination of P_2O_5 with CaO in the form of tricalcite phosphate, the index becomes:

- **according to FAIRLEY :** $b = \dfrac{\% \text{ Ca O}}{\% \text{ SiO}_2 + \% \text{ P}_2\text{O}_5}$

There exist other, more or less debated formulas:

- **according to HOLBROOK-JOSEPH :** $b = \dfrac{\% \text{ CaO} + \% \text{ MgO}}{\% \text{ Si O}_2 + \% \text{ Al}_2\text{O}_3}$

- **according to HERTY :**
  $b = \% \text{ CaO} - 0.93\% \text{ SiO}_2 - 1.18\% \text{ P}_2\text{O}_5$

In this formula, the excess lime characterises the efficiency of the slag.

- **according to BONISZEWSKI :** $b = \dfrac{\% \text{ CaO} + \% \text{ MgO} + \% \text{ BaO} + \% \text{ CaF}_2 + \% \text{ NbO}_2 + \% \text{ K}_2\text{O} + 0.5\% (\% \text{ MnO} + \% \text{ FeO})}{\% \text{ SiO}_2 + 0.5 (\% \text{ Al}_2\text{O}_3 + \% \text{ TiO}_2 + \% \text{ ZrO}_2)}$

This formula is more complete, but applies mainly to molten flux. By extension to other welding products: coated electrodes, flux-cored wires.

Nickel alloys

They have a characteristically good behaviour at high temperatures as well as a great resistance to corrosion.
They are used in chemical, petroleum chemistry, nuclear and aeronautical constructions.

According to their composition, nickel alloys can be gathered in various families:

- Pure nickel (e.g. nickel 200),
- Nickel-copper alloys (e.g. Monel 400),
- Nickel-molybdenum alloys (e.g. Alloy B2),
- Nickel-chromium-iron alloys (e.g. Inconel 600),
- Nickel-chromium-molybdenum alloys (e.g. Inconel 625),
- Nickel-chromium-molybdenum-copper alloys (e.g. Incoloy 825).

In welding, nickel alloys are mainly sensitive to hot cracking. It is essential to choose a base material and a filler material with very low impurity content. The presence of sulphur, lead or phosphorus that could come from greases, paints and various residual matters should absolutely be avoided (temperature indicating pencils, adhesives…).

Nickel alloys can also be sensitive to the forming of porosities, the main source being humidity. The welding of nickel alloys requires a careful preparation, quality filler products, as well as an adapted welding procedure (low heat input, temperature limitation between runs…). Gaseous shielding is essentially inert: argon and argon-helium mixtures.

Alloys sensitive to hot oxidation (titanium, zirconium, tantalum)

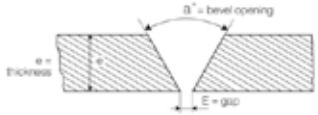
Used in aeronautical, nuclear and chemical industries, these alloys feature excellent fatigue behaviour owing to very good mechanical and chemical properties.

These materials offer a very large affinity to atmospheric gases (oxygen and nitrogen) even at temperatures that are not too high. These elements, oxygen in particular, bring on a very sensible modification of the mechanical characteristics. Resistance to fractures increases to the detriment of ductility that rapidly decreases. In order to keep the initial properties, it is essential to protect from atmospheric aggression during the welding:

- the fusion bath and its environment,
- the metal in the course of solidification,

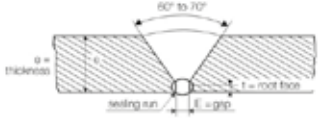
• **Volume of metal and weight of metal deposited per meter of weld for butt weld with bevel without root face**

Plate thickness (mm.) (e)	Bevel-opening (α)	Gap (mm) (E)	Volume of metal to be deposited (cm³)	Weight of metal to be deposited (kg/m)
5	80°	0	26	0.20
6	80°	1	42	0.323
8	70°	1	69	0.534
10	70°	1	100	0.78
12	60°	1.5	125	0.97
14	60°	1.5	164	1.28
16	60°	2	211	1.64
18	60°	2	259	2.02
20	60°	2	310	2.42



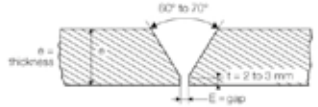
• **Volume of metal and weight of metal deposited per meter of weld for butt weld with bevel and back pass**

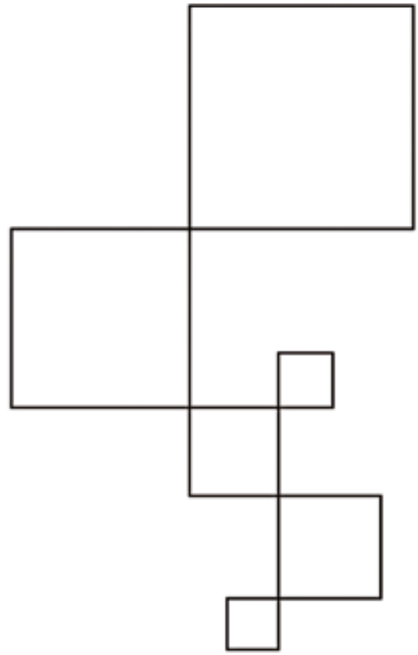
Thickness (mm) (e)	Gap (mm) (E)	Root face (mm) (t)	Volume of metal to be deposited (cm³)	Weight of metal to be deposited (kg/m)	Recommended diameters (mm)
5	1	1	30	0.23	3.15 and 4, sealing run with 3.15
6	1.5	1.5	44	0.34	3.15 and 4, sealing run with 3.15
8	1.5	1.5	70	0.54	3.15 and 4 - sealing run with 4
10	2	2	92	0.72	3.15 - 4 and 5, sealing run with 4
12	2	2	125	0.97	3.15 - 4 and 5, sealing run with 4
14	2	2	160	1.25	4-5 - 6.3 sealing run with 5
16	2	2	200	1.55	4-5 - 6.3 sealing run with 5



• **Volume of metal deposited and weight of metal deposited per meter of weld for butt weld with bevel and root face**

Plate thickness (mm.) (e)	Gap (mm) (E)	Volume to be deposited per meter (cm³)	Weight of metal to be deposited (kg/m)	Recommended diameters (mm)
6	2.5	36	0.28	3.15 and 4
8	2.5	61	0.47	3.15 and 4
10	3	93	0.72	3.15 - 4 - 5
12	3	123	0.96	3.15 - 4 - 5
14	3.5	167	1.31	4 - 5 - 6.3
16	4	217	1.69	4 - 5 - 6.3





MMA ELECTRODES

OERLIKON

MMA Electrodes / C-Mn and low-alloy steels			
Product name	AWS	EN / EN ISO / DIN	Page
FINCORD M	A5.1: E 6013	499: E 38 0 R 12 2560-A: E 38 0 R 12	73
SUPERCORD	A5.1: E 6013	2560-A: E 38 0 R 12	74
OVERCORD S	A5.1: E 6013	499: E 38 2 R 1 2 2560-A: E 38 2 R 1 2	75
SUPERCORD 42	A5.1: E 6013	499: E 42 A R 12 2560-A: E 42 A R 12	76
SUPERCORD 45	A5.1: E 6013	499: E 42 0 R 12 2560-A: E 42 0 R 12	77
OVERCORD	A5.1: E 6013	499: E 38 0 RC 11 2560-A: E 38 0 RC 11	78
FINCORD	A5.1: E 6013	499: E 42 0 RR 12 2560-A: E 42 0 RR 12	79
FLEXAL 60	A5.1: E 6010	499: E 38 3 C 21 2560-A: E 38 3 C 21	81
FLEXAL 70	A5.5: E 7010-P1	499: E 42 2 Mo C 21 2560-A: E 42 2 Mo C 21	82
FLEXAL 80	A5.5: E 8010-G	2560-A: E 46 3 1NiMo C21	83
FERROMATIC 130	A5.1: E 7024	499: E 42 0 RR 53 2560-A:E 42 0 RR 53	84
FERROMATIC 160	A5.1: E 7024	499: E 42 0 RR 73 2560-A: E 42 0 RR 73	85
FERROMATIC 180	A5.1: E 7024	499: E 42 0 RR 73 2560-A: E 42 0 RR 73	86
FERROMATIC 200	A5.1: E 7024	499: E 42 0 RR 73 2560-A: E 42 0 RR 73	87
SPEZIAL	A5.1: E 7016-H8	2560-A: E 38 3 B 12 H10	88
TENAX 56S	A5.1: E 7016-1 H4	499: E 42 5 B 12 H5 2560-A: E 42 5 B 12 H5	89
UNIVERS	-	499: E 38 6 B 42 H 5 2560-A: E 38 6 B 42 H5	90
FEBAMATIC 160S	A5.1: E 7028	499: E 42 4 B 54 H5 2560-A: E 42 4 B 54 H5	91
TENAX 58S	A5.1: E 7018-1 H4	2560-A: E 42 5 B 32 H5	92
TENAX 77 (ETC PH 77)	A5.1: E 7018-1 H4R	2560-A: E 42 5 B 32 H5	93
ETC PH 35S	A5.1: E 7018-1 H4	499: E 42 5 B 32 H5 2560-A: E 42 5 B 32 H5	94
ETC PH 35S DRY	A5.1: E 7018-1 H4R	499: E 42 5 B 32 H5 2560-A: E 42 5 B 32 H5	95
TENAX 55H	A5.1: E 7018-1 H4	499: E 42 5 B 32 H 5 2560-A: E 42 5 B 32 H5	96
TENAX 56ST (ETC PH 56ST)	A5.5: E 8018-G	2560-A: E 46 4 B 32 H5	97
TENAX 76S	A5.5: E 7018-G H4	499: E 46 6 1Ni B 32 H5 2560-A: E 46 6 1Ni B 32 H5	98
OE-CRYO 87	A5.5: E 7016-C2L	499: E 42 6 3 Ni B 12 H5 2560-A: E 42 6 3Ni B 12 H5	99
OE-CRYO 75 H	A5.5: E 7018-C1L	499: E 42 6 2Ni B 32 H5 2560-A: E 42 6 2Ni B 32 H5	100
TENAX 88S	A5.5: E 8016-G	499: E 50 6 Mn1Ni B 12 H5 2560-A: E 50 6 Mn1Ni B 12 H5	101
TENAX 88S HR	A5.5: E 8018-G H4	499: E 50 6 Mn1Ni B 32 H5 2560-A: E 50 6 Mn1Ni B 32 H5	102
FREEZAL ENi3	A5.5: E 8018-C2	499: E 46 6 3Ni B 3 2 H5 2560-A: E 46 6 3Ni B 3 2 H5	103
VERTICORD 80	A5.5: E 8018 G	499: E 46 4 B 35 H5 2560-A: E 46 4 B 4 5 H5	104
VERTICORD 90	A5.5: E 9018-G	757 : E 55 4 Z B 45 H5	105

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 Z (NiCu1) B 4 2 H5	106
TENCORD 85 CP	A5.5: E 8018-G	2560-A: E 46 4 Z B 32 H10	107

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	108
TENAX 118-M	A5.5: E 11018-M H4	757: E 69 5 Z B 32 H5	109
TENAX 128-M	A5.5: E 12018 – M	757: E 79 5 Mn2NiCrMo B 32 H5	110
TENAX 140	A5.5: ~ E 14018 M-H4	-	111

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	112
MOLYCORD Kb	A5.5: ~E 7018-A1-H4	3580-A: E Mo B 4 2 H5	113
OE-KV2L	A5.5: E 7015-A1	1599: E Mo B 22 H5	114
OE-KV2HR	A5.5: E 7018-A1 H4R	1599: E Mo B 32 H5	115
CROMOCORD 55	A5.5: E 8018-B1	3580-A: E CrMo0,5 B 1 2 H5	116
CROMOCORD Kb	A5.5: E 8018-B2-H4	3580-A: E CrMo1 B 4 2 H5	117
OE-KV5L	A5.5: E 7015-B2L	1599: E CrMo1L B 22 H5	118
OE-KV5HR	A5.5: E 8018-B2 H4R	1599: E CrMo1 B 32 H5	119
CROMOCORD 2 STC	A5.5: E 9018-B3-H4	3580-A: E CrMo2 B 4 2 H5	120
OE-KV3L	A5.5: E 8015-B3L-H4	1599: E CrMo2L B 22 H5	121
OE-KV3HR	A5.5: E 9018-B3 H4R	1599: E CrMo2 B 3 2 H5	122
CROMO E225	A5.5: E 9015-B3 H4	3580-A: E CrMo2 B 2 2 H5	123
CROMO E225V	A5.5: E 9015-G	3580-A: E Z (CrMoV) 2 B 2 2 H5	124
CROMOCORD 23	A5.5: E 8015-G	-	125
CROMOCORD 5	A5.5: E 8015-B6-H4	3580-A: E CrMo5 B 2 2 H5	126
CROMOCORD 5L	A5.5: E 8015-B6L	1599: E CrMo5 B 2 2 H5	127
CROMOCORD 9	A5.5: E 8015-B8	1599: ~E CrMo9 B 2 2 H5	128
CROMOCORD 9M	A5.5: E 9018-B9-H4	3580-A: ~E CrMo9 B 4 2 H5	129
CROMOCORD 91	A5.5: E 9018-B9-H4	3580-A: E CrMo91 B 4 2 H5	130
CROMOCORD 92	A5.5: E 9018-G	3580-A: E Z CrMoWVNb 9 0.5 2 B 4 2 H5	131
CROMOCORD 10M	A5.5: ~E 9018-G	8575: ~E CrMoW10 B 20+	132
CROMOCORD N125	A5.5: E 9015-G-H4	3580-A : ~E CrMoV1 B 4 2 H5	133

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 42	134
BASINOX 410 NiMo S	A5.4: E 410NiMo-15	1600: E 13 4 B 42	135
BASINOX 430 S	A5.4: E 430-15	1600: ~E 17 B 32	136
SUPRANOX 308L	A5.4: E 308L-17	1600: E 19 9 L R 1 2	137
SUPRANOX RS 308L	A5.4: E 308L-16	1600: E 19 9 L R 12	138
CRISTAL E308L	A5.4: E 308L-17	1600: E 19 9 L R 22	139
BASINOX 308L	A5.4: E 308L-15	1600: E 19 9 L B 12	140
BASINOX 308L T	A5.4: E 308L-15	1600: E 19 9 L B 12	141
SUPRANOX 347	A5.4: E 347-16	1600: E 19 9 Nb R 1 2	142
SUPRANOX RS 347	A5.4: E 347-16	1600: E 19 9 Nb R 12	143
BASINOX 347	A5.4: E 347-15	1600: E 19 9 Nb B 12	144
SUPRANOX 316L	A5.4: E 316L-17	1600: E 19 12 3 L R 1 2	145
SUPRANOX RS 316L	A5.4: E 316L-16	1600: E 19 12 3 L R12	146
CRISTAL E316L	A5.4: E 316L-17	1600: E 19 12 3 L R 22	147
BASINOX 316L	A5.4: E 316L-15	1600: E 19 12 3 L B 12	148
BASINOX 316L T	A5.4: E 316L-15	1600: E 19 12 2 B 12	149
SUPRANOX 317	A5.4: E 317-16	1600: E 19 13 4 N L R 12	150
SUPRANOX 318	A5.4: E 318-16	1600: E 19 12 3 Nb R 1 2	151
BASINOX 318	A5.4: E 318-15	1600: E 19 12 3Nb B 42	152
SUPRANOX E 22 9 3 N	A5.4: ~E 2209-16	1600: E 22 9 3 N L R 1 2	153
SUPRANOX RS 22 9 3 L	A5.4: E 2209-16	1600: E 22 9 3 N L R 12	154
BASINOX 22 9 3 N	A5.4: E 2209-15	1600: E 22 9 3 N L B 42	155
BASINOX EB 25 10 4 N	A5.4: E 2594-15	1600: E 25 9 4 N L B 42	156
SUPRANOX 904L	A5.4: E 385-16	1600: E 20 25 5 Cu N L R 5 3	157
BASINOX 904L	A5.4: E 385-15	1600: E Z 20 25 5 CuL B 12	158
SUPRANOX 308H	A5.4: E 308H-16	1600: E 19 9 R 12	159
BASINOX 308H	A5.4: E 308H-15	1600: E 19 9 H B 42	160
SUPRANOX RS 308H	A5.4: E 308H-16	1600: E 19 9 R 12	161
BASINOX 22 12 H	A5.4: ~E 309-15	1600: E 22 12 B 42	162
SUPRANOX RS 310	A5.4: ~E 310-16	1600: E 25 20 R 12	163
BASINOX 310	A5.4: E 310-15	1600: E 25 20 B 12	164
BASINOX 310Mo	A5.4: E 310Mo-15	-	165
DW RSP	-	-	166
SUPRANOX 309L	A5.4: E 309L-17	1600: E 23 12 L R 1 2	167
SUPRANOX RS 309L	A5.4: E 309L-16	1600: E 23 12 L R 12	168
CRISTAL E309L	A5.4: E 309L-17	1600: E 23 12 L R 22	169
BASINOX 309L	A5.4: E 309L-15	1600: E 23 12 L B 12	170
SUPRANOX 309MoL	A5.4: E 309LMo-17	1600: E 23 12 2 L R 1 2	171
SUPRANOX RS 309Mo	A5.4: E 309MoL-16	1600: E 23 12 2 L R 12	172
BASINOX 309Mo	A5.4: E 309MoL-15	1600: E 23 12 2 L B 12	173
BASINOX 309Nb	A5.4: E 309Nb-15	1600: E 23 12 Nb B 12	174
BASINOX 307	A5.4: E 307-15	1600: E 18 9 MnMo B 12	175
DW 312	A5.4: ~E 312-16	1600: ~E 29 9 R 12	176

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	177
SUPRANEL SR	A5.11: E NiCrFe-2	14172: E Ni 6092 (NiCr16Fe12NbMo)	178
SUPRANEL	A5.11: E NiCrFe-3	14172: E Ni 6182	179
SUPRANEL 600	A5.11: E NiCrFe-3	14172: E Ni 6182	180
SUPRANEL 625	A5.11: E NiCrMo-3	14172: E Ni 6625	181
SUPRANEL C276	A5.11: E NiCrMo-4	14172: E Ni 6276	182
FREEZAL ENi9	A5.11: E NiCrMo-6	14172: E Ni 6620	183
SUPRANEL 690	A5.11: E NiCrFe-7	14172: E Ni 6152 (nearest)	184
SUPRANEL NiCu7	A5.11: E NiCu-7	14172: E Ni 4060 (NiCu30Mn3Ti)	185
CITOBRONZE Sn	A5.6: E CuSn-C	-	186
CUPRONIC 70	A5.6: E CuNi	-	187

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	188
SUPERFONTE NiFe	A5.15: E NiFe-CI	1071 : E C NiFe-CI 1	189
SUPERFONTE BM	A5.15: E NiFe-CI	1071: E C NiFe CI 1	190

MMA Electrodes / Aluminum alloys			
Product name	AWS	EN / EN ISO / DIN	Page
ALCORD Al	A5.3: ~E1100	1732: EL-Al 99.8	191
ALCORD 5Si	A5.3: E4043	1732: EL-AlSi 5	192
ALCORD 12Si	-	1732: El-AlSi 12	193

MMA Electrodes / Hardfacing			
Product name	AWS	EN / EN ISO / DIN	Page
SUPRAMANGAN	-	14700 : ~E Fe9 8555 : ~E 7-UM-200-KP	194
SUPRADUR 2015	-	14700: ~E Fe1	195
SUPRADUR 345B	-	14700: E Fe13	196
SUPRADUR 400	-	14700: E Fe1	197
SUPRADUR 400B	-	14700: E Fe1 8555: E 1-UM-400	198
SUPRADUR 600	-	14700: E Fe2 8555: E 2-UM-60	199
SUPRADUR 600RB	-	14700: ~E Fe2 8555: E 6-UM-60	200
SUPRADUR 600B	-	14700: ~E Fe2 8555: E 6-UM-60	201
SUPRADUR V1000	-	14700: E Fe14 8555: E 10-UM-60-GR	202
SUPRADUR VF1000	-	14700: E Fe14 8555: E 10 UM 60 RZ	203
TOOLCORD	-	14700: E Fe4 8555: E 4 UM 65 GS	204

MMA Electrodes / Cutting			
Product name	AWS	EN / EN ISO / DIN	Page
SUPERCUT	-	-	205

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	500	750	15	(3)
17	300	450	15	(4)
19 9	350	550	30	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	350	550	25	none
19 13 4 N L	350	550	25	none
22 9 3 N L	450	550	20	none
25 7 2 N L	500	700	15	none
25 9 3 Cu N L	550	620	18	none
25 9 4 N L	550	620	18	none
18 15 3 L	300	480	25	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	320	510	25	none
27 31 4 Cu L	240	500	25	none
18 8 Mn	350	500	25	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	350	550	25	none
29 9	450	650	15	none
16 8 2	320	510	25	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	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	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	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.

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 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 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

Notes on MMA electrodes
Storage and handling

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.

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	cellulosic (C)	FLEXAL-Range	1
C-Mn and low-alloy	rutile (R, RR)	FINCORD	2
C-Mn and low-alloy	rutile-cellulosic (RC)	OVERCORD	2
C-Mn and low-alloy	rutile-acid (RA)	CITORAPID 160W	2
C-Mn and low-alloy	rutile-basic (RB)	CITOREX	2
C-Mn and low-alloy	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(ↄ).
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(ↄ) 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(ↄ) is recommended.
6	In order to avoid cold-cracking, re-drying for 2 hours at 300–350°C(ↄ) is required.
7	In order to avoid porosity, re-drying for 2 hours at 300°C – 350°C(ↄ) is required.
(ↄ)Note concerning temperatures and times: The product-specific indications on the labels or data sheets are applicable.	

FINCORD M

OERLIKON

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+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX PC	CBOX 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	●

SUPERCORD

OERLIKON

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	●

AIR LIQUIDE

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

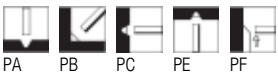
S(P)235 to S(P)355; GP240; GP280

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

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-



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	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

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-



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	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	●

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-



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

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-



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	●

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	●

FLEXAL 80

OERLIKON

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	●

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

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	●

OERLIKON

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	●

AIR LIQUIDE

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 340-360 °C for 2 hours, 5 times max.

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



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	●

OERLIKON

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 58S

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

General purpose basic coated low hydrogen electrode containing iron powder additions, suitable for positional welding. The weld appearance is excellent and spatter levels minimal. The excellent mechanical properties also make this electrode suitable for critical applications in such industries as offshore, nuclear and pressure vessels as well as the general construction industry. Very good x ray quality.

Classification	
EN ISO	2560-A: E 42 5 B 32 H5
AWS	A5.1: E 7018-1 H4

Approvals	Grade
DNV	3YH5
RINA	4YDH5

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06-0.1	0.8-1.5	≤ 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	≥ 400	490-550	≥ 24	≥ 80
620 °C x 1h	≥ 400	490 - 550	≥ 24	≥ 80

Materials

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

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+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX	
				PC	Code
2.5	300	60-90	20.2	185	●
2.5	350	60-90	23.2	185	●
3.2	350	85-140	36.2	120	●
3.2	450	90-140	47.2	120	●
4.0	450	130-170	68.2	85	●
5.0	450	200-250	98.4	55	●

AIR LIQUIDE

TENAX 77 (ETC PH 77)

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENAX 77 (ETC PH 77) is a basic coated electrode with low hydrogen content (< 4 ml/100g). The metal powder contained on the covering gives 120% recovery and high deposition rate. Suitable for pressure vessels welding, shipbuilding, earth moving machine and metal working. Good electric arc and controllable cold weld pool make this electrode suitable for difficult position joint. Easy slag removal. No spatter.

Classification	
EN ISO	2560-A: E 42 5 B 32 H5
AWS	A5.1: E 7018-1 H4R

Approvals	Grade
ABS	4YH5
BV	4YHHH
DNV	4YH5
LRS	4YmH5
RINA	4YDH5

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	V
0.06	1.3	0.35	≤0.03	≤0.03	≤0.08	≤0.08	≤0.06	≤0.06

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	≥ 450	520-640	≥ 26	≥ 80	≥ 60
620 °C x 1h	≥ 420	510-630	≥ 26	≥ 110	≥ 100

Materials

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

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

Shipbuilding; vessels, boilers fabrication (including chemical-petrochemical industry); pipes fabrication; off-shore fabrication.

Storage

Keep dry and avoid condensation.

HD ≤ 3 ml/100g: Re-dry at 400-420 °C for 1 hour, 5 times max.

HD ≤ 5 ml/100g after exposed (80% a.h. - 27°C - 9h.).

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	70-100	20.1	280	●	90	●
3.2	450	90-145	46.6	115	●	55	●
4.0	450	110-180	67.5	80	●	40	●
5.0	450	180-240	102.1	55	●	25	●

ETC PH 35S

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

ETC PH 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. 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

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

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

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+



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	●

AIR LIQUIDE WELDING

ETC PH 35S DRY

MMA Electrodes
C-Mn and low-alloy steels

ETC PH 35S DRY is a general purpose basic coated very low hydrogen MMA electrode containing iron powder additions, suitable for positional welding. The excellent mechanical properties make this electrode suitable for critical applications as low temperature requirement applications including offshore oil and gas, nuclear and pressure vessels and the general construction industry. 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 H4R
GOST	9467-75:?50A-E51 6

Approvals	Grade
ABS	4H5 4Y
DNV	4YH5
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

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

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

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+



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	●		

TENAX 56ST (ETC PH 56ST)

OERLIKON

MMA Electrodes
C-Mn and low-alloy steels

TENAX 56ST (ETC PH 56ST) is a very low hydrogen coated electrode exhibiting a very stable arc with good control of the molten weld pool in all-positions, specially suited for pipe welding. Excellent mechanical properties; tensile > 550 N/mm2. Efficiency 120%.

Classification	
EN ISO	2560-A: E 46 4 B 32 H5
AWS	A5.5: E 8018-G

Approvals	Grade
ABS	4YH5

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.06	1.7	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) -40 °C
As Welded	≥ 460	≥ 550	≥ 24	≥ 70

Materials

S(P)460
X60-X65

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+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	CBOX		VPMD	
				PC	Code	PC	Code
2.5	350	70-100	20.6	180	●		
3.2	450	90-130	49.6	115	●	55	●
4.0	450	110-170	70.0	80	●	40	●
5.0	450	175-220	105.5	55	●		

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 H4
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+



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	●

AIR LIQUIDE

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+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD 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	-73 °C °C
As Welded	≥ 420	510 - 660	≥ 26	≥ 80	≥ 60
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+



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	●

AIR LIQUIDE

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 and 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 production 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	●

AIR LIQUIDE

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+



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	●

AIR LIQUIDE

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+



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 Z (NiCu1) 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	●

AIR LIQUIDE

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 46 4 Z B 32 H10
AWS	A5.5: E 8018-G

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		VPMD	
				PC	Code	PC	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) -50 °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+



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	●

AIR LIQUIDE

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 should 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+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	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	●

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 recommended. 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+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD	
				PC	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	●

AIR LIQUIDE

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+



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	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

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-KV2L

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

OE-KV2 L is a positional basic coated electrode alloyed with a nominal 0.5% Mo. The low carbon content reduces the risk of cracking, mainly during root pass welding. Pre-heat and interpass temperatures of 100-150°C are recommended. Efficiency 100%.

Classification	
EN	1599: E Mo B 22 H5
AWS	A5.5: E 7015-A1

Approvals	Grade
RINA	MH5

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.05	0.70	0.35	≤ 0.015	≤ 0.015	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	≥ 420	510 - 610	≥ 24	≥ 47

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 400-420 °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)	CBOX		GASP	
				PC	Code	PC	Code
2.5	300	65-95	18.9	180	●		
3.2	350	90-130	34.2	120	●		
4.0	350	125-165	49.4			85	●
5.0	450	170-220	96.7			60	●

AIR LIQUIDE

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

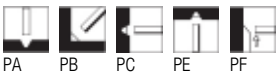
Storage

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+



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	●

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+



PA PB PC PE PF

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

OERLIKON

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+



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+



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	●		

AIR LIQUIDE

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) -30 °C
690 °C x 4h	≥ 470	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+



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	●

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+



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	●

AIR LIQUIDE WELDING

OE-KV3L

OERLIKON

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

OERLIKON

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	●

AIR LIQUIDE

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	130-170	60.2	90	●
5.0	450	150-220	94.9	55	●

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+



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	●

AIR LIQUIDE WELDING

CROMOCORD 23

OERLIKON

MMA Electrodes
Chromium-Molybdenum steels

CROMOCORD 23 is a 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+



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 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	●

AIR LIQUIDE

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

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

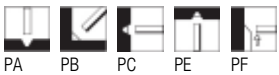
Storage

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+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	VPMD PC	VPMD 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	●

AIR LIQUIDE

CROMOCORD 9M

OERLIKON

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

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

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

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)	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

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

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 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	●

AIR LIQUIDE

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

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

X10CrMoWVNb9-2, A 213 T92, A 335 P92

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	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
21CrMoV5-11

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 42
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	●

AIR LIQUIDE

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

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

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

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

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

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+



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	●

AIR LIQUIDE

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	●

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	●

AIR LIQUIDE

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	DRYF 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 12
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

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

1.4541 (X6CrNiTi18-10)

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+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP	
				PC	Code
2.5	300	45-70	17.5	200	●
3.2	350	65-120	32.8	135	●
4.0	350	100-140	49.5	90	●
5.0	350	130-170	72.1	65	●

AIR LIQUIDE

BASINOX 308L T

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+



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	●

AIR LIQUIDE

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

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: 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	11.1	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 12
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	0.3	≤ 0.025	≤ 0.02	19	9.5	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+



Packaging data

Diam. (mm)	Length (mm)	Current (A)	Approx. weight (kg/1000)	GASP	
				PC	Code
2.5	300	45-70	17.7	200	●
3.2	350	65-120	33.2	135	●
4.0	350	115-140	48.2	90	●
5.0	350	130-170	76.0	65	●

AIR LIQUIDE

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

1.4571 (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)	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

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: 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	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	●

AIR LIQUIDE

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

1.4571 (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: 250-300 °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)	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	●

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 12
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

1.4401 (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: 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)	GASP	
				PC	Code
2.5	300	45-70	16.8	200	●
3.2	350	65-120	33.3	135	●
4.0	350	115-140	47.5	90	●
5.0	350	130-170	71.3	65	●

AIR LIQUIDE

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

1.4401 (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.

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	●

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+



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	35.8	55	●
4.0	350	100-140	55.05	40	●

AIR LIQUIDE

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

1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)

1.4571 (X6CrNiMoTi17-12-2) - 1.4401 (X4CrNiMo17-12-2)

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: 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	●

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+



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	●

AIR LIQUIDE WELDING

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	●

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+



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	●

AIR LIQUIDE

BASINOX 22 9 3 N

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+



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	●

BASINOX EB 25 10 4 N

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	A5.4: 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	●

AIR LIQUIDE WELDING

SUPRANOX 308H

MMA Electrodes
Stainless and Heat resistant steels

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: Ø 07X20H9

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	●

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. Operating temperatures are between 400º-700ºC and the deposit is insusceptible to scaling up to 800ºC. 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	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

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	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 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	VPMD 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	●

AIR LIQUIDE

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	●

AIR LIQUIDE WELDING

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	●

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	●

AIR LIQUIDE WELDING

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	●

AIR LIQUIDE

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	●

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

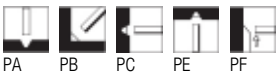
Keep dry and avoid condensation.

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)	GASP PC	GASP Code
2.5	300	45-70	19.3	200	●
3.2	350	65-120	36.2	125	●
4.0	350	115-140	54.1	90	●
5.0	350	130-180	86.6	65	●

AIR LIQUIDE WELDING

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	●

AIR LIQUIDE

BASINOX 309Mo

OERLIKON

MMA Electrodes
Stainless and Heat resistant steels

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

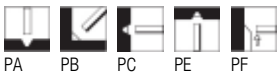
Keep dry and avoid condensation.

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	VPMD 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+



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	●

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+



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+



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

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

2.4066; 2.4068; 2.4061; 2.4060

UNS N02200; UNS N02201; UNS N02205

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	VPMD 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

UNS N06600; UNS N08800; UNS N08810

2.4816 (NiCr15Fe); 1.4876 (X10NiCrAlTi32-20); 1.4958 (X5NiCrAlTi31-20)

Cladding or buffer layer on steels.

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 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	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

SUPRANEL

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.
It is specially indicated for repairing works on difficult-to-weld steels and buffer layer due to its recovery 140% and type of core wire.

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	≤ 1.5	≤ 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

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

ASTM B574; B575; B619; B622

UNS N10276; HASTELLOY C276

Storage

Keep dry and avoid condensation.

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

Current condition and welding position

DC+



FREEZAL ENi9

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	DRYF 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

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

2.4360 (NiCu30Fe); 2.4375 (NiCu30Al)

UNS N04400; UNS N 05500

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)	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	●

CITOBRONZE Sn

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	●

CUPRONIC 70

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+



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	●

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	●

SUPERFONTE NiFe

OERLIKON

MMA Electrodes
Cast-iron

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	≤ 1.0	≤ 1.2	48-54	Rem

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-GJMB-350 (GTS 35-10)

EN-GJS-350 bis EN-GJS-400 (GGG 40)

EN-GJMW-360

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+



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
≤ 0.9	≤ 0.5	≤ 0.8	50-60	≤ 0.5	Rem	≤ 0.2

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-G7MB-350 (GTS 35-10)

EN-GJS-350 bis EN-GJS-4000 (GGG 40)

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

ALCORD AI

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-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: ~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

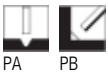
Keep dry and avoid condensation.

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

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	●

AIR LIQUIDE

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	Approvals	Grade
EN 14700: ~E Fe1	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

OERLIKON

MMA Electrodes
Hardfacing

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	●

AIR LIQUIDE

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+



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	●

AIR LIQUIDE

SUPRADUR 600

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	●

SUPRADUR 600RB

OERLIKON

MMA Electrodes
Hardfacing

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-



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	●		

AIR LIQUIDE

SUPRADUR 600B

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+



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 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	●

AIR LIQUIDE

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	●

AIR LIQUIDE

SUPERCUT

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

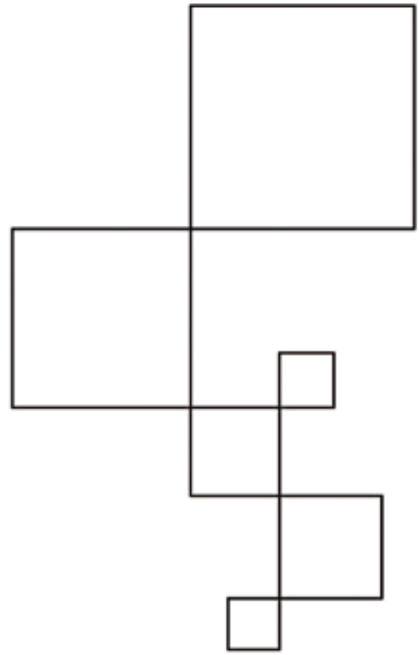
Current condition and welding position

AC; DC-



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	●



MIG/MAG SOLID WIRES-TIG RODS

OERLIKON

MIG/MAG solid wires-TIG rods / 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 M21 2Si1	219
CARBOFIL 1	A5.18: ER 70S-6	14341-A: G 42 4 M21 3Si1	220
CARBOFIL 1 GOLD	A5.18: ER 70S-6	14341-A: G 42 4 M21 3Si1	222
CARBOFIL 1A	A5.18: ER 70S-6	14341-A: G 46 4 M21 4Si1	224
CARBOFIL 1A GOLD	A5.18: ER 70S-6	14341-A: G 46 4 M21 4Si1	226
CARBOPIPE 70	A5.18: ER 70S-6	14341-A:G 46 5 M21 4Si1	228
CARBOFIL GALVA	-	14341-A: G 42 4 M21 2Ti	229
CARBOFIL Ni1	A5.28: ER 80S-Ni1	14341-A: G 46 6 M21 3Ni1	230
CARBOPIPE 80Ni	A5.28: ER 80S-G	14341-A: G 50 5 M21 0	231
CARBOFIL Ni2	A5.28: ER 80S-Ni2	14341-A: G 46 7 M21 2Ni2	232
CARBOFIL Mo	A5.28: ER 70S-A1	21952-A: G MoSi	233
CARBOFIL CrMo1	A5.28: ER 80S-G	21952-A: G CrMo1Si	234
CARBOFIL KV5	A5.28: ER 80S-B2	21952-B: G 55 M 1CM	235
CARBOFIL CrMo2	A5.28: ER 90S-G	21952-A: G CrMo2Si	236
CARBOFIL KV3	A5.28: ER 90S-B3	21952-B: G 62M 2C1M	237
CARBOFIL CrMo5	A5.28: ER 80S-B6	21952-A: G CrMo5Si	238
CARBOFIL CrMo9	A5.28: ER 80S-B8	21952-A: G CrMo9	239
CARBOFIL KV7M	A5.28-05: ER 90S-B9	21952-A: G CrMo91	240

MIG/MAG solid wires-TIG rods / Weathering steels			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOFIL NiCu	A5.28: ER 80S-G	14341-A: G 42 4 M21 0	241

MIG/MAG solid wires-TIG rods / High strength steels			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOFIL MnMo	A5.28: ER 80S-D2	14341-A: G 50 4 M21 4Mo	243
CARBOFIL NiMo1	A5.28: ER 100S-G	16834-A: G 62 4 M Mn3Ni1Mo	244
CARBOFIL MnNiMoCr	A5.28: ER 100S-G	16834-A: G 62 4 M Mn3NiCrMo	245
CARBOFIL NiMoCr	A5.28: ER 110 S-G	16834-A: G 69 4 M Mn3Ni1CrMo	246
CARBOFIL 2NiMoCr	A5.28: ER 120S-G	16834-A: G 89 4 M Mn4Ni2CrMo	247

MIG/MAG solid wires-TIG rods / Stainless and Heat resistant steels			
Product name	AWS	EN / EN ISO / DIN	Page
INERTFIL 410	A5.9: ER 410	14343-A: G 13	248
INERTFIL 410NiMo	A5.9: ER 410NiMo	14343-A: G 13 4	249
INERTFIL 420	A5.9: ER 420	-	250
INERTFIL 430	A5.9: ER 430	14343-A: G 17	251
INERTFIL 430LNb	-	14343-A: G 18 L Nb	252
INERTFIL 308LSi	A5.9: ER 308LSi	14343-A: G 19 9 L Si	253
INERTFIL 347Si	A5.9: ER 347Si	14343-A: G 19 9 Nb Si	255
INERTFIL 316LSi	A5.9: ER 316LSi	14343-A: G 19 12 3 L Si	256
INERTFIL 318Si	-	14343-A: G 19 12 3 Nb Si	257
INERTFIL 308H	A5.9: ER 308H	14343-A: G 19 9 H	258
INERTFIL 310	A5.9: ER 310	14343-A: G 25 20	259
INERTFIL 309LSi	A5.9: ER 309LSi	14343-A: G 23 12 L Si	260
INERTFIL 309LMo	A5.9: ~ER 309LMo	14343-A: G 23 12 2 L	261
INERTFIL 307	A5.9: ER 307 (approx)	14343-A: G 18 8 Mn	262
INERTFIL 312	A5.9: ER 312	14343-A: G 29 9	263
INERTFIL 904L	A5.9: ER 385	14343-A: G 20 25 5 Cu L	264
INERTFIL 20 16 L	-	14343-A:G 20 16 3 Mn N L	265
INERTFIL 22 9 3	A5.9: ER 2209	14343-A:G 22 9 3 N L	266
INERTFIL 25 10 4	A5.9: ER 2594	14343-A: G 25 9 4 N L	267

MIG/MAG solid wires-TIG rods / Nickel and Copper alloys			
Product name	AWS	EN / EN ISO / DIN	Page
NIFIL Ni1	A5.14: ER Ni-1	18274: S Ni 2061 (NiTi3)	268
NIFIL 600	A5.14: ER NiCr-3	18274: S Ni 6082 (NiCr20Mn3Nb)	269
NIFIL 625	A5.14: ER NiCrMo-3	18274: S Ni 6625 (NiCr22Mo9Nb)	270
NIFIL C276	A5.14: ER NiCrMo-4	18274: S Ni 6276 (NiCr15Mo16Fe6W4)	272
NIFIL 59	A5.14: ER NiCrMo-13	18274: S Ni 6059 (NiCr23Mo16)	273
NIFIL NiCu7	A5.14: ER NiCu7	18274: S Ni 4060 (NiCu30Mn3Ti)	274
CARBOCAST NiFe	-	1071: S NiFe1	275
COPPERFIL CuAl8	A5.7: ER CuAl-A1	24373: S Cu 6100 (CuAl8)	276
AMPCOTRODE G10	A5.7: ER CuAl-A2	-	277
AMPCOTRODE G150	A5.7: ER CuAl-A3	-	278
COPPERFIL CuSi3	A5.7: ER CuSi-A	24373: S Cu 6560 (CuSi3Mn1)	279
COPPERFIL 70/30	A5.7: ER CuNi	24373: S Cu 7158 (CuNi30Mn1FeTi)	280

MIG/MAG solid wires-TIG rods / Aluminum alloys			
Product name	AWS	EN / EN ISO / DIN	Page
ALUFIL Al99.5Ti	-	18273: S Al 1450 (Al 99.5 Ti)	281
ALUFIL AlSi5	A5.10: ER 4043	18273: S Al 4043 (AlSi5)	282
ALUFIL AlSi12	A5.10: ER 4047	18273: S Al 4047 (AlSi12)	283
ALUFIL AlMg5	A5.10: ER 5356	18273: S Al 5356 (AlMg5Cr(A))	284
ALUFIL AlMg4.5Mn	A5.10: ER 5183	18273: S Al 5183 (AlMg4.5Mn0.7(A))	285
ALUFIL AlMg5Mn	A5.10: ER 5556	18273: S Al 5556 (AlMg5Mn)	286

MIG/MAG solid wires-TIG rods / Hardfacing			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOFIL A 350	-	14700: S Fe2 8555: MSG 2-GZ-350P	287
CARBOFIL A 600	-	14700: S Fe 8 8555: MSG 6-GZ-60-GP	288

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.

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 coating 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

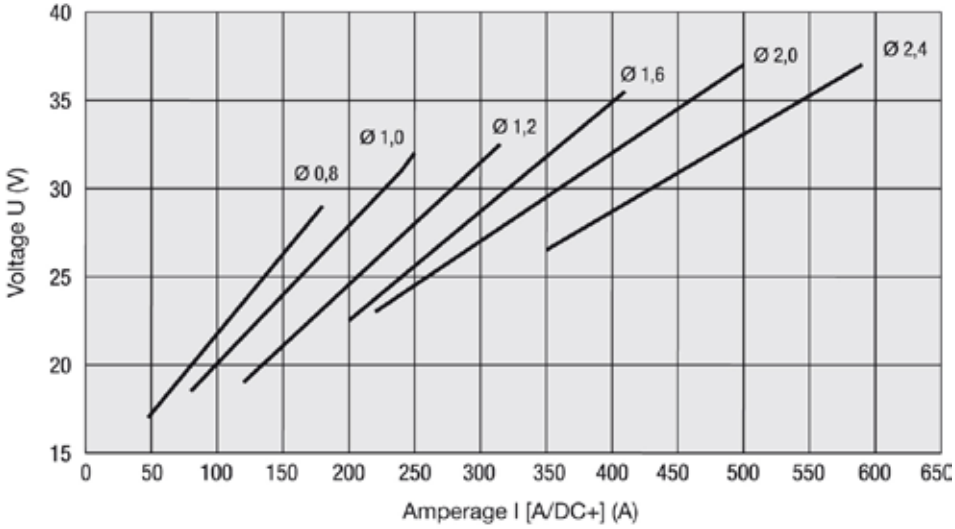
Symbols for the chemical composition of wire electrodes										
Symbols	Chemical composition [%] (m/m)(1) (2)(3)									
	C	Si	Mn	P	S	Cr	Ni	Mo	Cu	all other elements
Z	any other chemical composition agreed upon									
Mn3NiCrMo	0,14	0,60–0,80	1,3–1,8	0,015	0,018	0,40–0,65	0,50–0,65	0,15–0,30	0,30	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
Mn3Ni2,5CrM	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
Mn4Ni1,5CrM	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
Mn4Ni2,5CrM	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.

Parameters for unalloyed and low-alloy steels

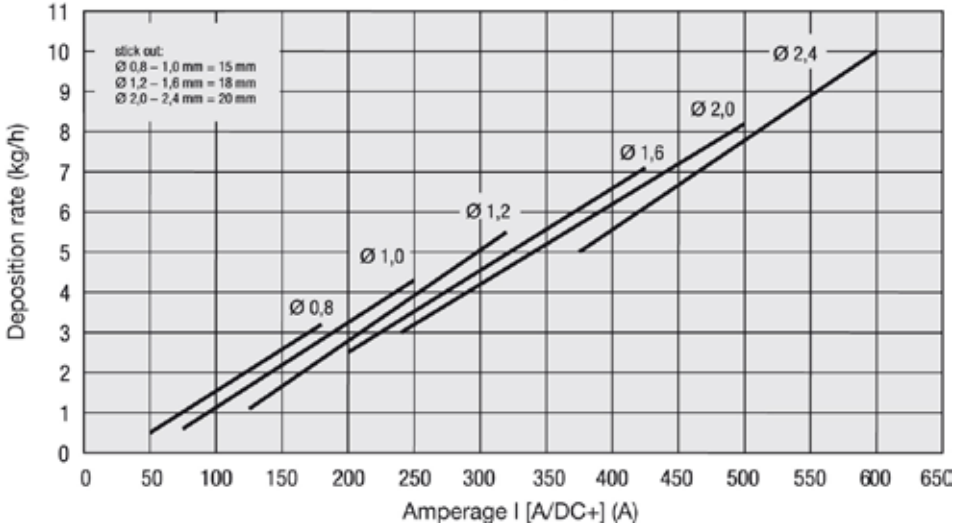
Welding parameters

Shielding gas 82% Ar + 18% CO_2



Deposition rate

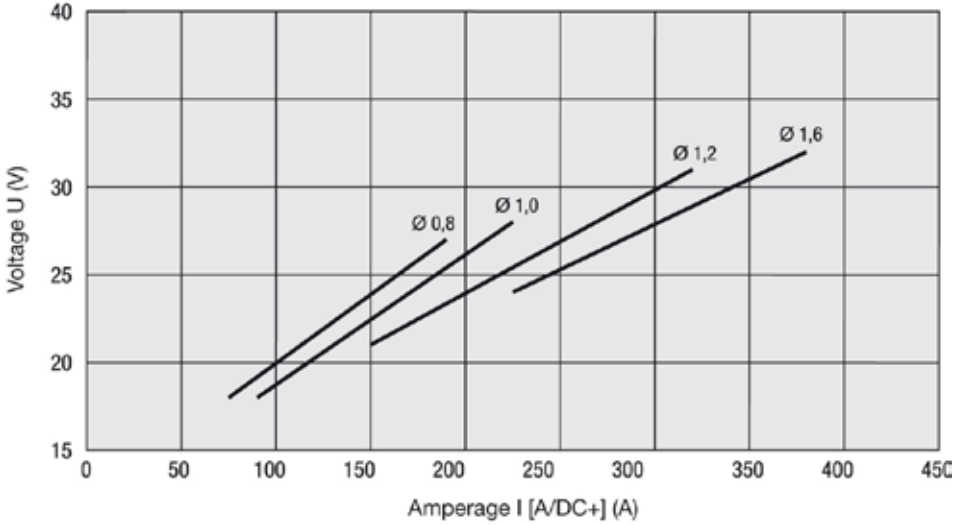
Shielding gas 82% Ar + 18% CO_2 ; 100% Duty cycle



Parameters for corrosion and heat resistant steels

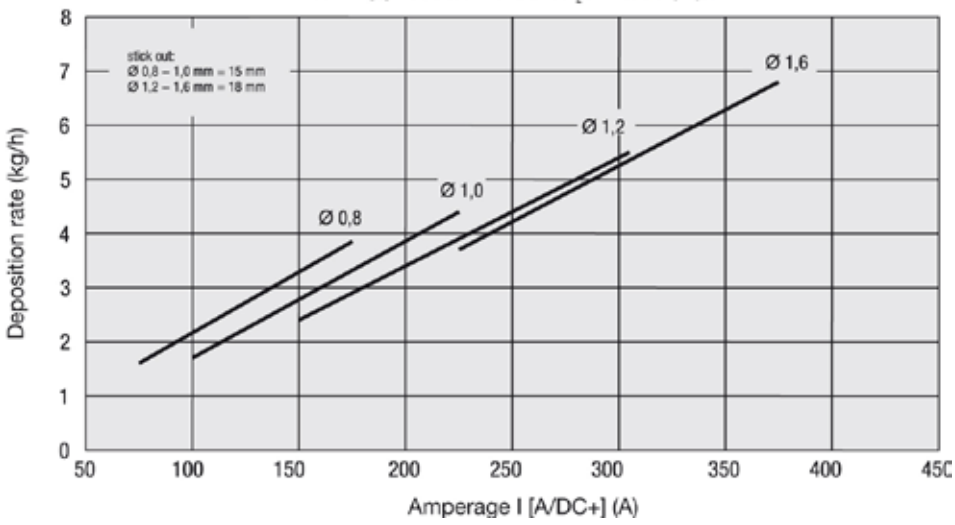
Welding parameters

Shielding gas 97,5% Ar + 2,5% CO_2



Deposition rate

Shielding gas 97,5% Ar + 2,5% CO_2 ; 100% Duty cycle



CARBOFIL

MIG/MAG solid wires-TIG rods
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 C1 2Si1
EN ISO	14341-A: G 42 3 M21 2Si1
AWS	A5.18: ER 70S-3

Approvals	Grade
DB	●

CE

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S
Wire	0.08	1.25	0.55	≤ 0.025	≤ 0.025
All weld metal (*)	0.08	0.85	0.35	≤ 0.025	≤ 0.025
All weld metal (**)	0.06	0.55	0.20	≤ 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) 0 °C
As Welded	≥ 420	480-550	≥ 22	≥ 90

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M2 - C1

Materials

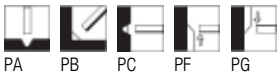
Steel up to a yield strength of 420 N/mm2: e.g. S(P)235 to S(P)355; GP240; GP280

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 solid wires-TIG rods
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 C1 3Si1
EN ISO	14341-A: G 42 4 M21 3Si1
AWS	A5.18: ER 70S-6

Approvals	Grade
ABS	3YSA
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 : C1, M14, M2, M3

Materials

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

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



AIR LIQUIDE

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

OERLIKON

MIG/MAG solid wires-TIG rods
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 C1 3Si1
EN ISO	14341-A: G 42 4 M21 3Si1
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 : C1, M14, M2, M3

Materials

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

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



AIR LIQUIDE

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 solid wires-TIG rods
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 C1 4Si1
EN ISO	14341-A: G 46 4 M21 4Si1
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	530-680	≥24	≥100	≥80	≥70
As Welded (**)	≥460	530-680	≥24	≥80	≥47	

Gas test: (*) 82% Ar+18% CO2, (**) 100% CO2

Shielding Gas - EN ISO 14175 : C1, M14, M2, M3

Materials

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

AIR LIQUIDE

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 solid wires-TIG rods
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 C1 4Si1
EN ISO	14341-A: G 46 4 M21 4Si1
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	530-680	≥24	≥100	≥80	≥70
As Welded (**)	≥460	530-680	≥24	≥80	≥47	

Gas test: (*) M21-Arcal 21, (**) C1-Arcal

Shielding Gas - EN ISO 14175 : C1, M14, M2, M3

Materials

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

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



AIR LIQUIDE

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 solid wires-TIG rods
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 C1 4Si1
EN ISO	14341-A:G 46 5 M21 4Si1
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

S(P)235 - S(P)460
X52, X56, X60, X65, X70 (nach API 5L-92)
L360MB, L385M, L415MB, L450MB, L485MB

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



AIR LIQUIDE

CARBOFIL GALVA

CE

MIG/MAG solid wires-TIG rods
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, 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 4 M21 2Ti

Chemical analysis (Typical values in %)

	C	Mn	Si	P	S	Ti	Al	Zr
Wire	0.07	1.2	0.7	≤ 0.025	≤ 0.025	0.13	0.10	0.11
All weld metal (*)	0.07	1.1	0.7	≤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	-40 °C
As Welded	≥420	500-640	≥22	≥100	≥70

Gas test: 82% Ar+18% CO2

Shielding Gas - EN ISO 14175 : M1, 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 solid wires-TIG rods
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 M21 3Ni1
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

CARBOPIPE 80Ni

OERLIKON

MIG/MAG solid wires-TIG rods
C-Mn and low-alloy steels

CARBOPIPE 80Ni is a copper coated G0 / 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	
EN ISO	14341-A: G 46 4 C1 0
EN ISO	14341-A: G 50 5 M21 0
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

L450MB, L485MB, L555MB (acc. to EN 10208-2)

X65, X70, X80 (acc. to API 5L)

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



CARBOFIL Ni2

OERLIKON

MIG/MAG solid wires-TIG rods
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 M21 2Ni2
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

CARBOFIL Mo

OERLIKON

MIG/MAG solid wires-TIG rods
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 solid wires-TIG rods
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 shielding 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

CARBOFIL KV5

OERLIKON

MIG/MAG solid wires-TIG rods
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 gases 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 solid wires-TIG rods
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 shielding 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. Main 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

CARBOFIL KV3

MIG/MAG solid wires-TIG rods
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 gases 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 solid wires-TIG rods
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

12CrMo19-5, A182 Gr. F5, A199 Gr. T5 and similar steels

X12CrMo5,GX12CrMo5,A213 Gr.T5,A217 Gr.C5,A335 Gr.P5,A336 Cl. F5, A369 Gr. FP5, A387 Gr.5, Cl 1 and 2

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+



AIR LIQUIDE

CARBOFIL CrMo9

OERLIKON

MIG/MAG solid wires-TIG rods
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

MIG/MAG solid wires-TIG rods
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	●

CARBOFIL NiCu

OERLIKON

MIG/MAG solid wires-TIG rods
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 C1 0
EN ISO	14341-A: G 42 4 M21 0
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 solid wires-TIG rods
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 M21 4Mo
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

fine grain steels with YS≤500

16Mo3

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 solid wires-TIG rods
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 solid wires-TIG rods
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 solid wires-TIG rods
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

CARBOFIL 2NiMoCr

OERLIKON

MIG/MAG solid wires-TIG rods
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

OERLIKON

MIG/MAG solid wires-TIG rods
Stainless and Heat resistant steels

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%02, 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	●

AIR LIQUIDE

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 solid wires-TIG rods
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%02, 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

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

OERLIKON

MIG/MAG solid wires-TIG rods
Stainless and Heat resistant steels

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	●

AIR LIQUIDE

INERTFIL 308LSi

OERLIKON

MIG/MAG solid wires-TIG rods
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+



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 347Si

OERLIKON

MIG/MAG solid wires-TIG rods
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 316LSi

OERLIKON

MIG/MAG solid wires-TIG rods
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

1.4401 (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	S300
Diam(mm) / weight(kg)	15	5	15
0.6	●	●	●
0.8	●	●	●
1.0	●	●	●
1.2	●	●	●
1.6	●	●	●

AIR LIQUIDE

INERTFIL 318Si

OERLIKON

MIG/MAG solid wires-TIG rods
Stainless and Heat resistant steels

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

1.4571 (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

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1.0	●
1.2	●

INERTFIL 308H

OERLIKON

MIG/MAG solid wires-TIG rods
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

INERTFIL 310

OERLIKON

MIG/MAG solid wires-TIG rods
Stainless and Heat resistant steels

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 309LSi

OERLIKON

MIG/MAG solid wires-TIG rods
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	●

AIR LIQUIDE

INERTFIL 309LMo

OERLIKON

MIG/MAG solid wires-TIG rods
Stainless and Heat resistant steels

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 solid wires-TIG rods
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

Difficult-to-weld steels

Ferrite-Austenite heterogeneous joints ("Black-White"),

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	●

AIR LIQUIDE

INERTFIL 312

OERLIKON

MIG/MAG solid wires-TIG rods
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	●

INERTFIL 904L

MIG/MAG solid wires-TIG rods
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

MIG/MAG solid wires-TIG rods
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

X2CrNiMoN18-14-3 (1.3952); X2CrNiMo18-14-3 (1.4435)

X2CrNiMoN17-13-3 (1.4429)

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 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	≥690	≥ 22	≥50	≥32

Gas test: 81% Ar + 18% He + 1% CO2

Shielding Gas - EN ISO 14175 : M12, M13

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
0.8	●
1.0	●
1.2	●

INERTFIL 25 10 4

OERLIKON

MIG/MAG solid wires-TIG rods
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	●

NIFIL Ni1

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 solid wires-TIG rods
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

UNS N06600; UNS N08800; UNS N08810

2.4816; 1.4876; 1.4958

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 solid wires-TIG rods
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. Cryogenic 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 C276

NIFIL C276 is an S Ni 6276 / ER NiCrMo-4 type solid MIG welding wire, supplied precision layer wound, depositing NiCr15Mo15Fe6W4 weld metal. Suitable for use with inert shielding gases.

NIFIL C276 is used for welding of CrMoW alloyed nickel alloys, matching with Alloy C276. Depending on the corrosion requirements also applicable foe welding of C22 and C4. The Ni-CrMoW weld metal offers good corrosion resistance in wide range of aggressive organic and inorganic acid media. Also suitable for dissimilar welds and overlays on other high nickel and ferrous alloys, including duplex stainless steels.

NIFIL C276 is used for welding plate, pipework, vessels and tanks where general corrosion and stress corrosion cracking resistance in chemical and petrochemical plant, offshore gas and oil equipment and fuel gas desulphurisation plant.

Classification	
EN ISO	18274: S Ni 6276 (NiCr15Mo16Fe6W4)
AWS	A5.14: ER NiCrMo-4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Cu	Fe	Co	V	W
0.005	0.5	0.05	0.02	0.005	16	58	16	0.05	6	<1.0	0.2	3.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	> 500	> 740	> 43

Gas test: 30 % He + 2 % H2 + 0,05 % CO2, rest Ar

Shielding Gas - EN ISO 14175 : I1, I3

Materials

Alloy C276; UNS N10276; ASTM B575; B626

NiMo16Cr15W (2.4819)

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+



NIFIL 59

NIFIL 59 is an S Ni 6059 / ER NiCrMo-13 type solid MIG welding wire, supplied precision layer wound, depositing NiCr23Mo16 weld metal. Suitable for use with inert shielding gases.

NIFIL 59 is used for welding of Ni-alloys with high CrMo content, to match with Alloy 59 base material. Excellent resistance against pitting, chloride-induced stress corrosion cracking, and crevice corrosion in acid sulfur phosphorus and chlorine surroundings.

The high level of Mo in Alloy 59 is similar to alloys C276 and C4 but performance in a wide range of more oxidising media is significantly enhanced by increasing Cr to 23%. Total alloying exceeds the level typically present in alloy C22; it is therefore considered suitable for welding this group of alloys.

Classification	
EN ISO	18274: S Ni 6059 (NiCr23Mo16)
AWS	A5.14: ER NiCrMo-13

Approvals	Grade
TÜV	●
CE	

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Fe
≤ 0.01	≤ 0.5	≤ 0.1	≤ 0.020	≤ 0.015	23	≥ 56	16	≤ 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	> 440	> 710	> 35	> 100

Gas test: 30 % He + 2 % H2 + 0,05 % CO2, rest Ar

Shielding Gas - EN ISO 14175 : I1, I3 (10-30% He), ArHeH, ArHeH+C

Materials

Alloy 59; UNS N06059; N06022; ASTM B575; B626

NiCr23Mo16Al (2.4605), NiCr21Mo14W (2.4602), NiMo16Cr16Ti (2.4610), NiMo16Cr15W (2.4819), X1NiCrMoCu 32-28-7 (1.4562), 1.4563, 1.4529, 1.4539

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+



NIFIL NiCu7

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	●

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	Approvals	Grade
EN ISO 1071: S NiFe1	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	●

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

Cu-Al-alloys, like CuAl8, CuAl5, G-CuAl9

For welding of galvanized steels

For MIG-Brazing applications

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

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	●

AMPCOTRODE G150

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

For MIG-Brazing applications

Cu-Al-alloys, like CuAl8, CuAl5, G-CuAl9

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

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

2.0872 (CuNi10Fe1Mn9); 2.0882 (CuNi30Mn1Fe); 2.0837

UNS C70600; UNS C71500

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

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

AlSi- and AlSiMg-alloys with max. 7% Si

AlMgSi0.5, AlMgSi0.7, AlMgSi1

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

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	●

ALUFIL AlMg5

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 3, Al Mg 5, Al Zn 4,5 Mg 1;

G-Al Mg 3Si; G-Al Mg 5Si

Al Mg 1SiCu, Al Mg Si 0,7;

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		●	

ALUFIL AlMg4.5Mn

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

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

DC+



Packaging data

Packaging Type	BS300	S200	S300
Diam(mm) / weight(kg)	7	2	6
1.0	●	●	●
1.2	●	●	●
1.6	●	●	●

ALUFIL AlMg5Mn

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

AlZn4.5Mg1;

AlMg4.5Mn, AlMg5;

AlMgSi1;

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 solid wires-TIG rods
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 steels and low-alloy steels			
Product name	AWS	EN / EN ISO / DIN	Page
CARBOROD	A5.18: ER 70S-3	636-A: W 42 4 W2Si	293
CARBOROD 1	A5.18: ER 70S-6	636-A: W 42 4 W3Si1	294
CARBOROD 1A	A5.18: ER 70S-6	636-A: W 46 5 W4Si1	295
CARBOROD GALVA	A5.18: ER 70S-2	636-A: W2Ti	296
CARBOROD Ni1	A5.28: ER 80S-Ni1	636-A: W 46 6 W3Ni1	297
CARBOROD Ni2	A5.28: ER 80S-Ni2	636-A: W 46 9 M W2Ni2	298
CARBOROD Ni3	A5.28: ER 80S-Ni3	636-B: W 55A 10 WN71	299
CARBOROD Mo	A5.28: ER 70S-A1	21952-A: W Mo Si	300
CARBOROD CrMo1	A5.28: ER 80S-G	21952-A: W CrMo1 Si	301
CARBOROD KV5	A5.28: ER 80S-B2	21952-B: W 55M 1CM	302
CARBOROD CrMo2	A5.28: ER 90S-G	21952-A: W CrMo2 Si	303
CARBOROD KV3	A5.28: ER 90S-B3	21952-B: W 62M 2C1M	304
CARBOROD W 225V	A5.28: ER 90S-G	-	305
CARBOROD CrMo5	A5.28: ER 80S-B6	21952-A: W CrMo5 Si	306
CARBOROD CrMo9	A5.28: ER 80S-B8	21952-A: W CrMo9	307
CARBOROD KV7M	A5.28: ER 90S-B9	21952-A: W CrMo91	308
CARBOROD NiCu	A5.28: ER 80S-G	-	309
CARBOROD MnMo	A5.28: ER 80S-D2	-	310
CARBOROD NiMo1	A5.28: ER 100S-G	16834-A: W Mn3Ni1Mo	311
CARBOROD NiMoCr	A5.28: ER 110 S-G	16834-A: W Mn3Ni1CrMo	312

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	313
INERTROD 410NiMo	A5.9: ER 410NiMo	14343-A: W 13 4	314
INERTROD 420	A5.9: ER 420	-	315
INERTROD 430	A5.9: ER 430	14343-A: W 17	316
INERTROD 308L	A5.9: ER 308L	14343-A: W 19 9 L	317
INERTROD 347	A5.9: ER 347	14343-A: W 19 9Nb	318
INERTROD 316L	A5.9: ER 316L	14343-A: W 19 12 3L	319
INERTROD 318	A5.9: ER 318	14343-A: W 19 12 3 Nb	320
INERTROD 308H	A5.9: ER 308H	14343-A: W 19 9 H	321
INERTROD 310	A5.9: ER 310	14343-A: W 25 20	322
INERTROD 309L	A5.9: ER 309L	14343-A: W 23 12L	323
INERTROD 309LMo	A5.9: ~ER 309LMo	14343-A: W 23 12 2 L	324
INERTROD 307	A5.9: ~ ER 307	14343-A: W 18 8 Mn	325
INERTROD 312	A5.9: ER 312	14343-A: W 29 9	326
INERTROD 904L	A5.9: ER 385L	14343-A: W 20 25 5 Cu L	327
INERTROD 20 16 L	-	14343-A: W 20 16 3 Mn N L	328
INERTROD 22 9 3	A5.9: ER 2209	14343-A: W 22 9 3 N L	329
INERTROD 25 10 4	A5.9: ER 2594	14343-A: W 25 9 4 N L	330

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)	331
NIROD 600	A5.14: ER NiCr 3	18274: S Ni 6082 (NiCr20Mn3Nb)	332
NIROD 625	A5.14: ER NiCrMo-3	18274: S Ni 6625 (NiCr22Mo9Nb)	333
NIROD C276	A5.14: ER NiCrMo-4	18274: S Ni 6276 (NiCr15Mo16Fe6W4)	335
NIROD NiCu7	A5.14: ER NiCu 7	18274: S Ni 4060 (NiCu30MnTi)	336
CUROD	A5.7: ER Cu	24373: S Cu 18 98 (CuSn1)	337
AMPCOTRODE T150	A5.7: ER CuAl-A3	-	338
NIROD 59	A5.14: ER NiCrMo-13	18274: S Ni 6059 (NiCr23Mo16)	339

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)	340
ALUROD AlSi5	A5.10: ER 4043	18273: S Al 4043 (AlSi5)	341
ALUROD AlSi12	A5.10: ER 4047	18273: S Al 4047 (AlSi12)	342
ALUROD AlMg5	A5.10: ER 5356	18273: S Al 5356	343
ALUROD AlMg4.5Mn	A5.10: ER 5183	18273: S Al 5183	344

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

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 GALVA

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD GALVA is a copper coated G2Ti/ER70S-2 type solid TIG welding rod. Suitable for use mainly with Ar shielding gas.

CARBOROD GALVA is a microalloyed steel rod, triple-deoxidised with Ti, Al and Zr, 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

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

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	●

CARBOROD Ni3

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

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

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

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 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 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

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 metal 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

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

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

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

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

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

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 MnMo

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD MnMo is a copper coated ER 80S-D2 type solid TIG welding rod. Suitable for use mainly with Ar shielding gas.

CARBOROD MnMo 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 MnMo 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

CARBOROD NiMo1

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD NiMo1 is a copper coated WMn3Ni1Mo/ER100S-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 100S-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	●

CARBOROD NiMoCr

OERLIKON

TIG Rods
C-Mn steels and low-alloy steels

CARBOROD NiMoCr is a copper coated GMn3Ni1CrMo/ER110S-G type solid TIG welding rod 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 mainly with Ar shielding gases.

CARBOROD NiMoCr is used to weld <690 MPa yield strength steels with excellent mechanical properties and also for low temperature applications down to -40°C.

Low heat inputs are recommended to obtain optimum joint mechanical properties.

Classification	
EN ISO	16834-A: W Mn3Ni1CrMo
AWS	A5.28: ER 110 S-G

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 : I1

Materials

S620, S690, HY 100

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



AIR LIQUIDE

INERTROD 410

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

1.4000 (X6Cr13); 1.4006 (X12Cr13)

AISI 410

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 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

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	●

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	-196 °C
As Welded	≥ 350	≥ 520	≥ 35	≥ 140	≥ 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	●

INERTROD 347

OERLIKON

TIG Rods
Stainless and Heat resistant steels

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	●

AIR LIQUIDE

INERTROD 316L

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	-196 °C
As Welded	≥ 350	≥ 510	≥ 30	≥ 130	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

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-



Packaging data

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.0	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

INERTROD 308H

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	●

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

Carbon steel to stainless steel joints,
Ferrite-Austenite heterogeneous joints ("Black-White"),
A312 TP309S;
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	●

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

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

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

Diam. (mm)	Packaging Type	Weight (kg)	Code
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 312

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	●

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

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

X2CrNiMoN18-14-3 (1.3952); X2CrNiMo18-14-3 (1.4435)

X2CrNiMoN17-13-3 (1.4429)

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 22 9 3

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	≥690	≥ 22	≥ 50	≥ 32

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

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

Diam. (mm)	Packaging Type	Weight (kg)	Code
1.6	TUB	5	●
2.0	TUB	5	●
2.4	TUB	5	●

INERTROD 25 10 4

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	●

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

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 C276

NIROD C276 is an S Ni 6276 / ER NiCrMo-4 type solid TIG welding rod, depositing NiCr15Mo15Fe6W4 weld metal. Suitable for use with inert shielding gases.

NIROD C276 is used for welding of CrMoW alloyed nickel alloys, matching with Alloy C276. Depending on the corrosion requirements also applicable foe welding of C22 and C4. The Ni-CrMoW weld metal offers good corrosion resistance in wide range of aggressive organic and inorganic acid media. Also suitable for dissimilar welds and overlays on other high nickel and ferrous alloys, including duplex stainless steels.

NIROD C276 is used for welding plate, pipework, vessels and tanks where general corrosion and stress corrosion cracking resistance in chemical and petrochemical plant, offshore gas and oil equipment and fuel gas desulphurisation plant.

Classification	
EN ISO	18274: S Ni 6276 (NiCr15Mo16Fe6W4)
AWS	A5.14: ER NiCrMo-4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Fe	W
0.005	0.5	0.05	0.02	0.005	16	58	16	6	3.5

All-weld metal Mechanical Properties

Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
As Welded	> 500	> 740	> 43

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

Alloy C276; UNS N10276; ASTM B575; B626

NiMo16Cr15W (2.4819)

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC+



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

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	●

NIROD 59

NIROD 59 is an S Ni 6059 / ER NiCrMo-13 type solid TIG welding rod, depositing NiCr23Mo16 weld metal. Suitable for use mainly with inert shielding gases.

NIROD 59 is used for welding of Ni-alloys with high CrMo content, to match with Alloy 59 base material. Excellent resistance against pitting, chloride-induced stress corrosion cracking, and crevice corrosion in acid sulfur phosphorus and chlorine surroundings.

The high level of Mo in Alloy 59 is similar to alloys C276 and C4 but performance in a wide range of more oxidising media is significantly enhanced by increasing Cr to 23%. Total alloying exceeds the level typically present in alloy C22; it is therefore considered suitable for welding this group of alloys.

Classification	
EN ISO	18274: S Ni 6059 (NiCr23Mo16)
AWS	A5.14: ER NiCrMo-13

Approvals	Grade
TÜV	●

CE

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Fe
≤ 0.01	≤ 0.5	≤ 0.1	≤ 0.020	≤ 0.015	23	≥ 56	16	≤ 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	> 440	> 710	> 35	> 100

Gas test: 100% Ar

Shielding Gas - EN ISO 14175 : I1

Materials

Alloy 59; UNS N06059; N06022; ASTM B575; B626

NiCr23Mo16Al (2.4605), NiCr21Mo14W (2.4602), NiMo16Cr16Ti (2.4610), NiMo16Cr15W (2.4819), X1NiCrMoCu 32-28-7 (1.4562), 1.4563, 1.4529, 1.4539

Storage

Keep dry and avoid condensation.

Current condition and welding position

DC-



ALUROD Al99.5Ti

OERLIKON

TIG Rods
Aluminum alloys

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	●

AIR LIQUIDE

ALUROD AlSi5

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

AlSi- und AlSiMg-alloys with max. 7% Si

AlMgSi0.5, AlMgSi0.7, AlMgSi1

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

ALUROD AlMg5

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 3, Al Mg 5, Al Zn 4,5 Mg 1;

Al Mg 1SiCu, Al Mg Si 0,7;

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	●

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

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

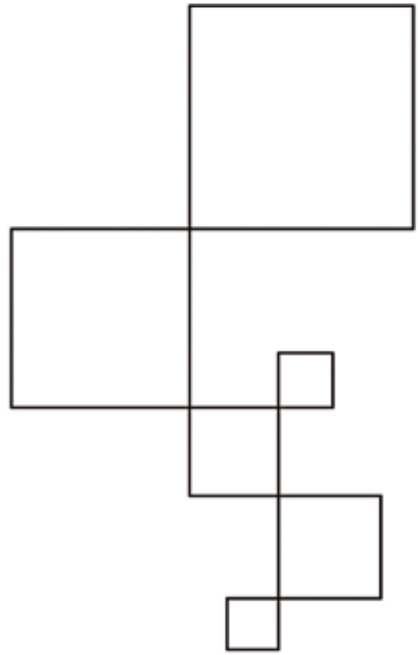
AC



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



MIG/MAG CORED WIRES

OERLIKON

MIG/MAG 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-B: T552T15-1MA-UH5	373
CITOFLUX M60A	A5.18: E70C-3M H8	17632-A: T 42 2 M M 1 H5	374
CRISTAL F206	A5.18: E70C-6M H4	17632-B: T493T15-1MA-UH5	375
FLUXOFIL M 10	A5.18: E70C-6M H4	17632-B: T554T15-1MA-UH5	376
CITOFLUX M60	A5.18: E 70C-6M H4	17632-B: T494T1-1MA-UH5	377
CITOFLUX M00	A5.18: E70C-6M H4	17632-A: T 46 5 M M 1 H5	378
FLUXOFIL M 10 S	A5.18: E70C-6M H4	17632-A: T 42 6 M M 1 H5	379
CITOFLUX M20	A5.18: E70C-GM H4	17632-A: T 46 6 Mn1Ni M M 1 H5	380
FLUXOFIL M 10 PG	A5.18: E70C-GM H4	17632-B: T554TG-1MA-UH5	381
CITOFLUX GALVA	A5.18: E70C-GS	17632-A: T3T Z M M 1 H15	382
FLUXOFIL 14	A5.20: E71T-1M-JH4	17632-A: T 46 4 P M 1 H5	383
FLUXOFIL 14 HD	A5.20: E71T-1M-JH4	17632-A: T 46 2 P C 1 H5	384
CITOFLUX R00	A5.20: E71T-1C-H4	17632-B: T493T1-1MA-UH5	386
FLUXOFIL 14 HD S	A5.20: E71T-1M-JH4	17632-A: T 46 4 P M 1 H5	388
CITOFLUX R00Ni	A5.29: E81T1-GC-H4	17632-B: T554T1-1MA-N1-UH5	390
CITOFLUX R00C	A5.20: E71T-1C-JH4	17632-A: T 42 3 P C 1 H5	391
FLUXOFIL 19 HD S	A5.20: E71T-1C-JH4	17632-A: T 46 4 P C 1 H5	392
CITOFLUX R00NiC	A5.20: E71T-1C JH4	17632-A: T 46 4 P C 1 H10	393
CITOFLUX R111	-	17632-A: T 42 2 1Ni R C 3 H10	394
FLUXOFIL 20 HD	A5.29: E81T1-Ni1M-JH4	17632-B: T554T1-1MA-N1-UH5	395
FLUXOFIL 21 HD	A5.29: E81T1-Ni1C-JH4	17632-A: T 46 4 1Ni P C 1 H5	396
CITOFLUX R82	A5.29: E81T1-Ni1M-H4	17632-A: T 46 5 1Ni P M 1 H5	397
CITOFLUX R82 SR	A5.29: E81T1-Ni1M-H4	17632-A: T 46 6 1Ni P M 1 H5	398
FLUXOFIL 31	A5.20: E70T-5C-JH4	17632-B: T494T5-1MA-UH5	399
CITOFLUX B00	A5.20: E70T-5C-JH4	17632-B: T495T5-1MA-UH5	400
FLUXOFIL 40	A5.29: E80T5-GC-H4	17632-B: T556T5-1MA-N2-UH5	401
FLUXOFIL 140 mod.	A5.29: E81TG-GM-H4	17632-A: T 46 6 1Ni B M 2 H5	402
FLUXOFIL 44	A5.29: E70T5-GM-JH4	17632-A: T 42 8 2Ni B M 2 H5	403
FLUXOFIL 43.1	-	-	404
CITOFLUX B13-O	A5.20: E71-T7	17632-A: T 42 Z Y 1 H15	405

MIG/MAG Cored Wires / Weathering steels			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOFIL M 48	A5.29: E81TG-W2M	17632-B: T553T15-1MA-NCC1-UH5	406
FLUXOFIL 18 HD	A5.29: E81T1-GM-H4	17632-B: T573T1-1MA-NCC1-UH5	407
FLUXOFIL 48	A5.29: E81T5-GC-H4	17632-B: T556T5-1MA-G-UH5	408

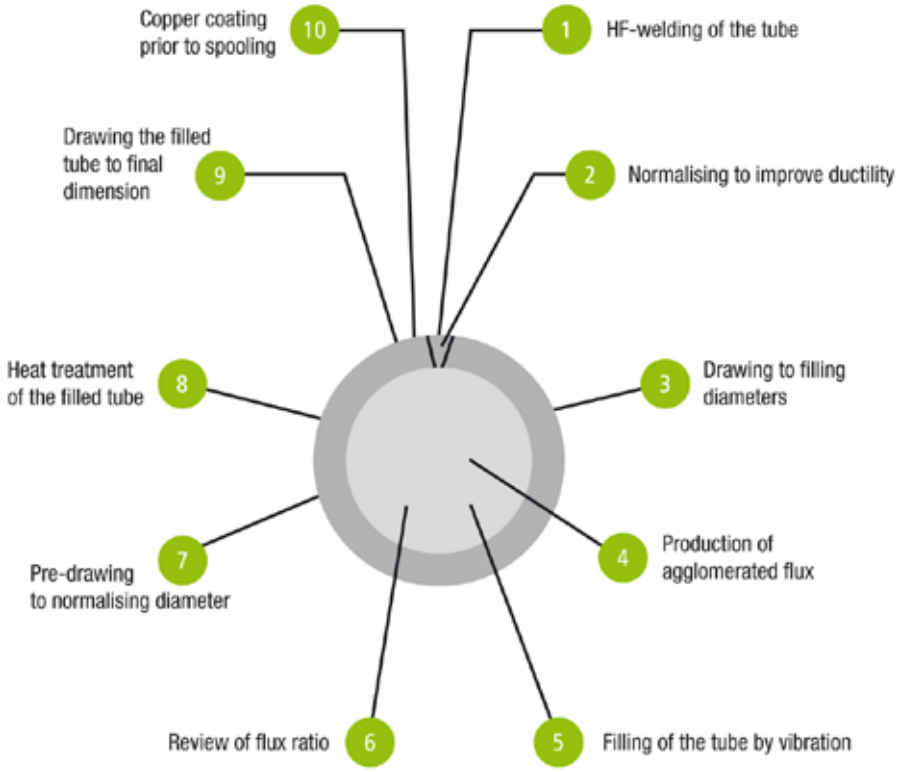
MIG/MAG Cored Wires / High-strength steels			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOFIL M 41	A5.28: E90C-GM H4	18276-A: T 55 5 Z M M 1 H5	409
FLUXOFIL 41	A5.29: E90T5-GC-H4	18276-B: T624T5-1MA-N2M2-UH5	410
CITOFLUX R550	A5.29: E91T1-G M H4	18276-A: T55 5 Mn1,5Ni P M 1 H5	411
CITOFLUX R620	A5.29: E91T1-G H4	18276-A: T 62 4 1NiMo P M 1 H5	412
CITOFLUX R620 Ni2	A5.29: E 91 T1-G H4	18276-A: T 62 5 Mn2,5Ni P M 1 H5	413
FLUXOFIL 29 HD	A5.29: E 111 T1-GMJ H4	18276-A: T 69 4 Z P M 1 H5	414
FLUXOFIL M 42	A5.28: E110C-GM H4	18276-A: T 69 4 Mn2NiCrMo M M 1 H5	415
FLUXOFIL 42	A5.29: E110T5-K4C-H4	18276-B: T786T5-1 MA-N4C1M2-UH5	416
FLUXOFIL 45	A5.29: E120T5-GM H4	18276-A: T 89 4 Z B M 2 H5	417
FLUXOFIL 70	A5.29: E110T5-GM-H4	18276-B: T78YT5-0MP-G-UH5	418

MIG/MAG Cored Wires / Chromium-Molybdenum steels			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOFIL 25	A5.29: E81T1-A1M-H4	17634-B: T55T1-1M-2M3-H5	419
FLUXOFIL 35	A5.29: E80T5-GC-H4	17634-B: T55T5-1M-2M3-H5	420
FLUXOFIL 36	A5.29: E80T5-B2C-H4	17634-B: T55T5-1M-1CM-H5	421
FLUXOFIL 37	A5.29: E80T5-B3C-H4	17634-B: T55T5-1M-2C1M-H5	422
FLUXOFIL 38 C	A5.29: E70T5-GC-JH4	17634-B: TZT5-0M-Z-H5	423

MIG/MAG Cored Wires / Stainless and Heat resistant steels			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXINOX 430Ti	A5.22: E 430 T0-G	-	424
FLUXINOX 308L	A5.22: E308LT0-4	17633-B: TS308L-FB0	425
FLUXINOX 308L PF	A5.22: E308LT1-4	17633-B: TS308L-FB1	426
FLUXINOX 308H	A5.22: E308HT0-4	17633-B: TS308H-FB0	427
FLUXINOX 347	A5.22: E347T0-4	17633-B: TS347L-FB0	428
FLUXINOX 347 PF	A5.22: E347T1-4	17633-B: TS347L-FB1	429
FLUXINOX 316L	A5.22: E316LT0-4	17633-B: TS316L-FB0	430
FLUXINOX 316L PF	A5.22: E316LT1-4	17633-B: TS316L-FB1	431
FLUXINOX 318	-	17633-A: T 19 12 3 Nb R C 3	432
FLUXINOX 318 PF	-	17633-A: T 19 12 3 Nb P C 1	433
FLUXINOX 22 9 3 L	A5.22: E2209T0-1	17633-A: T 22 9 3 N L R C 3	434
FLUXINOX 22 9 3 L PF	A5.22: E2209T1-1	17633-A: T 22 9 3 N L P C 1	435
FLUXINOX 307	-	17633-A: T 18 8 Mn R C 3	436
FLUXINOX 307 PF	-	17633-A: T 18 8 Mn P C 1	437
FLUXINOX 309L	A5.22: E309LT0-4	17633-B: TS309L-FB0	438
FLUXINOX 309L PF	A5.22: E309LT1-1	17633-B: TS309L-FB1	439
FLUXINOX 309MoL	A5.22: E309LMoT0-4	17633-B: TS309LMo-FB0	440
FLUXINOX 309MoL PF	A5.22: E309LMoT1-4	17633-B: TS309LMo-FB1	441
FLUXINOX 312	A5.22: E312T0-4	17633-B: TS312-FB0	442
FLUXINOX 312 PF	A5.22: E312T1-4	17633-B: TS312-FB1	443
FLUXINOX 310	A5.22: E 310T0-G	17633-A: T 25 20 R C 3	444
FLUXINOX 310 PF	A5.22: E 310T1-1	17633-A: T 25 20 P C 1	445
FLUXINOX 309H	A5.22: E309T0-4	17633-B: TS309-FB0	446
FLUXINOX 309H PF	A5.22: E309T1-4	17633-B: TS309-FB1	447
FLUXINOX 25 4	-	17633-A: T Z 25 4 R C 3	448
FLUXINOX 904L	A5.22: ~E385LT1-1/4	17633-A: T Z 20 25 5 Cu L P M 1	449
FLUXINOX 25 4 PF	-	17633-A: T Z 25 4 P C 3	450
FLUXINOX 625	A5.34: ENiCrMo3T1-4	-	451

MIG/MAG Cored Wires / Hardfacing			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOFIL 50	-	14700: T Fe1	452
FLUXOFIL 51	-	14700: T Fe1	453
FLUXOFIL 52	-	14700: T Fe1	454
FLUXOFIL 54	-	14700: T Z Fe1	455
FLUXOFIL 56	-	14700: T Fe8	456
FLUXOFIL 58	-	14700: T Fe8	457
FLUXOFIL M 58	-	14700: T Fe8	458
CITOFLUX H06	-	14700: T Fe8	459
FLUXOFIL 66	-	14700:T Z Fe8	460
FLUXODUR 62-O	-	14700: T Fe15	461

Schematic representation of the FLUXOFIL process



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.

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 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

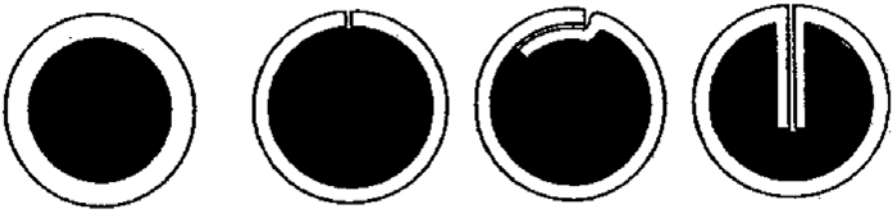
Symbols for hydrogen content of deposited weld metal	
Symbols	Hydrogen content ml/100 grams deposited weld metal max.
H5	5
H10	10
H15	15

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.

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		

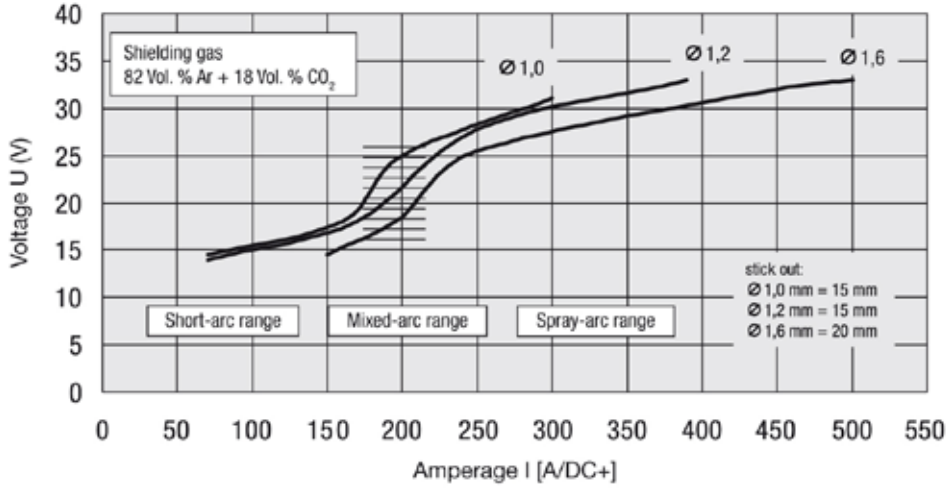
Function of metallic sheath:

- 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:

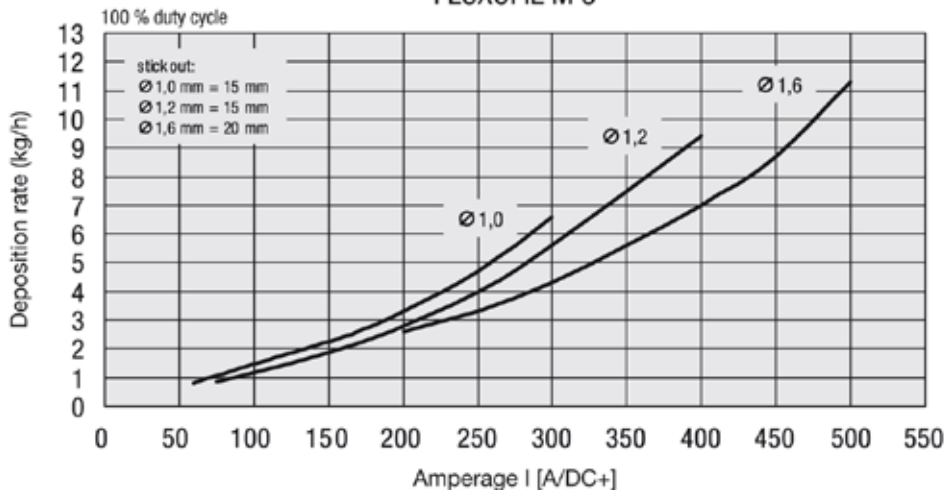
- Arc stabilisers for high process stability
- Alloying elements to optimise metallurgy
- Micro-alloying elements for improving mechanical properties of the weld metal
- Slag forming elements
- Prevention of moisture pick-up
- Purify the weld pool from elements promoting cracking and to improve weldability especially in positional welding

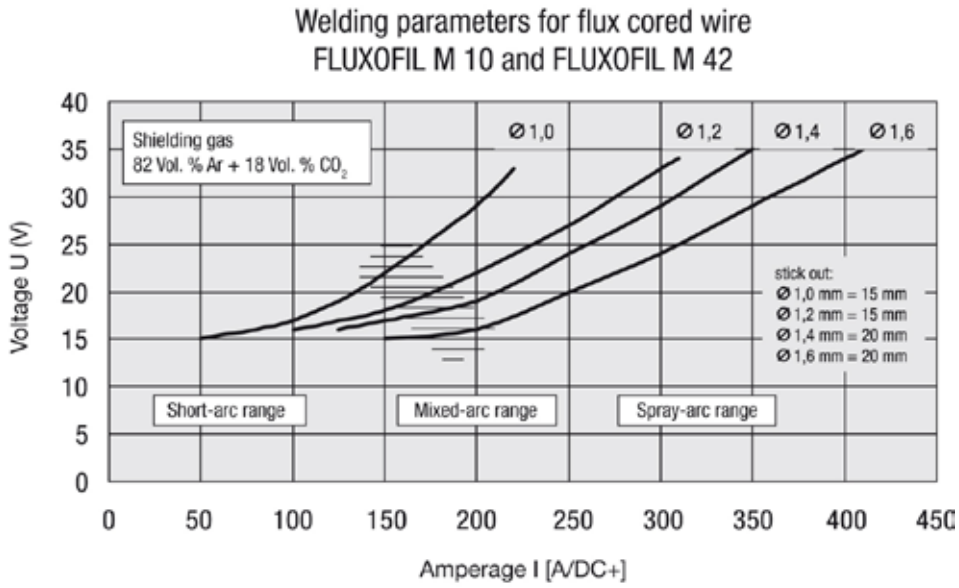
Welding parameters for flux cored wire FLUXOFIL M 8

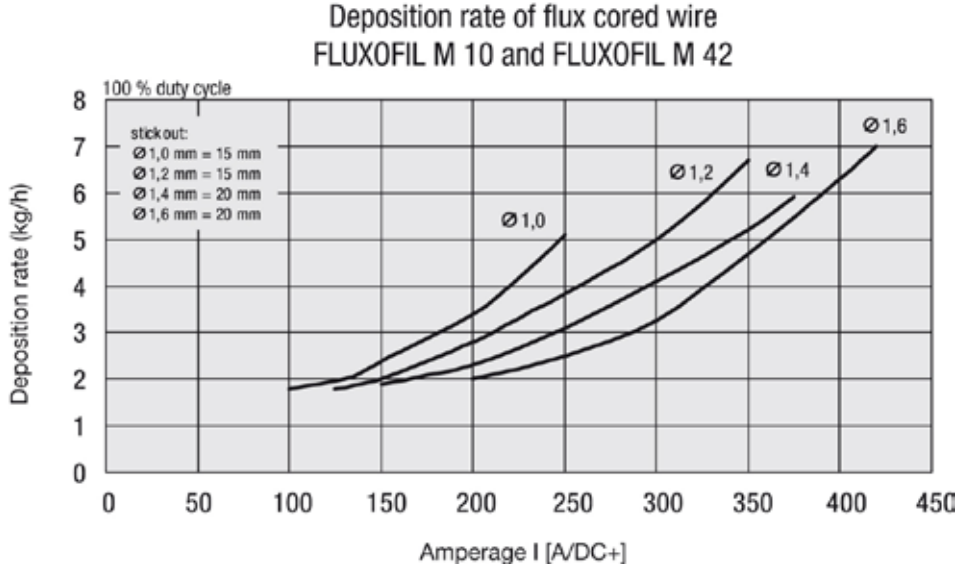


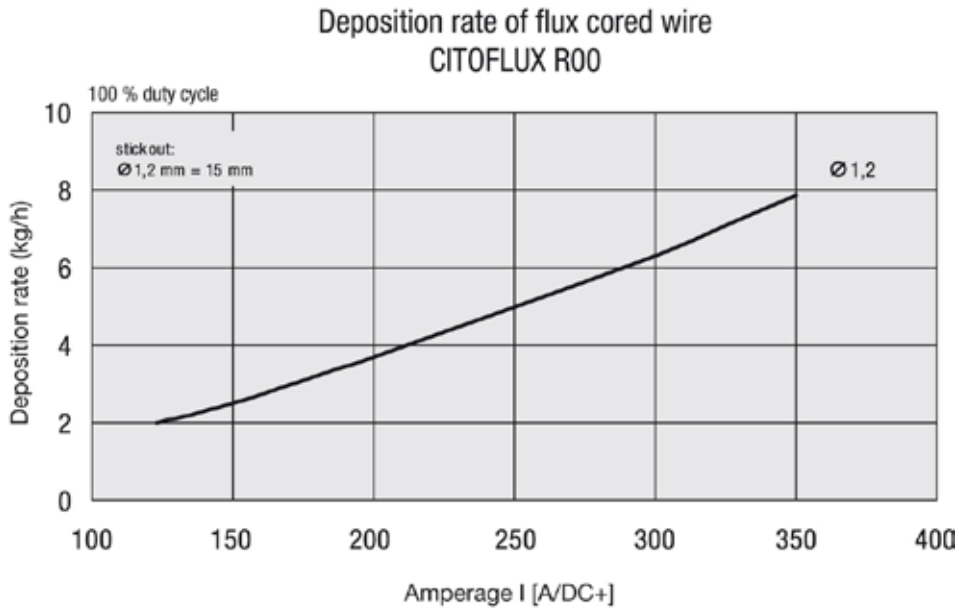
When using shielding gas according to DIN EN 439-C1 (100 Vol % CO_2) increase arc-voltage by about 3 volts

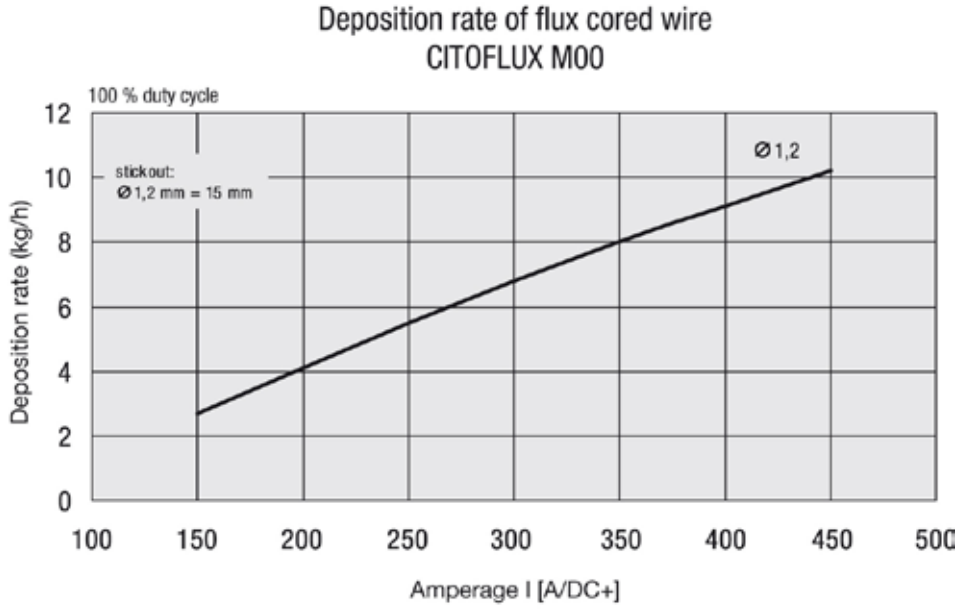
Deposition rate of flux cored wire FLUXOFIL M 8



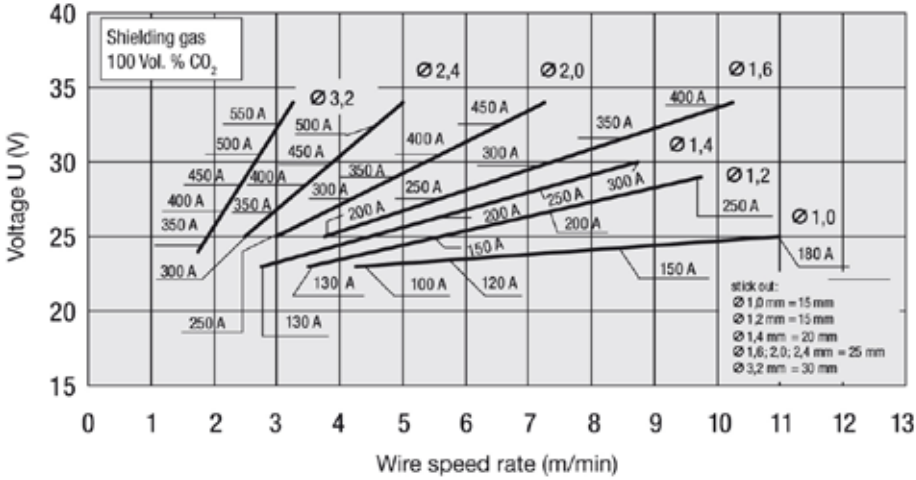

Welding parameters for flux cored wire
FLUXOFIL M 10 and FLUXOFIL M 42
Shielding gas
82 Vol. % Ar + 18 Vol. % CO_2
Ø 1,0
Ø 1,2
Ø 1,4
Ø 1,6
stick out:
Ø 1,0 mm = 15 mm
Ø 1,2 mm = 15 mm
Ø 1,4 mm = 20 mm
Ø 1,6 mm = 20 mm
Short-arc range
Mixed-arc range
Spray-arc range
Voltage U (V)
Amperage I [A/DC+]


Deposition rate of flux cored wire
FLUXOFIL M 10 and FLUXOFIL M 42
100 % duty cycle
stick out:
Ø 1,0 mm = 15 mm
Ø 1,2 mm = 15 mm
Ø 1,4 mm = 20 mm
Ø 1,6 mm = 20 mm
Ø 1,0
Ø 1,2
Ø 1,4
Ø 1,6
Deposition rate (kg/h)
Amperage I [A/DC+]


Deposition rate of flux cored wire
CITOFLUX R00
100 % duty cycle
stick out:
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+]

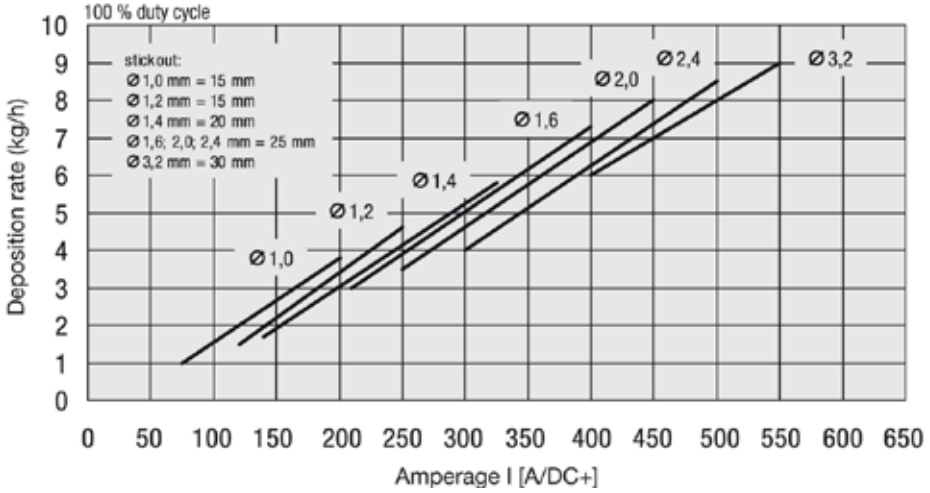

Deposition rate of flux cored wire
CITOFLUX M00
100 % duty cycle
stick out:
Ø1,2 mm = 15 mm
Ø1,2
Deposition rate (kg/h)
0
2
4
6
8
10
12
100
150
200
250
300
350
400
450
500
Amperage I [A/DC+]

Welding parameters for flux cored wires
FLUXOFIL 14, 20, 25, 30, 31, 35, 36, 37, 40, 41, 42, 43.1, 44, 48, 70

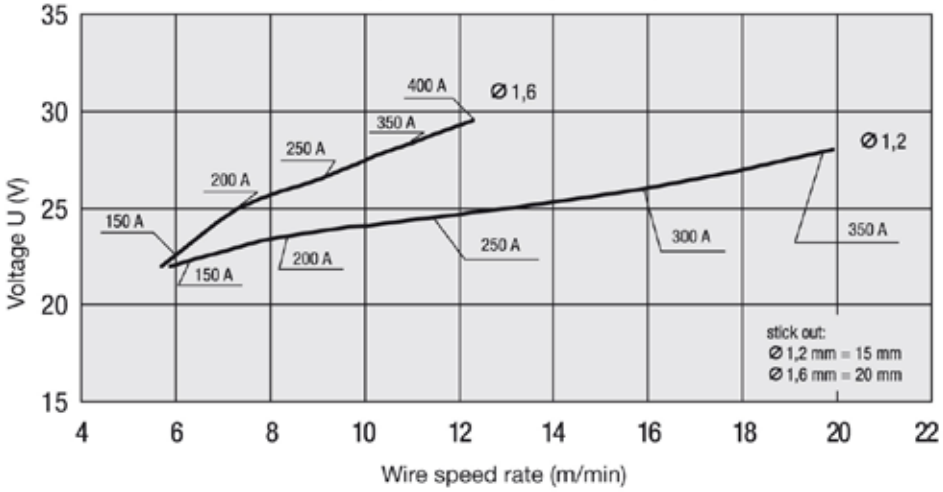


When using shielding gas according to DIN EN 439 M21 (82 Vol.% Ar + 18 Vol.% CO_2) reduce arc-voltage by about 3 volts

Deposition rates of flux cored wires
FLUXOFIL 14, 20, 25, 30, 31, 35, 36, 37, 40, 41, 42, 43.1, 44, 48, 70

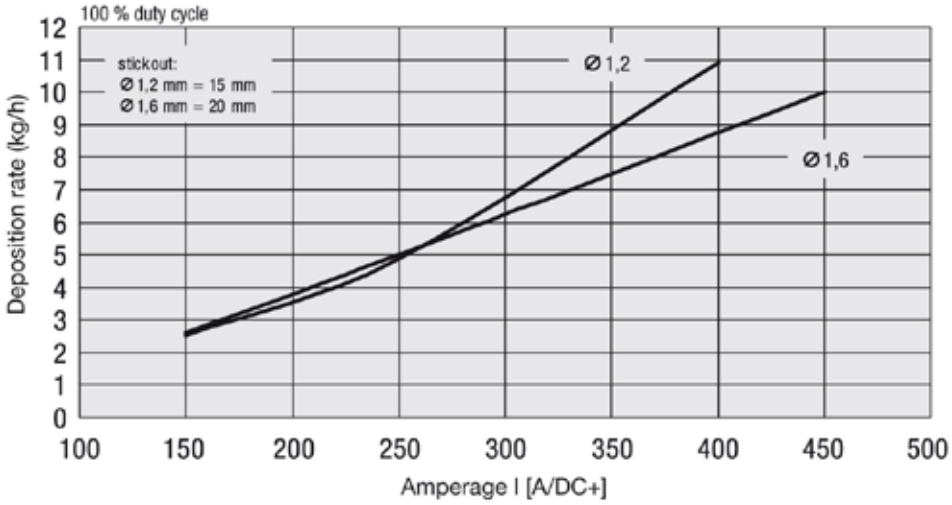


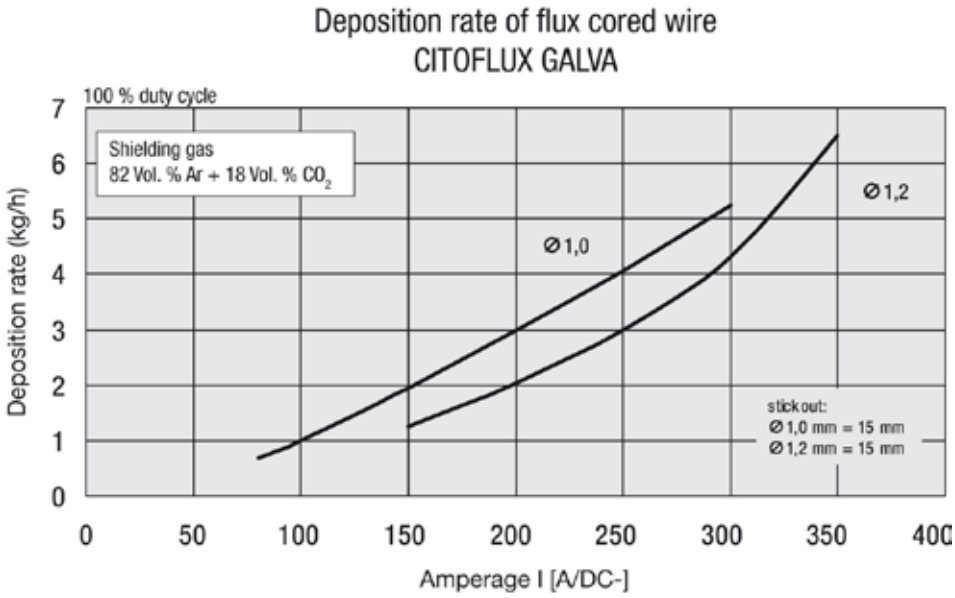
Welding parameters for flux cored wires
FLUXOFIL 14 HD, 19 HD, 18 HD, 19 HDS, 20 HD, 21 HD



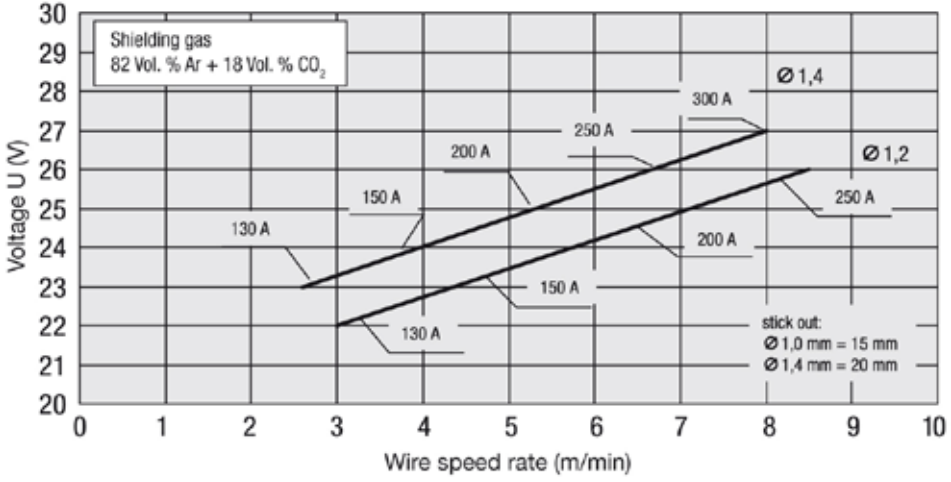
When using shielding gas according to DIN EN 439 - C1 (100 Vol% CO_2) increase arc-voltage by about 3 volts

Deposition rate of flux cored wires
FLUXOFIL 14 HD, 19 HD, 18 HD, 19 HDS, 20 HD, 21 HD

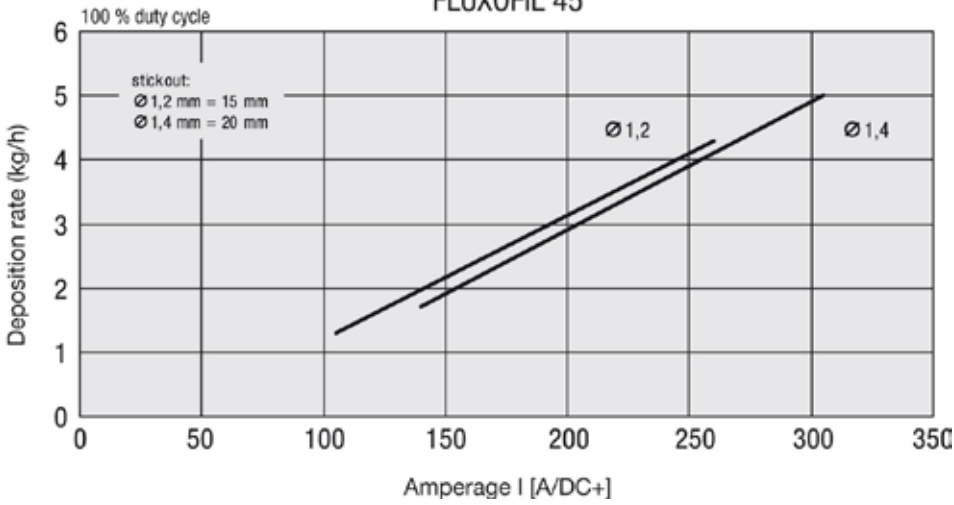



Deposition rate of flux cored wire
CITOFLUX GALVA
100 % duty cycle
Shielding gas
82 Vol. % Ar + 18 Vol. % CO_2
Ø1,0
Ø1,2
stick out:
Ø1,0 mm = 15 mm
Ø1,2 mm = 15 mm
Deposition rate (kg/h)
0
1
2
3
4
5
6
7
0
50
100
150
200
250
300
350
400
Amperage I [A/DC-]

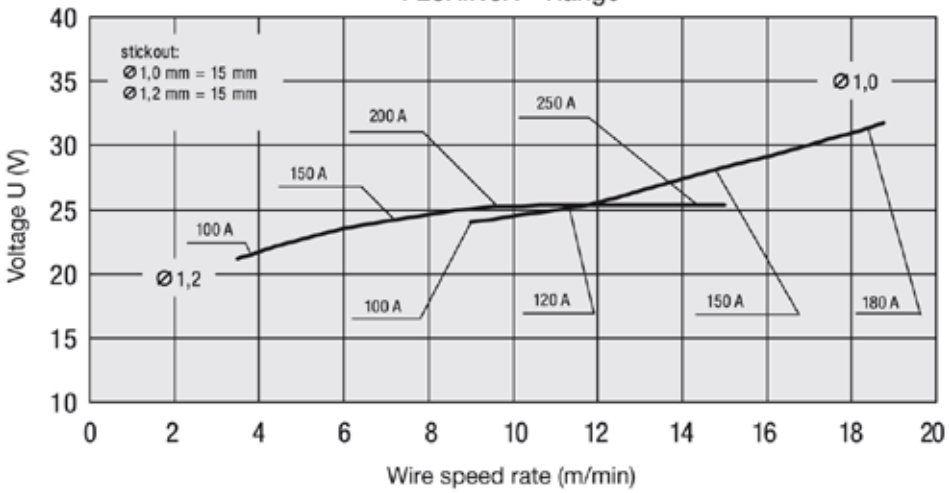
Welding parameters for flux cored wire FLUXOFIL 45



Deposition rate of flux cored wire FLUXOFIL 45

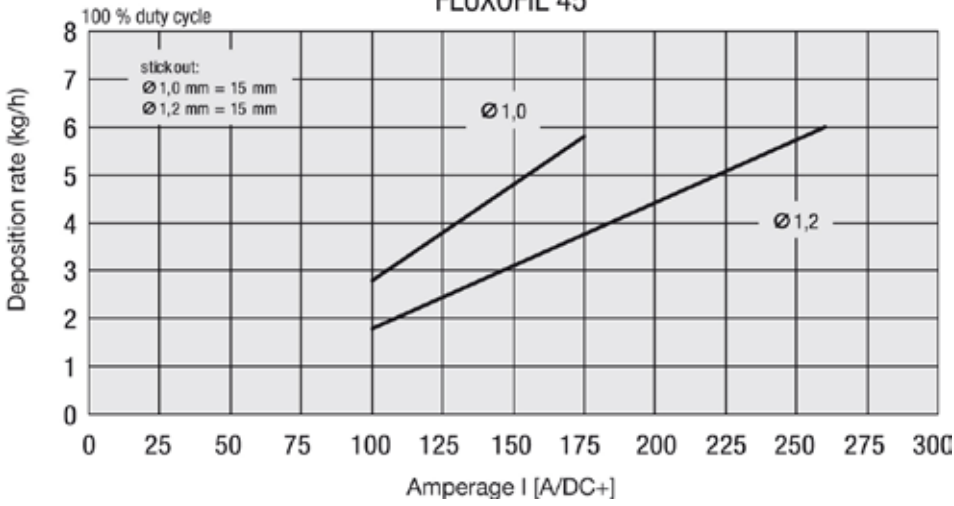


Welding parameters for flux cored wire FLUXINOX - Range

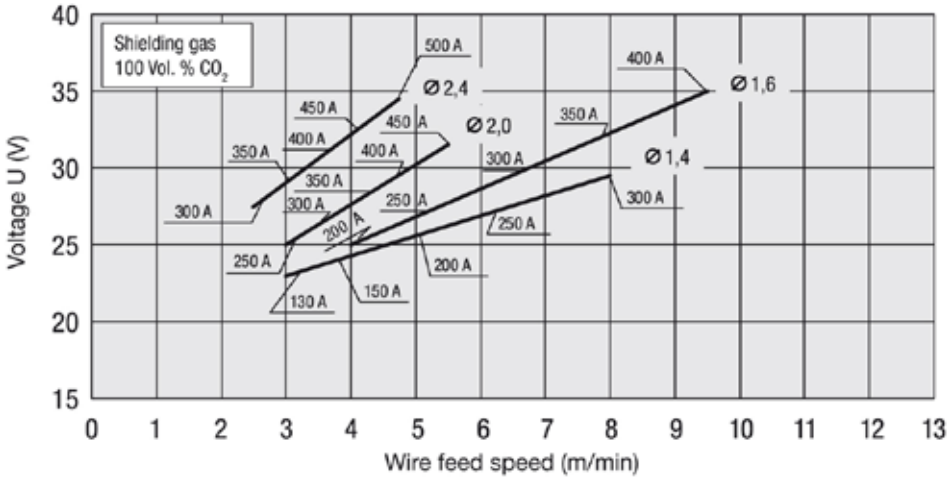


Shielding gas 82 Vol.% Ar + 18 Vol.% CO_2
When using 100 Vol. % CO_2 increase voltage by about 3 volts

Deposition rate of flux cored wire FLUXOFIL 45

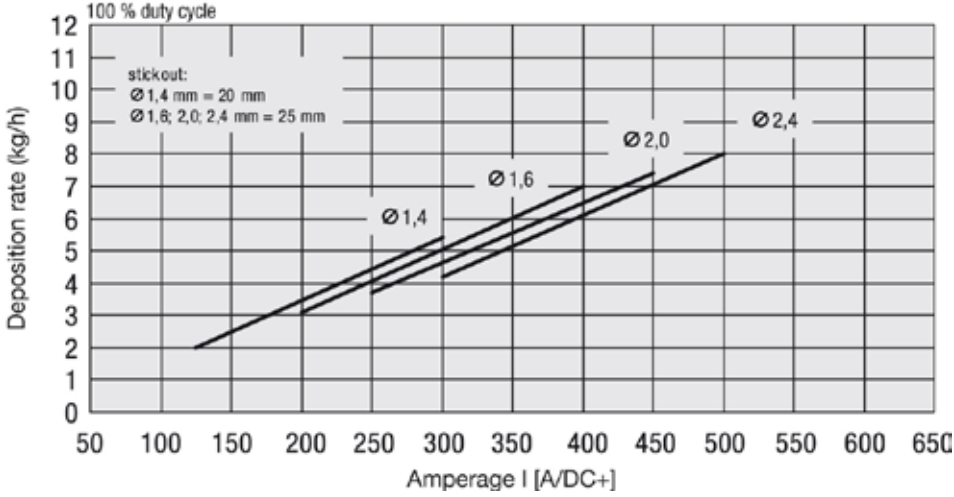


Welding parameters for flux cored wires
FLUXOFIL 50, 51, 52, 54, 56, 58, 66

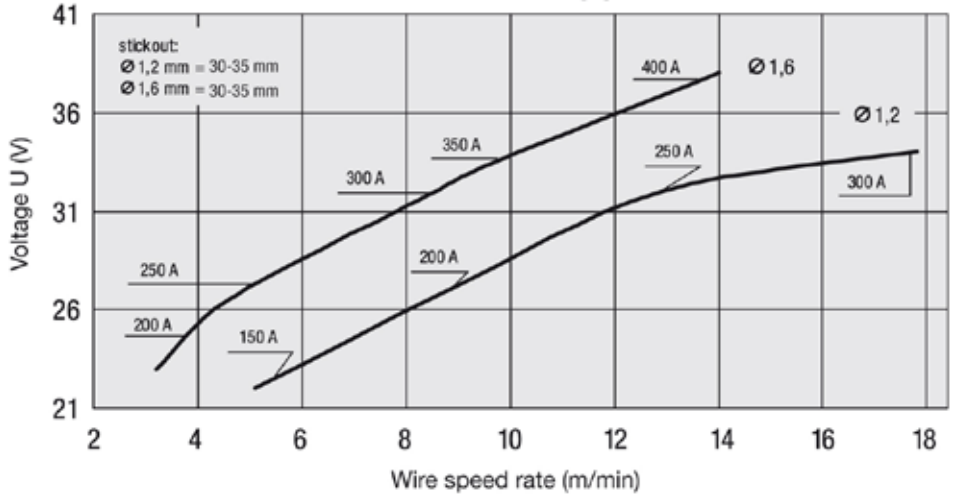


When using shielding gas (82 Vol.% Ar + 18 Vol.% CO_2) reduce arc-voltage by about 3 volts

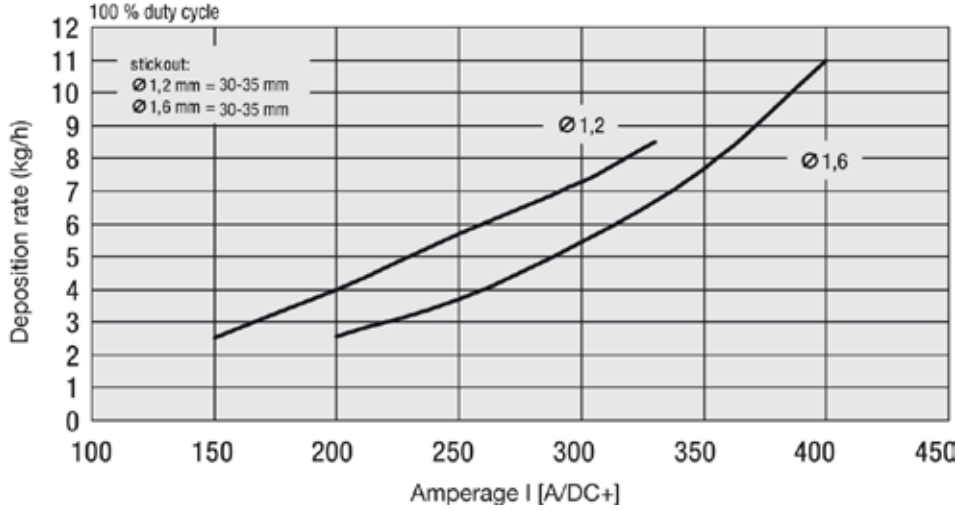
Deposition rate of flux cored wires
FLUXOFIL 50, 51, 52, 54, 56, 58, 66



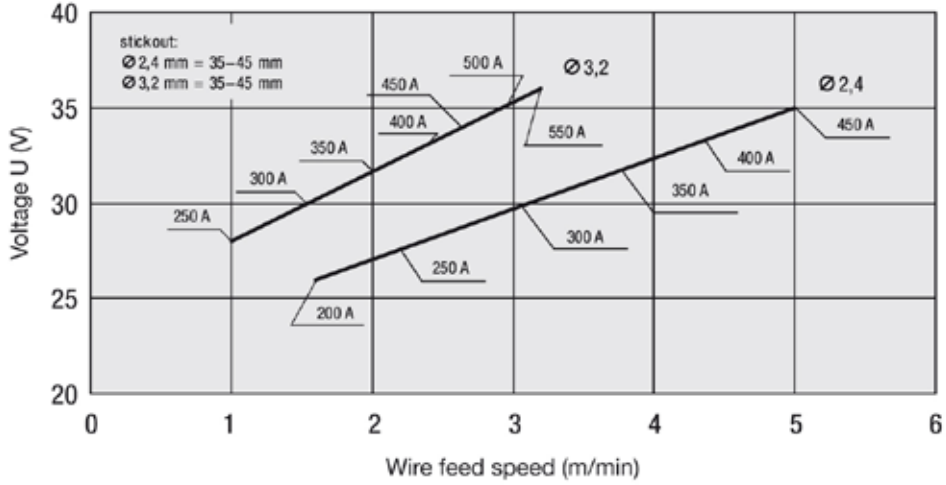
Welding parameters for flux cored wires FLUXODUR 62 and FLUXODUR 62-0 without shielding gas



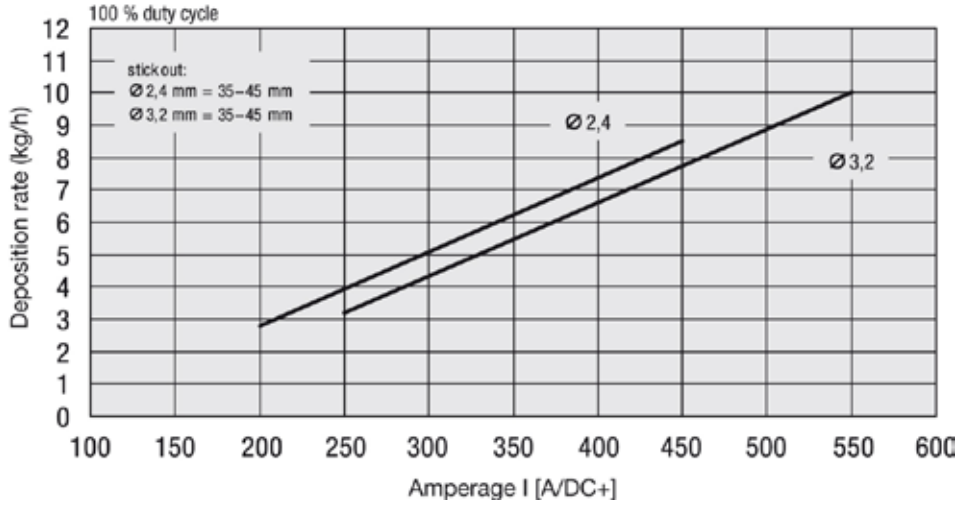
Deposition rates of flux cored wires FLUXODUR 62 and FLUXODUR 62-0



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



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

FLUXOFIL M 8

OERLIKON

MIG/MAG 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

MIG/MAG 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

CRISTAL F206

OERLIKON

MIG/MAG 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

MIG/MAG 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

MIG/MAG 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

MIG/MAG 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 5 M M 1 H5
EN ISO	17632-B: T555T15-1MA-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) -50 °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

FLUXOFIL M 10 S

OERLIKON

MIG/MAG 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

MIG/MAG 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

FLUXOFIL M 10 PG

MIG/MAG 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

MIG/MAG 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

FLUXOFIL 14

OERLIKON

MIG/MAG 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	●

FLUXOFIL 14 HD

OERLIKON

MIG/MAG 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+



AIR LIQUIDE

Packaging data

Packaging Type	B300	DRUM	S200
Diam(mm) / weight(kg)	16	200	5
1.2	●	●	●
1.4	●		
1.6	●		

CITOFLUX R00

OERLIKON

MIG/MAG 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

Shipbuilding steels A,B,D,E,AH32 - EH36

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

X42 - X65

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



AIR LIQUIDE

Packaging data

Packaging Type	B300	S200
Diam(mm) / weight(kg)	16	5
1.0	●	
1.2	●	●
1.6	●	

FLUXOFIL 14 HD S

OERLIKON

MIG/MAG 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+



AIR LIQUIDE

Packaging data

Packaging Type	B300
Diam(mm) / weight(kg)	16.0
1.2	●
1.4	●
1.6	●

CITOFLUX R00Ni

OERLIKON

MIG/MAG 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	●	●

AIR LIQUIDE

CITOFLUX R00C

OERLIKON

MIG/MAG 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	●	●

FLUXOFIL 19 HD S

OERLIKON

MIG/MAG 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

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	●

AIR LIQUIDE

CITOFLUX R00NiC

CE

MIG/MAG Cored Wires
C-Mn and low-alloy steels

Closed-shape flux-cored wire electrode with rutile, fast-freezing slag for gas-shielded metal arc welding of unalloyed steels for operating temperatures from -40°C up to +450°C in all welding positions with spray arc featuring increased welding parameters and increased deposition rates. Very good slag removal, smooth seam surface without undercutting into the base metal. Very good mechanical property in as welded and after PWHT. Can be welded in all positions with one setting of parameters. Very well suited for use on ceramic weld pool backing. To be used under CO2 as shielding gas.

Classification	
EN ISO	17632-A: T 46 4 P C 1 H10
AWS	A5.20: E71T-1C JH4

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Ni
0.06	1.2	0.4	≤ 0.015	≤ 0.015	0.4

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	510-610	≥ 24	≥ 80	≥ 47
580 °C x 2 h/f.	≥ 460	510-610	≥ 24	≥ 80	

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1

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	●	●

CITOFLUX R111

OERLIKON

MIG/MAG Cored Wires
C-Mn and low-alloy steels

CITOFLUX R111 is a folded rutile flux cored wire with a slow–freezing slag and outstanding welding properties in downhand and fillet positions. Designed for
welding single and multi-layer butt, negligible spatter loss, easy slag removal, smooth, finely rippled weld beads without undercutting into the base metal. CITOFLUX R111 has an excellent weld appearance to improve fatigue resistance. Typical application heavy transport vehicles and road construction machinery.

Classification
EN ISO 17632-A: T 42 2 1Ni R C 3 H10

Chemical analysis (Typical values in %)

C	Mn	Si	Ni
0.04	0.8	0.4	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	≥ 420	500-620	≥ 26	≥ 80

Gas test: 100% CO2

Shielding Gas - EN ISO 14175 : C1

Materials

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

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



PA PB

AIR LIQUIDE

FLUXOFIL 20 HD

OERLIKON

MIG/MAG 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

MIG/MAG 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

CITOFLUX R82

OERLIKON

MIG/MAG 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

MIG/MAG 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

MIG/MAG 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. Weld metal with very low content of diffusible hydrogen (HD< 3 ml/100g deposited weld metal). 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	●

CITOFLUX B00

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE

FLUXOFIL 40

OERLIKON

MIG/MAG 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	●

FLUXOFIL 140 mod.

CE

MIG/MAG 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

MIG/MAG 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	●

FLUXOFIL 43.1

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE WELDING

CITOFLUX B13-O

OERLIKON

MIG/MAG 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

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	●

FLUXOFIL M 48

OERLIKON

MIG/MAG 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

FLUXOFIL 18 HD

OERLIKON

MIG/MAG 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,C1

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 48

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE

FLUXOFIL M 41

OERLIKON

MIG/MAG 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	●	●

FLUXOFIL 41

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE

CITOFLUX R550

OERLIKON

MIG/MAG 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	≥ 20	≥ 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

MIG/MAG 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

MIG/MAG 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. The use with CO2 is possible.

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
AWS	A5.29: E 91 T1-G H4

Approvals	Grade
DNV	IVY55MS H5
LRS	4Y55S 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

OERLIKON

MIG/MAG 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

Approvals	Grade
ABS	2Y69 (add. 47J@-40°

CE

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	●	●

AIR LIQUIDE

FLUXOFIL M 42

OERLIKON

MIG/MAG 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
580°C x 2 h/furnace (*)	≥ 690	760-850	≥ 17	≥ 47
As Welded (**)	≥ 690	780-980	≥ 17	≥ 70

Gas test: (*) M21, (**) 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

MIG/MAG 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

FLUXOFIL 45

OERLIKON

MIG/MAG 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 Z 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	●

FLUXOFIL 70

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE

FLUXOFIL 25

OERLIKON

MIG/MAG 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	●

FLUXOFIL 35

OERLIKON

MIG/MAG 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, (**) 82% Ar+18% 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	●

AIR LIQUIDE

FLUXOFIL 36

OERLIKON

MIG/MAG 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	●

FLUXOFIL 37

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE

FLUXOFIL 38 C

OERLIKON

MIG/MAG 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	●

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

MIG/MAG 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	≥ 40	≥ 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	●

FLUXINOX 308L PF

OERLIKON

MIG/MAG Cored Wires
Stainless and Heat resistant steels

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	≥ 40	≥ 27

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	●

AIR LIQUIDE WELDING

FLUXINOX 308H

OERLIKON

MIG/MAG 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

AISI 304H; 1.4948 (X6CrNi18-10); 1.4310 (X10CrNi18-8)

1.4941(X8CrNiTi18-10)

Storage

Keep dry and avoid condensation

Current condition and welding position

DC+



Packaging data

Packaging Type	BS300
Diam(mm) / weight(kg)	15.0
1.0	●
1.2	●

FLUXINOX 347

OERLIKON

MIG/MAG 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
As Welded	≥ 350	≥ 550	≥ 30	≥ 47

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	●

AIR LIQUIDE

FLUXINOX 347 PF

OERLIKON

MIG/MAG 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	●

FLUXINOX 316L

OERLIKON

MIG/MAG 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	-110 °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	●

AIR LIQUIDE

FLUXINOX 316L PF

OERLIKON

MIG/MAG 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
DB	●
DNV	316L
LRS	316L S
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	-110 °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	●	●

FLUXINOX 318

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

1.4581 (GX5CrNiMoNb19-10) - 1.4436 (X4CrNiMo17-13-3)
1.4580 (X6CrNiMoNb17-12-2) - 1.4408 (GX5CrNiMo19-11)
1.4571 (X6CrNiMoTi17-12-2) - 1.4401 (X4CrNiMo17-12-2)
1.4583 (X10CrNiMoNb18-12)

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 318 PF

OERLIKON

MIG/MAG 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

1.4571 (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

Packaging Type	BS300
Diam(mm) / weight(kg)	15
1,2	●
1.0	●

FLUXINOX 22 9 3 L

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	≥ 40	≥ 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

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	●

FLUXINOX 307

CE

MIG/MAG 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	≥ 30

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

MIG/MAG 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	●

FLUXINOX 309L

OERLIKON

MIG/MAG 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	≥ 27

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	●

AIR LIQUIDE

FLUXINOX 309L PF

OERLIKON

MIG/MAG 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	≥ 27

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	●	●

FLUXINOX 309MoL

CE

MIG/MAG 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

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	●	●

FLUXINOX 312

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE

FLUXINOX 312 PF

OERLIKON

MIG/MAG 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

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	●

FLUXINOX 310

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE

FLUXINOX 310 PF

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 310T1-1
Not Applicable	A5.22: E 310T1-4

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	●

FLUXINOX 309H

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE

FLUXINOX 309H PF

OERLIKON

MIG/MAG 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 1
EN ISO	17633-A: T 22 12 H P M 1
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	●

FLUXINOX 25 4

OERLIKON

MIG/MAG 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

1.4821 (X 20 CrNiSi 25 4) - 1.4745 (G-X 40 CrSi 29) - 1.4822 (G-X 40 CrNi 24 5)

1.4724 (X 10 CrAl 13) - 1.4776 (G-X 40 CrSi 29) - 1.4742 (X 10 CrAl 18)

1.4762 (X 10 CrAl 24) - 1.4823 (G-X CrNiSi 27 4)

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	●

AIR LIQUIDE WELDING

FLUXINOX 904L

OERLIKON

MIG/MAG 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 25 4 PF

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

1.4821 (X 20 CrNiSi 25 4) - 1.4745 (G-X 40 CrSi 29) - 1.4822 (G-X 40 CrNi 24 5)
1.4724 (X 10 CrAl 13) - 1.4776 (G-X 40 CrSi 29) - 1.4742 (X 10 CrAl 18)
1.4762 (X 10 CrAl 24) - 1.4823 (G-X CrNiSi 27 4)

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

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	A5.34: ENiCrMo3T1-4

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	≥ 460	≥ 740	≥ 35	≥ 55

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	●

FLUXOFIL 50

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE WELDING

FLUXOFIL 51

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

MIG/MAG 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

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

MIG/MAG 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	●

AIR LIQUIDE WELDING

FLUXOFIL 58

OERLIKON

MIG/MAG 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	●

FLUXOFIL M 58

OERLIKON

MIG/MAG 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	●

AIR LIQUIDE

CITOFLUX H06

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

MIG/MAG 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	●

AIR LIQUIDE WELDING

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

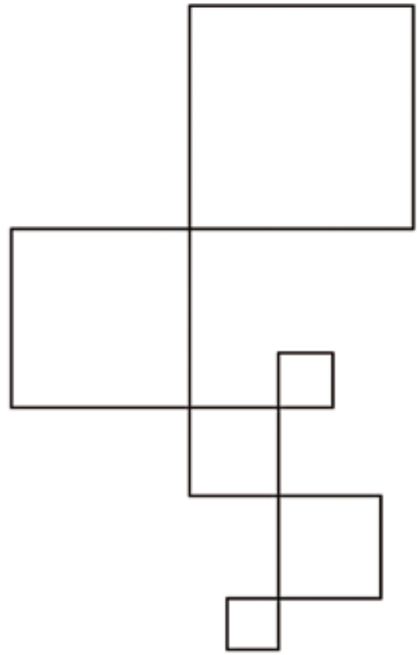
Heat Treatment	Hardness
As Welded	57-62 HRC

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

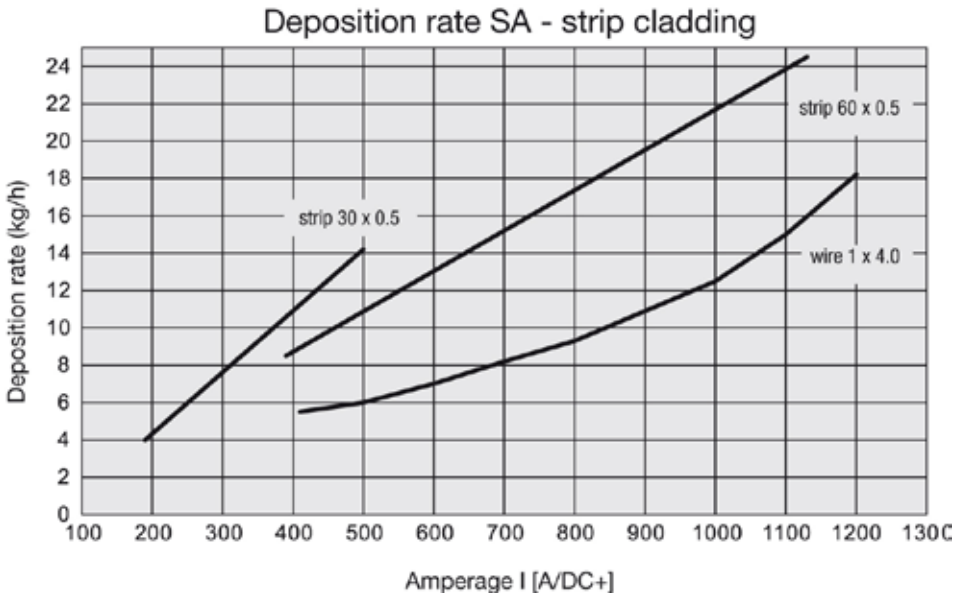
b) for Cr-Ni-steels
- Wire diameter [mm]: 4,0
- Welding current [A]: 550
- Welding voltage [V]: 30
- Welding speed [cm/min]: 70

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 and Electro-slag Strip Cladding

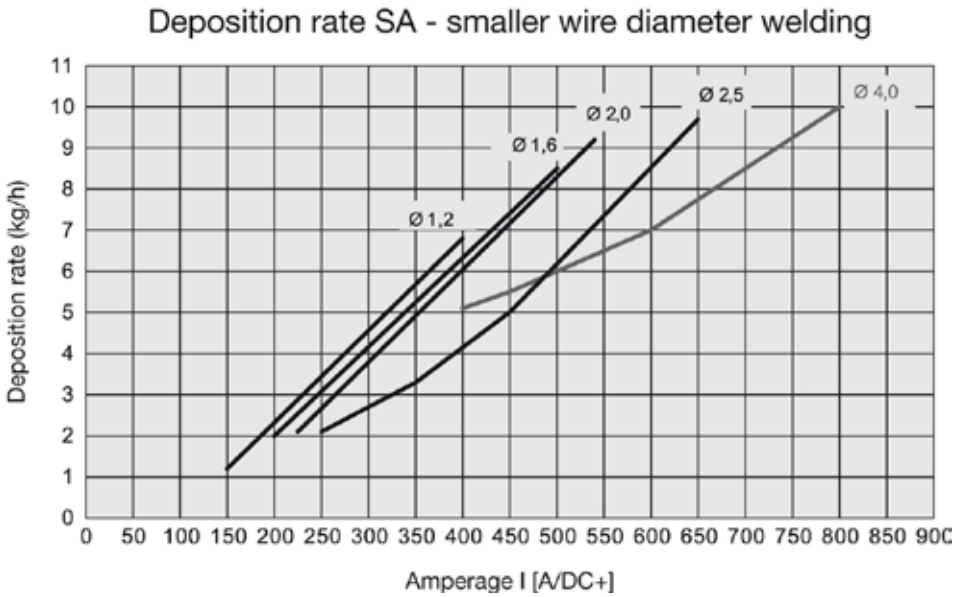
For high-efficiency corrosion resistant cladding of vessels used in the chemical and petro-chemical industries. Welds deposited are flat with a very smooth surface, even if cladding rates are as high as 0.8 m2/hour. For this application there is a range of OERLIKON fluxes used in combination with OERLIKON 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.

Submerged-arc smaller diameter wire welding technique

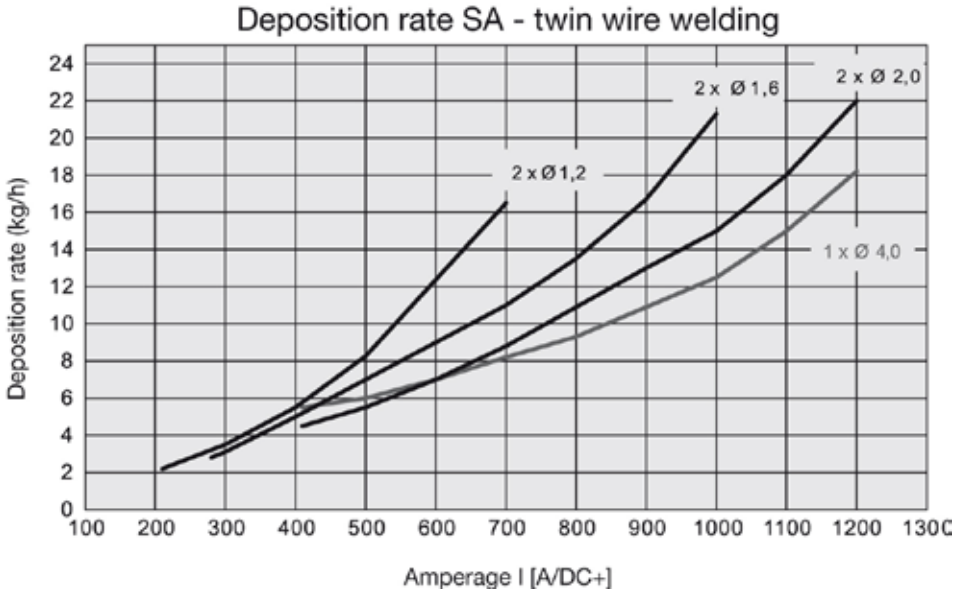
Submerged-arc welding with smaller diameter wires constitutes a high deposition rate process variant, which permits the optimisation of technology and efficiency. Using wire electrodes of 1.2 mm, 1.6 mm and 2.0 mm diameter, submerged-arc welding enters domains formerly reserved for MAG-welding, thus 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.

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.

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

SAW FLUXES

OERLIKON

SAW Fluxes / SAW Rutile-Acid Fluxes			
Product name	AWS	EN / EN ISO / DIN	Page
OP 176	A5.17: F7A2-EM12K	760: SA MS 1 88 AC H5	478
OP F55	A5.17: F7A0-EM12K	760: S F MS 1 67 AC 14171-A S 42 0 MS S1	480
PIE 18	-	760: SF CS 1 77	482
OP F72	A5.17: F7A2-EM12K	760: S F CS 1 66 AC 14171-A- S 46 0 CS S2Mo	484
OP 119	A5.17: F7A2-EM12K	760: SA CS 1 77 AC	486
OP 143	5.17: F7A0-EM12K	760: SA CS 1 98 AC	488
OP 181	A5.17: F7A0-F7PZ-EL12	760: SA AR 1 88 AC 14171-A - S 42 0 AR S1	490
OP 191	A 5.23: F8AZ-EG-G	760: SA AR 1 87 AC 14171-A- S 42 0 AR SZ	493
UNIFLUX D1	A5.17: F7A0-EL12	760: SA AR 1 97 AC	495

SAW Fluxes / SAW Basic and Semi-basic Fluxes			
Product name	AWS	EN / EN ISO / DIN	Page
OP 100	A5.17: F7A0-EM12K	760: S A AB 1 76 AC	497
OP 160	A5.17: F7A2-EM12K	760: SA AB 1 76 AC H5 14171-A- S 38 2 AB S2	500
OP 180S	5.17: F7A0-EM12K	760: SA AB 1 67 AC	501
OP 192	A5.23: F7A2-EG-G	760: S A AB 1 67 AC H5 14171-A- S 42 2 AB SZ	504
OP 132	5.17: F7A5-EH12K	760: SA AB 1 67 AC H5	507
OP 139	A5.23: F8A5-EA2-A3	760: SA AB 1 68 AC H5	510
OP 41TT	A5.17: F7A8-F6P8-EH12K	760: SA FB 1 53 DC H5	512
OP 121TT	A5.23: F11A8-EG-G	760: SA FB 1 55 AC H5	515
OP 121TTW	A5.23: F8P4-EB2-B2	760: SA FB 1 55 AC H5	519
OP 122	A5.23: F7A2-EA2-A2	760: SA FB 1 65 AC H5	522

SAW Fluxes / SAW Basic Fluxes			
Product name	AWS	EN / EN ISO / DIN	Page
OP CROMO F537	A5.23: F8P0-EB6-B6	760: SA FB 1 55 AC H5	524

SAW Fluxes / Stainless and Heat resistant steels			
Product name	AWS	EN / EN ISO / DIN	Page
OP 33	-	760: SA AF 2 54 DC	527
OP 76	-	760: SA FB 2 55 AC H5	529
OP F77	-	760: SF CS 2 65 AC H5	532
OP F500	-	760: S A FB 2 53 AC	533
OP XNi	-	760: SA AB 2 AC H5	535

SAW Fluxes / Hardfacing			
Product name	AWS	EN / EN ISO / DIN	Page
OP 1250A	-	760: SA CS 3 97 CCrMo AC	536
OP 1300A	-	760: SA CS 3 87 CCrMo AC	537
OP 1350A	-	760: SA CS 3 99 CCrMo AC	538
OP 1450A	-	760: SA CS 3 87 CCrMo AC	539

SAW Fluxes / Backing			
Product name	AWS	EN / EN ISO / DIN	Page
OP 10U	-	760: SA CS 1	540

SAW Fluxes / Cladding			
Product name	AWS	EN / EN ISO / DIN	Page
OP 87	-	760: SA CS 2 99 AC	541
AST 300	-	760: S A CS 2 Cr	543
AST 347	-	760: S A AB 2	544
AST 600	-	760: S A AB 2	545

OP 176

OERLIKON

SAW Fluxes
SAW Rutile-Acid Fluxes

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
All weld metal	OE-S2 Mo	0.05	1.4	0.7	0.45
All weld metal	OE-S1	0.06	0.8	0.15	-
All weld metal	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

AIR LIQUIDE WELDING

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	
OE-S1	EN ISO	14171-A S 42 0 MS S1
OE-S2	EN ISO	14171-A- S 42 0 MS S2
	EN	760: S F MS 1 67 AC
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
All weld metal	OE-S1	0.05	1.1	0.2
All weld metal	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 Mo	DB	●
OE-S2 Mo	TÜV	●
OE-S2	DB	●

	Approvals	Grade
OE-S2	TÜV	●
OE-S3	DB	●
OE-S3	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
All weld metal	OE-S2 Mo	0.06	1.2	0.5	-	0.4	-
All weld metal	OE-S2 NiCu	0.06	1.2	0.5	0.7	-	0.4
All weld metal	OE-S2	0.06	1.2	0.5	-	-	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 460	550-680	≥ 19
OE-S2 NiCu	As Welded	≥ 460	530-680	≥ 19
OE-S2	As Welded	≥ 420	550-640	≥ 20

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	0 °C	-20 °C
OE-S2 Mo	As Welded	≥ 60	≥ 47	≥ 28
OE-S2 NiCu	As Welded	≥ 60	≥ 47	≥ 28
OE-S2	As Welded	≥ 100	≥ 75	≥ 50

Typical applications

	Materials
OE-S2 NiCu	ASME: EN: S235J0W; S235J2W; S355J0W; S355J2W; S355K2W
OE-S2 Mo	ASME: API 5L Grades A, B, X42, X46, X52, X56 EN: 16Mo3; 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
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		
OE-S2 Mo	EN ISO	14171-A- S 46 0 CS S2Mo
OE-S1	EN ISO	14171-A- S 35 0 CS S1
OE-S2	EN ISO	14171-A- S 42 2 CS S2
	EN	760: S F CS 1 66 AC
OE-S2 Mo	AWS	A5.23: F8A0-EA2-A2
OE-S1	AWS	A5.17: F6A0-EL12
OE-S2	AWS	A5.17: F7A2-EM12K

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
All weld metal	OE-S2 Mo	0.03	1	0.35	0.5
All weld metal	OE-S1	0.04	0.8	0.35	-
All weld metal	OE-S2	0.03	1	0.35	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 480	570-640	≥ 22
OE-S1	As Welded	≥ 350	440-490	≥ 22
OE-S2	As Welded	≥ 400	490-550	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)
		-20 °C
OE-S2 Mo	As Welded	≥ 35
OE-S1	As Welded	≥ 35
OE-S2	As Welded	≥ 35

Typical applications

	Materials
OE-S2 Mo	ASME: EN: 16Mo3
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	Current Conditions
100°Cx1h	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.

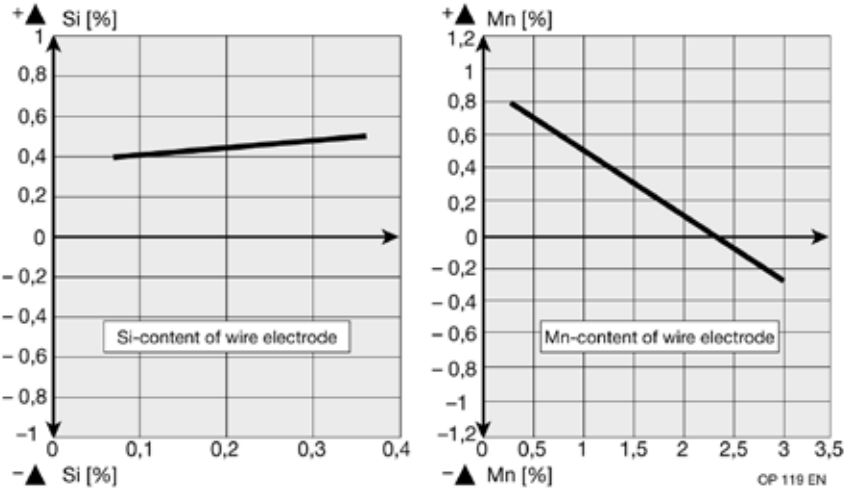
Classification		
	EN	760: SA CS 1 77 AC
OE-S2 Mo	AWS	A5.23: F8A0-EA2-A2
OE-S1	AWS	A5.17: F7A0-EL12
OE-S2	AWS	A5.17: F7A2-EM12K

	Approvals	Grade
OE-S2 Mo	DB	●
OE-S1 CrMo2	TÜV	●
OE-S2 CrMo1	TÜV	●
OE-S2 Mo	TÜV	●
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	DB	●
OE-S2	TÜV	●
OE-S3	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
All weld metal	OE-S2 Mo	0.05	1.3	0.5	0.5
All weld metal	OE-S1	0.05	1.1	0.5	-
All weld metal	OE-S2	0.05	1.4	0.5	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 480	600-700	≥ 20
OE-S1	As Welded	≥ 360	420-520	≥ 24
OE-S2	As Welded	≥ 400	520-620	≥ 24

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	0 °C	-20 °C
OE-S2 Mo	As Welded	≥ 90	≥ 50	≥ 35
OE-S1	As Welded	≥ 100	≥ 60	≥ 30
OE-S2	As Welded	≥ 100	≥ 80	≥ 50

Typical applications

	Materials
OE-S2 Mo	ASME: 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

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

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-S2 Mo	AWS	5.23: F8A0-EA2-A3
OE-S1	AWS	5.17: F6A0-EL12
OE-S2	AWS	5.17: F7A0-EM12K

	Approvals	Grade
OE-S2 Mo	TÜV	●
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	DB	●
OE-S2	TÜV	●

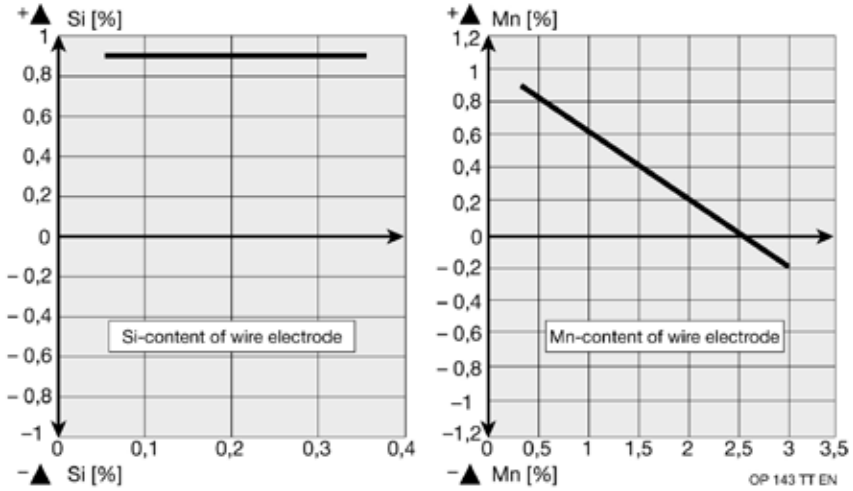
CE

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
All weld metal	OE-S2 Mo	0.05	1.70	0.90	0.50
All weld metal	OE-S1	0.04	1.30	0.80	-
All weld metal	OE-S2	0.05	1.70	0.90	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 480	600-700	≥ 22
OE-S1	As Welded	≥ 360	460-560	≥ 24
OE-S2	As Welded	≥ 400	530-630	≥ 24

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	0 °C	-20 °C
OE-S2 Mo	As Welded	≥ 65	≥ 50	≥ 35
OE-S1	As Welded	≥ 90	≥ 50	≥ 30
OE-S2	As Welded	≥ 90	≥ 50	≥ 35

Typical applications

	Materials
OE-S2 Mo	ASME: API 5L Grades A, B, X42, X46, X52, X56, X60 EN: 16Mo3, S(P)355-S(P)420, 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

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 181

OERLIKON

SAW Fluxes
SAW Rutile-Acid Fluxes

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		
OE-S2 Mo	EN ISO	14171-A - S 46 0 AR S2Mo
OE-S1	EN ISO	14171-A - S 42 0 AR S1
OE-S2	EN ISO	14171-A - S 42 2 AR S2
	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	●
OE-S2 Mo	DB	●
FLUXOCORD 31HD	TÜV	●
OE-S2 CrMo1	TÜV	●
OE-S2 Mo	TÜV	●
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	ABS	3YT-3YM

	Approvals	Grade
OE-S2	BV	3YTM
OE-S2	DB	●
OE-S2	DNV	IIIYTM
OE-S2	GL	3YTM
OE-S2	LRS	3YT, 3YM
OE-S2	RMRS	3YTM
OE-S2	TÜV	●

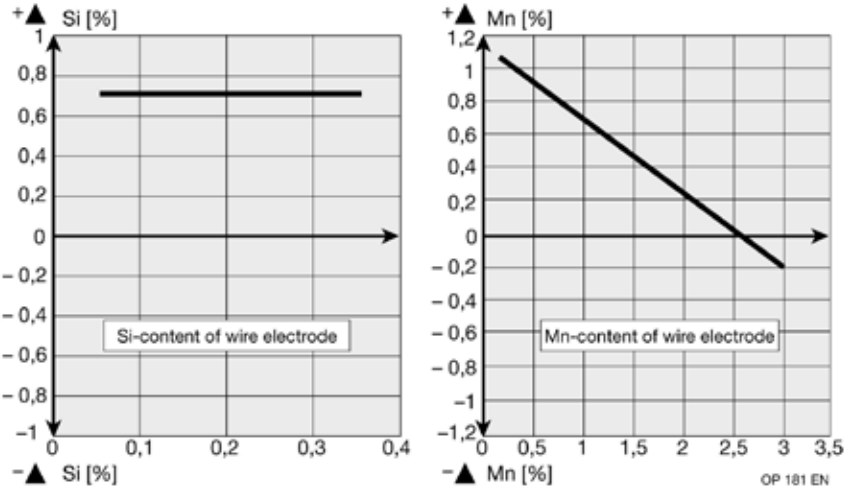
Flux Main Components	
Al_2O_3 + MnO	50 %
SiO_2 + TiO_2	30 %
CaF_2	10 %

Boniszewski Basicity	0.4

AIR LIQUIDE

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
All weld metal	OE-S2 Mo	0.04	1.3	0.6	0.5
All weld metal	OE-S1	0.03	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 Mo	As Welded	≥ 490	610-710	≥ 18
OE-S1	As Welded	≥ 420	520-620	≥ 22
OE-S2	As Welded	≥ 450	560-660	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)	
		0 °C	-20 °C
OE-S2 Mo	As Welded	≥ 47	
OE-S1	As Welded	≥ 47	
OE-S2	As Welded		≥ 47

Typical applications

	Materials
OE-S2 Mo	ASME: API 5L Grades A, B, X42, X46, X52, X56 EN: 16Mo3, S(P)355-S(P)420, 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

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		
OE-S2 NiCu	EN ISO	14171-A- S 42 0 AR SZ
OE-S1	EN ISO	14171-A- S 42 A AR S1
OE-S2	EN ISO	14171-A- S 42 0 AR S2
	EN	760: SA AR 1 87 AC
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

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 CrMo2	TÜV	●
OE-S2 CrMo1	TÜV	●
OE-S2 Mo	TÜV	●
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	DB	●
OE-S2	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
All weld metal	OE-S2 Mo	0.06	1.4	0.7	0.5
All weld metal	OE-S1	0.06	1.1	0.6	-
All weld metal	OE-S2	0.05	1.4	0.7	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 450	580-680	≥ 18
OE-S1	As Welded	≥ 360	450-550	≥ 22
OE-S2	As Welded	≥ 400	500-600	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)
		+20 °C
OE-S2 Mo	As Welded	≥ 50
OE-S1	As Welded	≥ 60
OE-S2	As Welded	≥ 50

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: ASTM A355 Gr. P1; A182M Gr. F1 EN: 16Mo3
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°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-S2 Mo	AWS	A5.23: F7A0-EA2-A2
OE-S1	AWS	A5.17: F6A0-EL12
OE-S2	AWS	A5.17: F7A0-EM12K

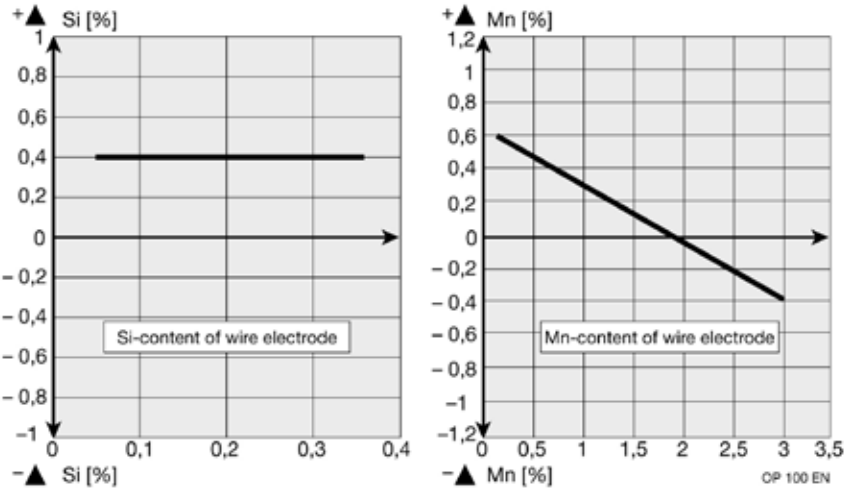
	Approvals	Grade
OE-S2 Mo	DB	●
OE-S1 CrMo2	TÜV	●
OE-S2 CrMo1	TÜV	●
OE-S2 Mo	TÜV	●
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	DB	●
OE-S2	TÜV	●
OE-S3	DB	●
OE-S3	TÜV	●

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
All weld metal	OE-S2 Mo	0.06	1.4	0.4	0.4
All weld metal	OE-S1	0.06	1.0	0.3	-
All weld metal	OE-S2	0.06	1.4	0.4	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 450	600-700	≥ 20
OE-S1	As Welded	≥ 360	420-420	≥ 24
OE-S2	As Welded	≥ 400	500-600	≥ 24

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		+20 °C	0 °C	-20 °C
OE-S2 Mo	As Welded	≥ 65	≥ 45	≥ 35
OE-S1	As Welded	≥ 90	≥ 60	≥ 30
OE-S2	As Welded	≥ 90	≥ 60	≥ 30

Typical applications

	Materials
OE-S2 Mo	ASME: ASTM A355 Gr. P1; A182M Gr. F1 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

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 160

OERLIKON

SAW Fluxes
SAW Basic and Semi-basic Fluxes

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		
OE-S2	EN ISO	14171-A- S 38 2 AB S2
	EN	760: SA AB 1 76 AC H5
OE-S2	AWS	A5.17: F7A2-EM12K

Approvals	Grade
ABS	2YTM
BV	A3YTM
DNV	3YTM

Flux Main Components	
$Al_2O_3 + TiO_2 + ZrO_2$	30 %
$CaO + CaF_2 + MgO$	30 %
SiO_2	15 %
$MnO + FeO$	10 %

Boniszewski Basicity 1.2

Chemical analysis (Typical values in %)

		C	Mn	Si
All weld metal	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
-	●

AIR LIQUIDE WELDING

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-S2 Mo	AWS	5.25: F8A0-EA2-A2
OE-S1	AWS	5.17: F6A0-EL12
OE-S2	AWS	5.17: F7A0-EM12K

	Approvals	Grade
OE-S2 Mo	TÜV	●
OE-S1	DB	●
OE-S1	TÜV	●
OE-S2	ABS	2YT-3YM
OE-S2	BV	2YT-3YM
OE-S2	DB	●

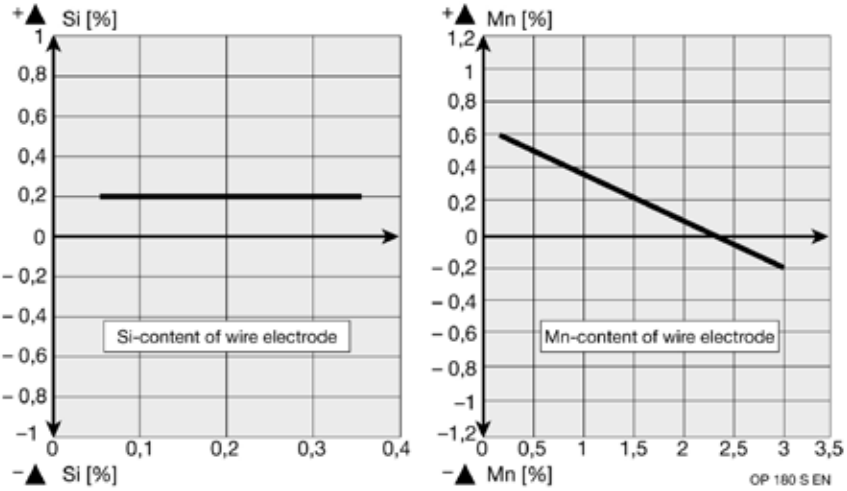
	Approvals	Grade
OE-S2	DNV	IIIY40TM
OE-S2	GL	2YT-3YM
OE-S2	LRS	2YT, 3YM
OE-S2	RMRS	3YTM
OE-S2	TÜV	●

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
All weld metal	OE-S2 Mo	0.05	1.4	0.3	0.5
All weld metal	OE-S1	0.05	1	0.2	-
All weld metal	OE-S2	0.05	1.4	0.3	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 450	600-700	≥ 20
OE-S1	As Welded	≥ 360	430-530	≥ 25
OE-S2	As Welded	≥ 400	520-620	≥ 22

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		20 °C	0 °C	-20 °C
OE-S2 Mo	As Welded	≥ 60	≥ 50	≥ 35
OE-S1	As Welded	≥ 100	≥ 60	≥ 35
OE-S2	As Welded	≥ 120	≥ 70	≥ 50

Typical applications

	Materials
OE-S2 Mo	ASME: - EN: 16Mo3, S(P)355-S(P)460, L245-L450
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

Redrying	Current Conditions
300-350°Cx2-4h	AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

OP 192

OERLIKON

SAW Fluxes
SAW Basic and Semi-basic Fluxes

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		
OE-S2 NiCu	EN ISO	14171-A- S 42 2 AB SZ
	EN	760: S A AB 1 67 AC H5
OE-S2 Mo	AWS	A5.23: F8A2-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

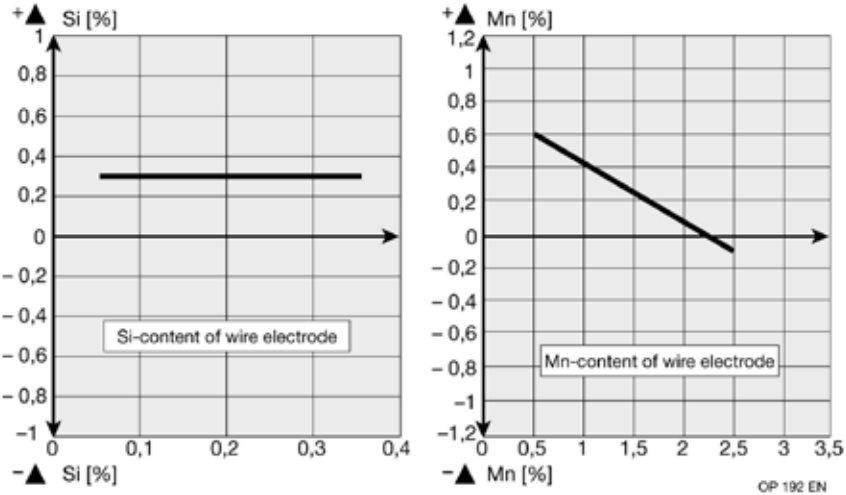
Flux Main Components	
CaO + CaF2 + MgO	39 %
Al2O3 + TiO2 + ZrO2	30 %
SiO2	20 %
MnO + FeO	9 %

Boniszewski Basicity 1.3

AIR LIQUIDE

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	Ni	Mo	Cu
All weld metal	OE-S2 Mo	0.07	1.5	0.6	-	0.5	-
All weld metal	OE-S2 NiCu	0.07	1.5	0.6	0.7	-	0.5
All weld metal	OE-SD3 Mo	0.07	1.7	0.6	-	0.5	-
All weld metal	OE-S1	0.05	1	0.4	-	-	-
All weld metal	OE-S2	0.05	1.5	0.6	-	-	-
All weld metal	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 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-S2 Mo	AWS	5.23: F8A5-EA2-A2
OE-SD3 Mo	AWS	5.23: F9A6-EA4-A4
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

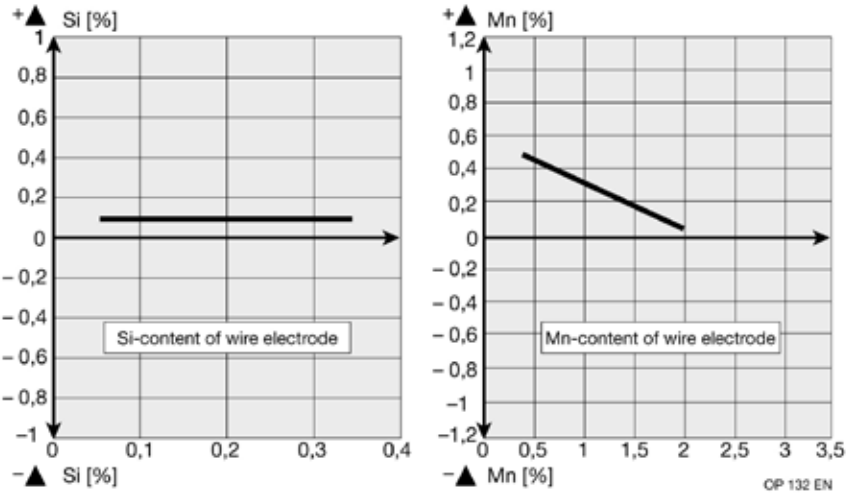
	Approvals	Grade
FLUXOCORD 31HD	DB	●
OE-S2 Mo	DB	●
OE-S2 Mo	LRS	3Y42T, 4Y42M
FLUXOCORD 31HD	TÜV	●
OE-S2 Mo	TÜV	●
OE-S2	DB	●
OE-S2	TÜV	●

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



Chemical analysis (Typical values in %)

		C	Mn	Si	Mo	Ti	B
All weld metal	OE-S2 Mo	0.07	1.3	0.2	0.5	-	-
All weld metal	OE-SD3 Mo	0.05	1.7	0.4	0.4	-	-
All weld metal	OE-S1	0.06	0.8	0.15	-	-	-
All weld metal	OE-S2	0.07	1.3	0.2	-	-	-
All weld metal	OE-SD3	0.07	1.8	0.4	-	-	-
All weld metal	OE-S4	0.07	1.8	0.3	-	-	-
All weld metal	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-S2 Mo	As Welded	≥ 470	550-620	≥ 21
OE-SD3 Mo	As Welded	≥ 540	620-660	≥ 23
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

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)					
		0 °C	-20 °C	-30 °C	-40 °C	-50 °C	-60 °C
OE-S2 Mo	As Welded		≥ 110		≥ 80	≥ 50	
OE-SD3 Mo	As Welded				≥ 60	≥ 50	≥ 40
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		

Typical applications

	Materials
OE-SD3 Mo	ASME: ASTM A204 Grades A, B, C; A355 Grade P1; A209 Grades T1, T1A, T1B EN: S(P)355-S(P)460, L245-L450
OE-S2 Mo	ASME: 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: EN S(P)235-S(P)420
OE-S4	ASME: EN S(P)355-S(P)460
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

OERLIKON

SAW Fluxes
SAW Basic and Semi-basic Fluxes

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: F8A5-EA2-A3
OE-S2 Mo	AWS	A5.23: F8P5-EA2-A3
OE-S2	AWS	A5.17: F7A5-EM12K
OE-S2	AWS	A5.17: F7P5-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	
Al2O3 + MnO	30 %
CaO + MgO	25 %
CaF2	20 %
SiO2 + TiO2	20 %

Boniszewski Basicity 1.7

Chemical analysis (Typical values in %)

		C	Mn	Si	Mo
All weld metal	OE-S2 Mo	0.06	1.8	0.3	0.4
All weld metal	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	-40 °C
OE-S2 Mo	As Welded	≥110	≥ 60
OE-S2 Mo	620°Cx1h		≥ 50
OE-S2	As Welded	≥ 140	≥ 60
OE-S2	620°Cx1h	≥ 100	≥ 50

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	Current Conditions
300-350°Cx2-4h	AC; DC+

Packaging data

Packaging Type	PE	DRYBAG
Weight (kg)	25	25
-	●	●

OP 41TT

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-S2 Mo	AWS	A5.23: F8A8-F6P5-EA2
OE-S2 Ni1	AWS	A5.23: F7A8-F7P10-ENi1
OE-SD3	AWS	A5.17: F7A8-F6P8-EH12K

	Approvals	Grade
OE-S2 CrMo1	TÜV	●
OE-S2 Mo	TÜV	●
OE-S2 Ni2	TÜV	●
OE-SD3 Mo	TÜV	●
OE-SD3	ABS	3YM
OE-SD3	BV	3YM
OE-SD3	DB	●

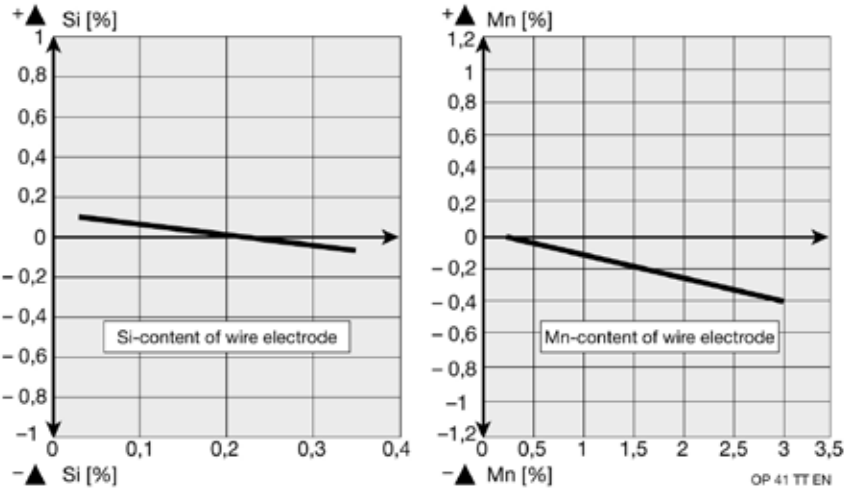
	Approvals	Grade
OE-SD3	DNV	IIIYM
OE-SD3	GL	3YM
OE-SD3	LRS	3M, 3YM
OE-SD3	RMRS	3YM
OE-SD3	TÜV	●
OE-SD3 1Ni ½Mo	TÜV	●

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
All weld metal	OE-S1 CrMo2	0.08	0.5	0.2	2.2	-	1
All weld metal	OE-S2 CrMo1	0.07	0.8	0.2	1	-	0.5
All weld metal	OE-S2 Mo	0.07	0.8	0.2	-	-	0.5
All weld metal	OE-S2 Ni1	0.07	1.1	0.3	0.15	1.15	0.3
All weld metal	OE-SD3	0.07	1.2	0.3	-	-	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1 CrMo2	740°C	≥ 450	550-650	≥ 22
OE-S2 CrMo1	710°C	≥ 380	530-630	≥ 24
OE-S2 Mo	As Welded	≥ 490	570-670	≥ 20
OE-S2 Ni1	As Welded	≥ 420	500-600	≥ 24
OE-S2 Ni1	600°Cx2h	≥ 380	480-500	≥ 26
OE-SD3	As Welded	≥ 420	530-630	≥ 24

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)				
		+20 °C	0 °C	-20 °C	-40 °C	-60 °C
OE-S1 CrMo2	740°C	≥ 140	≥ 100			
OE-S2 CrMo1	710°C	≥ 200	≥ 150			
OE-S2 Mo	As Welded	≥ 140	≥ 120	≥ 100	≥ 70	≥ 50
OE-S2 Ni1	As Welded	≥ 150	≥ 130	≥ 100	≥ 70	≥ 50
OE-S2 Ni1	600°Cx2h	≥ 170	≥ 140	≥ 110	≥ 90	≥ 70
OE-SD3	As Welded	≥ 170	≥ 150	≥ 120	≥ 70	≥ 40

Typical applications

	Materials
OE-S1 CrMo2	ASME: A387 Gr.22, Cl 1 and 2, A182 Gr.F 22, A 36 Gr.F22 EN: 10CrMo9-10, 12CrMo9-10
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 CrMo1	ASME: A199 and A200 Grade T11, A213 Grades T11, T12 EN: 13CrMo4-5, 13CrMoSi5-5
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

Redrying
300-350°Cx2-4h

Current Conditions
DC+

Packaging data

Packaging Type	DRYBAG
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: F8P4-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

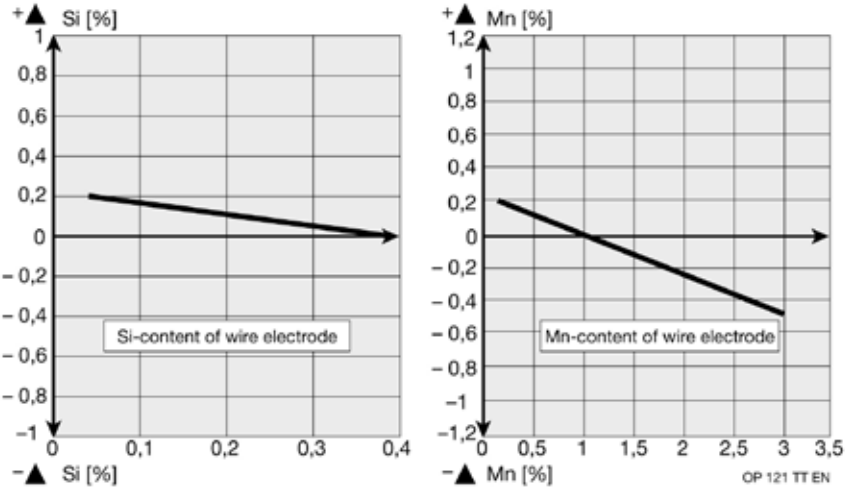
	Approvals	Grade
OE-S2 Mo	ABS	3YM-3YT
FLUXOCORD 31	DB	●
FLUXOCORD 31HD	DB	●
FLUXOCORD 42	DB	●
OE-S2 Mo	DB	●
OE-S2 Ni2	DNV	5YM H5, 3YT H5
OE-S2 Ni2	GL	in Progress
OE-S2 Mo	LRS	3Y40T, 4Y40M H5
FLUXOCORD 31HD	LRS	4Y
FLUXOCORD 41	TÜV	●
OE-S1 CrMo2	TÜV	●
OE-S2 CrMo1	TÜV	●
OE-S2 Mo	TÜV	●
OE-S2 Ni1	TÜV	●
OE-S2 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	5YQ420 H5
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	35 %
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
All weld metal	OE-S1 CrMo2	0.08	0.6	0.3	2.2	-	1
All weld metal	OE-S2 CrMo1	0.07	0.9	0.3	1.1	-	0.5
All weld metal	OE-S2 Mo	0.07	0.9	0.2	-	-	0.5
All weld metal	OE-S2 Ni2	0.07	0.9	0.3	-	2.3	-
All weld metal	OE-S2 Ni3	0.06	0.9	0.2	-	3.3	-
All weld metal	OE-S2	0.07	0.9	0.2	-	-	-
All weld metal	OE-SD3	0.07	1.6	0.3	-	-	-
All weld metal	OE-SD3 1Ni ¼Mo	0.07	1.3	0.3	-	0.9	0.2
All weld metal	OE-SD3 1Ni ½Mo	0.07	1.5	0.3	-	0.95	0.5
All weld metal	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

OERLIKON

SAW Fluxes
SAW Basic and Semi-basic Fluxes

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: F8P4-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 1Ni ¼Mo	LRS	5Y50M H5
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
All weld metal	OE-S1 CrMo2	0.08	0.6	0.3	2.2	-	1
All weld metal	OE-S2 CrMo1	0.07	0.9	0.3	1.1	-	0.5
All weld metal	OE-S2 Mo	0.07	0.9	0.2	-	-	0.5
All weld metal	OE-S2 Ni2	0.07	0.9	0.3	-	2.3	-
All weld metal	OE-S2 Ni3	0.06	0.9	0.2	-	3.3	0.15
All weld metal	OE-S2	0.07	0.9	0.2	-	-	-
All weld metal	OE-SD3	0.07	1.6	0.3	-	-	-
All weld metal	OE-SD3 1Ni ¼Mo	0.07	1.3	0.3	-	0.9	0.2
All weld metal	OE-SD3 1Ni ½Mo	0.07	1.5	0.3	-	0.95	0.5
All weld metal	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 CrMo1	ASME: A199 and A200 grade T11, A213 Grades T11, T12 EN: 13CrMo4-5, 13CrMoSi5-5
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 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

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 Mo	AWS	A5.23: F7A2-EA2-A2
OE-S2	AWS	A5.17: F7A5-F6P5-EM12K
OE-SD3	AWS	A5.17: F7A4-F6P4-EH12K

	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	●
OE-S2 Mo	DB	●
FLUXOCORD 35 25 2D	DB	●
FLUXOCORD 35 25 2D	DNV	IIIY40T
FLUXOCORD 35 25 2D	GL	3YT
FLUXOCORD 35 25 3D	GL	3YTM
OE-S2 Mo	GL	3YTM
FLUXOCORD 35 25 2D	LRS	3YT, 3YM

	Approvals	Grade
FLUXOCORD 35 25 3D	LRS	3YT, 3YM
OE-S2 Mo	LRS	4YTM
FLUXOCORD 35 25 2D	RMRS	3YTM
OE-S2 Mo	TÜV	●
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	●

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
All weld metal	OE-S2 Mo	0.07	1.0	0.2	0.5
All weld metal	OE-S2	0.07	1.0	0.2	-
All weld metal	OE-SD3	0.07	1.5	0.3	-

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S2 Mo	As Welded	≥ 480	550 - 650	≥ 20
OE-S2	As Welded	≥ 400	450 - 550	≥ 24
OE-SD3	As Welded	≥ 400	500 - 600	≥ 24

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)			
		20 °C	0 °C	-20 °C	-40 °C
OE-S2 Mo	As Welded	≥ 90	≥ 70	≥ 40	
OE-S2	As Welded	≥ 150	≥ 110	≥ 90	
OE-SD3	As Welded	≥ 160	≥ 130	≥ 100	≥ 70

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: API-5L X60, X65, 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: 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 CROMO F537

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-S1 CrMo5	AWS	A5.23: F8P0-EB6-B6
OE-CROMO S225	AWS	A5.23: F9P2-EB3R-B3R
OE-CROMO S225V	AWS	A5.23: F9P2-EGR-GR

Approvals		Grade
OE-S1 CrMo5	TÜV	●
OE-S2 CrMo1	TÜV	●
OE-CROMO S225	TÜV	●

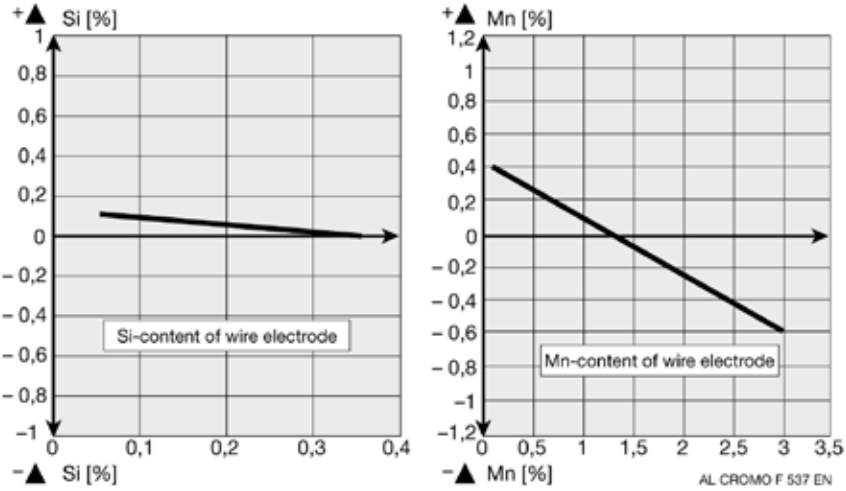
CE

Flux Main Components	
CaO + MgO	40 %
CaF2	25 %
Al2O3 + MnO	20 %
SiO2 + TiO2	15 %

Boniszewski Basicity ~2.6

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
All weld metal	OE-S1 CrMo5	≤ 0.12	≤ 1	≤ 0.5	5	0.5	-	-
All weld metal	OE-CROMO S225	≤ 0.12	≤ 1	≤ 0.25	2.2	1	-	-
All weld metal	OE-CROMO S225V	≤ 0.12	≤ 1	≤ 0.25	2.4	1	0.02	0.25

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-S1 CrMo5	760°Cx2h	≥ 470	550 - 700	≥ 20
OE-CROMO S225	690°Cx8h	≥ 540	620 - 750	≥ 18
OE-CROMO S225V	710°Cx8h	≥ 540	620 - 750	≥ 18

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)		
		0 °C	-20 °C	-40 °C
OE-S1 CrMo5	760°Cx2h		≥ 54	
OE-CROMO S225	690°Cx8h	≥ 100	≥ 100	≥ 50
OE-CROMO S225V	710°Cx8h		≥ 27	

OP CROMO F537

Typical applications

	Materials
OE-S1 CrMo5	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
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

Redrying	Current Conditions
300-350°Cx2-4h	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
All weld metal	OE-308L	≤ 0.03	1.5	18	9	-	-
All weld metal	OE-347	≤ 0.07	1.6	18	9	-	0.5
All weld metal	OE-316L	≤ 0.03	1.6	18	10	2.7	-
All weld metal	OE-318	≤ 0.07	1.3	18	10	2.7	0.5
All weld metal	OE-20 16 L	≤ 0.015	7	20	16	3	-
All weld metal	OE-S 22 09	≤ 0.03	1.8	23	9	3	-
All weld metal	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	Current Conditions
300-350°Cx2-4h	DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

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	N
All weld metal	OE-NIFIL 600	0.03	-	22	74	-	2.5	-
All weld metal	OE-NIFIL 625	0.03	0.3	23	60	10	3.5	-
All weld metal	OE-308L	0.03	1.2	19	9	-	-	-
All weld metal	OE-347	0.07	1.5	19	9	-	0.5	-
All weld metal	OE-316L	0.03	1.6	19	10	3	-	-
All weld metal	OE-318	0.07	1.3	19	10	3	0.5	-
All weld metal	OE-20 16 L	0.03	7	20	16	3	0.5	0.15
All weld metal	OE-S 22 09	0.03	1.8	23	9	3	-	0.1
All weld metal	OE-S 25 10	0.04	0.5	25	10	4	-	0.25

All-weld metal Mechanical Properties

	Heat Treatment	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation A5 (%)
OE-NIFIL 600	As Welded	≥ 380	≥ 600	≥ 30
OE-NIFIL 625	As Welded	≥ 450	≥ 760	≥ 23
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

All-weld metal Mechanical Properties - CV

	Heat Treatment	Impact Energy (J)	
		+20 °C	-40 °C
OE-NIFIL 600	As Welded	≥ 100	
OE-NIFIL 625	As Welded	≥ 75	
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

Typical applications

	Materials
OE-NIFIL 600	ASME: UNS N06600; UNS N08800; UNS N08810 EN: 2.4816; 1.4876; 1.4958
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 625	ASME: UNS N06625;UNS N08825, A353-70, A553-70 EN: 2.4816; 1.4876; 1.4958

Redrying	Current Conditions
300-350°Cx2-4h	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
All weld metal	OE-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	Current Conditions
100°Cx1h	AC; DC+

Packaging data

Packaging Type	PE
Weight (kg)	25
-	●

AIR LIQUIDE

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	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
All weld metal	OE-308L	0.02	1.5	0.5	18	9	-	-	≤ 0.35	-
All weld metal	OE-347	0.07	1.5	0.5	18	9	-	1	≤ 0.35	-
All weld metal	OE-316L	0.02	1.5	0.5	18	10	2.5	-	-	-
All weld metal	OE-318	0.07	1.5	0.5	18	10	2.5	-	-	-
All weld metal	OE-S 22 09	0.03	1.5	0.5	22	8.5	3	-	-	0.18
All weld metal	OE-309L	0.02	1.5	0.5	22	13	-	-	-	-
All weld metal	OE-309L Mo	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	Current Conditions
300-350°Cx2-4h	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
All weld metal	NIFIL 600	0.02	4	0.35	21.5	70	-	2.5	0.8
All weld metal	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
OE-NIFIL 625	ASME: SA353-70; SA553-70; UNS N06625; UNS N08825 EN: 2.4816; 1.4876; 1.4958; X7Ni9 (1.5663); X8Ni9 (1.5662)
OE-NIFIL 600	ASME: UNS N06600; UNS N08800; UNS N08810 EN: 2.4816; 1.4876; 1.4958
OE-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
All weld metal	OE-S2 Mo	0.1	1.4	0.5	0.5	0.3
All weld metal	OE-S2 Mo	0.1	1.4	0.5	0.5	0.5
All weld metal	OE-S2 Mo	0.1	1.5	0.7	0.7	0.6
All weld metal	OE-S2	0.1	1.3	0.5	0.3	0.1
All weld metal	OE-S2	0.1	1.4	0.7	0.5	0.2
All weld metal	OE-S2	0.1	1.5	0.9	0.8	0.3

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
(~1) OE-S2 Mo	As Welded	225 HB
(~2) OE-S2 Mo	As Welded	230 HB
(~3) OE-S2 Mo	As Welded	260 HB
(~1) OE-S2	As Welded	220 HB
(~2) OE-S2	As Welded	225 HB
(~3) OE-S2	As Welded	250 HB

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Diam(mm) / weight(kg)	25
-	●

AIR LIQUIDE

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
All weld metal	OE-S2 Mo	0.1	1.2	0.5	1.3	0.3
All weld metal	OE-S2 Mo	0.1	1.3	0.7	2.0	0.5
All weld metal	OE-S2 Mo	0.1	1.4	0.8	2.1	0.6
All weld metal	OE-S2	0.1	1.2	0.5	1.1	0.1
All weld metal	OE-S2	0.1	1.3	0.7	1.4	0.2
All weld metal	OE-S2	0.1	1.5	0.9	1.8	0.3

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
(~1) OE-S2 Mo	As Welded	260 HB
(~2) OE-S2 Mo	As Welded	350 HB
(~3) OE-S2 Mo	As Welded	360 HB
(~1) OE-S2	As Welded	230 HB
(~2) OE-S2	As Welded	280 HB
(~3) OE-S2	As Welded	290 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
All weld metal	OE-S2 Mo	0.1	1.5	0.6	1.3	0.4
All weld metal	OE-S2 Mo	0.1	1.7	0.8	1.5	0.5
All weld metal	OE-S2 Mo	0.1	1.9	1.0	2.1	0.6
All weld metal	OE-S2	0.1	1.5	0.6	1.2	0.2
All weld metal	OE-S2	0.1	1.7	0.7	1.4	0.2
All weld metal	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
-	●

AIR LIQUIDE

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
All weld metal	OE-S2 Mo	0.17	0.9	0.4	1.9	0.3
All weld metal	OE-S2 Mo	0.19	1.1	0.6	2.6	0.6
All weld metal	OE-S2 Mo	0.2	1.2	0.7	2.9	0.6
All weld metal	OE-S2	0.14	1.2	0.4	1.9	0.1
All weld metal	OE-S2	0.18	1.3	0.5	2.8	0.2
All weld metal	OE-S2	0.19	1.3	0.6	2.8	0.3

All-weld metal Mechanical Properties

	Heat Treatment	Hardness
(~1) OE-S2 Mo	As Welded	310 HB
(~2) OE-S2 Mo	As Welded	440 HB
(~3) OE-S2 Mo	As Welded	450 HB
(~1) OE-S2	As Welded	280 HB
(~2) OE-S2	As Welded	350 HB
(~3) OE-S2	As Welded	370 HB

Redrying
300-350°Cx2-4h

Current Conditions
AC; DC+

Packaging data

Packaging Type	PE
Diam(mm) / weight(kg)	25
-	●

OP 10U

OERLIKON

SAW Fluxes
Backing

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
-	●

AIR LIQUIDE

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
All weld metal	OE-308L	0.03	18	9	-	-
All weld metal	OE-347	0.07	18	9	-	≥ 8xC
All weld metal	OE-316L	0.03	18	10	2.5	-
All weld metal	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

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 and is also suitable to be combined with stainless steel wires (OE-308L, OE-316L, OE-309L). 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
All weld metal	SUPRASTRIP 19 9 L	0.028	1.42	0.78	19.6	10.4
All weld metal	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
All weld metal	SUPRASTRIP 24 13 LNb	0.05	1.2	0.7	18.5	10.5	0.6	-
All weld metal	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+

AIR LIQUIDE

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 %

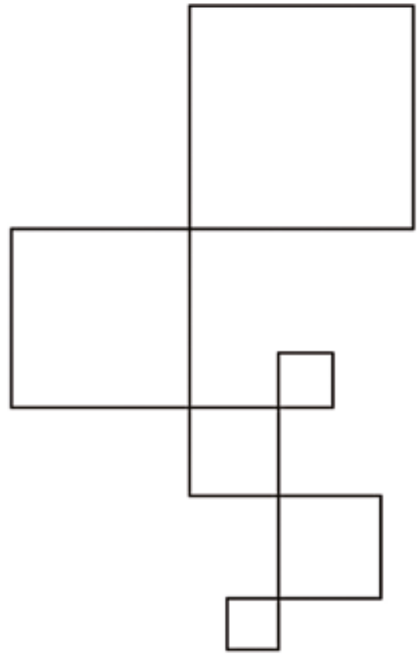
Boniszewski Basicity 1.5

Chemical analysis (Typical values in %)

		C	Mn	Si	Cr	Ni	Mo	Nb	Fe
All weld metal	SUPRASTRIP 625	0.04	1	0.4	19	Rem	8	2.8	12
All weld metal	SUPRASTRIP 625	0.02	1	0.3	20	Rem	9	3.2	3

Redrying
300-350°Cx2-4h

Current Conditions
DC+



ELECTROSLAG FLUXES

OERLIKON

Electroslag / Cladding Fluxes			
Product name	AWS	EN / EN ISO / DIN	Page
ELT 300	-	760: SA FB 2	550
ELT 300S	-	760: S A FB 2	551
ELT 347-1	-	760: SA FB 2CrNi	552
ELT 316-1	-	760: SA FB 2CrNiMo	553
ELT 600	-	760: S A FB 2	554
ELT 600S	-	760: SA FB 2	555
ELT 825-1	-	760: SA FB 2 CrNiMo	556

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 FB 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
All weld metal	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+

AIR LIQUIDE

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
All weld metal	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
All weld metal	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

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
All weld metal	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+

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
All weld metal	SUPRASTRI P 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+

AIR LIQUIDE

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
All weld metal	SUPRASTRI P 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+

ELT 825-1

OERLIKON

Electroslag Cladding Fluxes

ELT 825-1 is an electroslag flux designed for monolayer overlaying in combination with SUPRASTRIP 825. ELT 825-1 is a high basic agglomerated flux used with very easy slag detachability and excellent wetting properties. ELT 825-1 exhibits a very low moisture pick up and a high hot cracking resistance. Damp flux should be re-dried at 300-350°C. Grain size according to EN 760: 2-20.

Classification	
EN	760: SA FB 2 CrNiMo

Flux Main Components	
CaF2	60 %
Al2O3	20 %
SiO2	7 %

Boniszewski Basicity	4

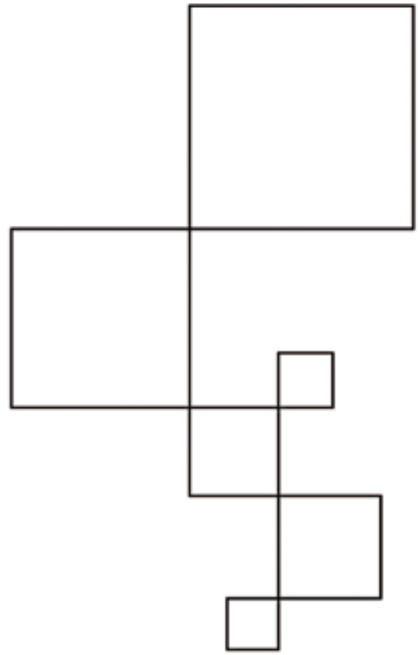
Chemical analysis (Typical values in %)

		C	Mn	Si	Cr	Ni	Mo	Nb	Cu	Fe	Ti
All weld metal	SUPRAS TRIP 825	0.02	0.7	0.7	21	Rem	2.9	0.1	1.7	35	0.1

Redrying
300-350°Cx2h

Current Conditions
DC+

AIR LIQUIDE



SAW SOLID WIRES

OERLIKON

SAW Wires / C-Mn and low-alloy steels			
Product name	AWS	EN / EN ISO / DIN	Page
OE-S1	A5.17: EL12	14171-A-S1	560
OE-S2	A5.17: EM12K	14171-A-S2	560
OE-S3	A5.17: EH10K	14171-A-S3	560
OE-S4	A5.17: EH 14	14171-A-S4	560
OE-SD3	A5.17: EH 12K	14171-A-S3Si	560
OE-S2 NiCu	A5.23: EG	14171-A-S2Ni1Cu	561
OE-S2 Ni1	A5.23: ENi1	14171-A-S2Ni1	561
OE-S2 Ni2	A5.23: ENi2	14171-A-S2Ni2	561
OE-S2 Ni3	A5.23: ENi3	14171-A-S2Ni3	561
OE-S2 Mo	A5.23: EA2	14171-A-S2Mo	561
OE-SD3 Mo	A5.23: EA4	14171-A-S3Mo	562
OE-S4 Mo	A5.23: EG	14171-A-S4Mo	562
OE-SD3 1Ni ¼Mo	A5.23: EG	14171-A-SZ	562
OE-SD3 1Ni ½Mo	A5.23: EF3/EG	26304-A-S3Ni1Mo	562
OE-SD2 1NiCrMo	A5.23: EG	26304-A-SZ	562
OE-SD3 2NiCrMo	A5.23: EG	26304-A-S3Ni2,5CrMo	563
OE-TIBOR 22	A5.23: EG	14171-A-SZ	563
OE-TIBOR 33	A5.23: EG	14171-A-SZ	563
OE-S2 CrMo1	A5.23: EB2	24598-A: S CrMo1	563
OE-S1 CrMo2	A5.23: EB3	24598-A: S CrMo 2	563
OE-CROMO S225	A5.23: EB3 R	24598-A: S CrMo 2	564
OE-CROMO S225V	-	2459-A: SZ	564
OE-S1 CrMo5	A5.23: EB6	24598-A: S CrMo5	564
OE-S1 CrMo91	A5.23: EB9	14171-A-SCrMo91	564

SAW Wires / Stainless and Heat resistant steels			
Product name	AWS	EN / EN ISO / DIN	Page
OE-410	A5.9: ER 410	14343-A-S 13	565
OE-430	A5.9: ER 430	14343-A-S 17	565
OE-308L	A5.9: ER308L	14343-A-S 19 9 L	565
OE-347	A5.9: ER 347	14343-A-S 19 9 Nb	565
OE-316L	A5.9: ER 316L	14343-A-S 19 12 3 L	565
OE-318	A5.9: ER 318	14343-A-S 19 12 3 Nb	566
OE-S 22 09	A5.9: ER 2209	14343-A-S 22 9 3 N L	566
OE-S 25 10	-	14343-A-S 25 9 4 N L	566
OE-309L	A5.9: ER309L	14343-A-S 23 12 L	566
OE-309LMo	A5.9: EG	14343-A-S 23 12 2 L	566
OE-22 12 H	A5.9: EG	14343-A-S 22 12 H	567
OE-20 16 L	A5.9: EG	14343-A-S 20 16 3 Mn N L	567
OE-904L	A5.9: ER 385	14343-B-385	567

SAW Wires / Nickel and Copper alloys			
Product name	AWS	EN / EN ISO / DIN	Page
OE-NIFIL 600	A5.14: ER NiCr3	18274-S Ni 6082	568
OE-NIFIL 625	A5.14: Er NiCrMo-3	18274- S Ni 6625	568
OE-NIFIL C276	5.14: ERNiCrMo-4	18274-S Ni 6276	568

OE-S1

Classification	
EN ISO	14171-A-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 ISO	14171-A-S2
AWS	A5.17: EM12K

Chemical analysis (Typical values in %)

C	Mn	Si	P	S
0.1	1	0.12	≤0.025	≤0.025

OE-S3

Classification	
EN ISO	14171-A-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 ISO	14171-A-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 ISO	14171-A-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 ISO	14171-A-S2Ni1Cu
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	<0.4	0.8	0.5

OE-S2 Ni1

Classification	
EN ISO	14171-A-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 ISO	14171-A-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 ISO	14171-A-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 ISO	14171-A-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 ISO	14171-A-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 ISO	14171-A-S4Mo
AWS	A5.23: EG

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Mo
0.1	1.9	0.15	≤ 0.015	≤ 0.015	0.5

OE-SD3 1Ni ¼Mo

Classification	
EN ISO	14171-A-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 ISO	26304-A-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 ISO	26304-A-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 ISO	26304-A-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

OE-TIBOR 22

Classification	
EN ISO	14171-A-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

OE-TIBOR 33

Classification	
EN ISO	14171-A-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	0.9	0.1	≤ 0.01	≤ 0.01	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-S1 CrMo91

Classification	
EN ISO	14171-A-SCrMo91
AWS	A5.23: EB9

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	V
0.1	0.5	0.3	9	0.6	0.95	0.055	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	16.5

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 ISO	14343-A-S 19 9 Nb
AWS	A5.9: ER 347

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.04	1.6	0.4	≤ 0.02	≤ 0.02	20	10

OE-316L

Classification	
EN ISO	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	19	12.5	2.8

OE-318

Classification	
EN ISO	14343-A-S 19 12 3 Nb
AWS	A5.9: ER 318

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo
<0.05	1.3	0.4	19	12.5	2.7

OE-S 22 09

Classification	
EN ISO	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
0.012	1.6	0.4	≤ 0.02	≤ 0.003	23	8.8	3.2	0.15

OE-S 25 10

Classification	
EN ISO	14343-A-S 25 9 4 N L
EN ISO	14343-B-2594

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 ISO	14343-A-S 23 12 L
AWS	A5.9: ER309L

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni
0.01	1.8	0.4	≤ 0.03	≤ 0.03	24	13

OE-309LMo

Classification	
EN ISO	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	21.5	14.5	2.7

OE-22 12 H

Classification	
EN ISO	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 ISO	14343-A-S 20 16 3 Mn N L
AWS	A5.9: EG

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	N
0.02	7	0.5	≤ 0.03	≤ 0.015	20	16	3	0.16

OE-904L

Classification	
EN ISO	14343-A-S 20 25 5 Cu L
EN ISO	14343-B-385
AWS	A5.9: ER 385

Chemical analysis (Typical values in %)

C	Mn	Si	P	S	Cr	Ni	Mo	Cu
0.015	2.3	0.2	≤ 0.02	≤ 0.02	21	25	4.9	1.5

OE-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

OE-NIFIL 625

Classification	
EN ISO	18274- S Ni 6625
AWS	A5.14: Er NiCrMo-3

Chemical analysis (Typical values in %)

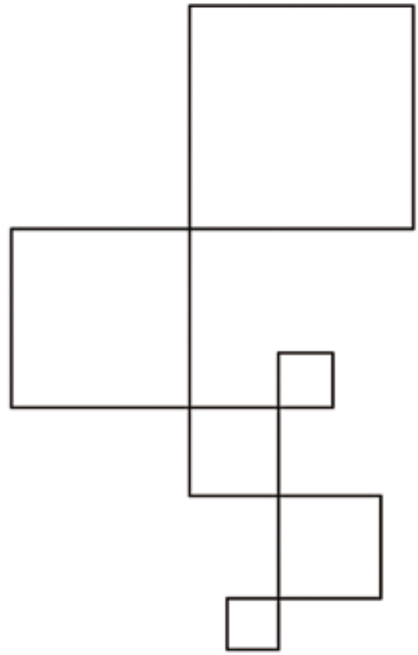
C	Mn	Si	Cr	Ni	Mo	Nb	Fe
0.02	0.3	0.3	22	> 60	9	3.5	<1

OE-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	AWS	EN / EN ISO / DIN	Page
FLUXOCORD 31HD	A5.17: F7A8-F7P8-ECG	14171-A- S 42 6 FB T3	572
FLUXOCORD 41HD	A5.23: F8P8-EC-F3	756: S 55 5 FB T2Ni1Mo	574
FLUXOCORD 42	A5.23: F11A8–EC–F5	756: S 69 6 FB TZ	575
FLUXOCORD 43.1	-	-	576
FLUXOCORD 48HD	A5.23: F8A2-ECG-G	14171-A- S 46 4 FB TZ	577

SAW Cored Wires / Hardfacing			
Product name	AWS	EN / EN ISO / DIN	Page
FLUXOCORD 50	-	14700: T Fe1 8555: UP1-GF-BFB1-65-250	578
FLUXOCORD 51	-	14700: T Fe1 8555: UP1-GF-BFB1-65-300	580
FLUXOCORD 52	-	14700: T Fe1 8555: UP1-GF-BFB1-65-400-P	582
FLUXOCORD 54	-	14700: ~T Fe2 8555: UP1-GF-BFB1-65-40-P	584
FLUXOCORD 54-6	-	14700: ~T Fe2 8555: UP5-GF-BFB4-652-40-GP	586

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 ISO	14171-A- 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 121TTW	LRS	4Y42M H5
OP 121TT	ABS	4YM
OP 121TT	DB	●
OP 181	DB	●
OP 121TT	DNV	VYM
OP 121TT	GL	6YM
OP 121TT	LRS	4Y42M H5
OP 181	TÜV	●

Chemical analysis (Typical values in %)

		C	Mn	Si
All weld metal	OP 132	0.06	1.7	0.7
All weld metal	OP 121TT	0.06	1.7	0.4
All weld metal	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+

AIR LIQUIDE WELDING

Packaging data

Packaging Type	B450
Diam(mm) / weight(kg)	25
2.4	●
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 121TTW	LRS	4Y50M
OP 121TT	TÜV	●

Chemical analysis (Typical values in %)

		C	Mn	Si	Ni	Mo
All weld metal	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	●

AIR LIQUIDE WELDING

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 121TTW (DC+ or AC). The weld metal composition obtained with FLUXOCORD 42 / OP 121TTW 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 redrying. 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
All weld metal	OP 121TTW	0.05	1.4	0.25	0.5	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	-40 °C	-60 °C
OP 121TTW	As Welded	>80		>69
OP 121TTW	580°Cx2h	> 69J	> 47J	

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
All weld metal	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	●

AIR LIQUIDE WELDING

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 ISO	14171-A- S 46 3 AB TZ
OP 121TT	EN ISO	14171-A- S 46 4 FB TZ
OP 132	AWS	A5.23: F8A2-ECG-G
OP 121TT	AWS	A5.23: F8A2-ECG-G

Chemical analysis (Typical values in %)

		C	Mn	Si	Cr	Ni	Cu
All weld metal	OP 132	0.06	1.4	0.6	0.4	0.6	0.5
All weld metal	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

Keep dry and avoid condensation

Current Conditions

AC; DC+

Packaging data

Packaging Type	B450
Diam(mm) / weight(kg)	25
2.4	●
3.2	●
4.0	●

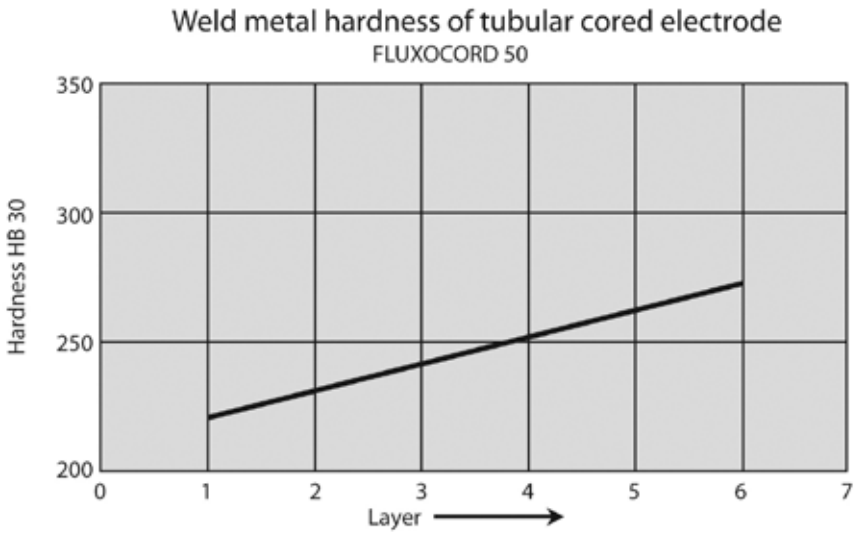
FLUXOCORD 50

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
All weld metal	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	●	●

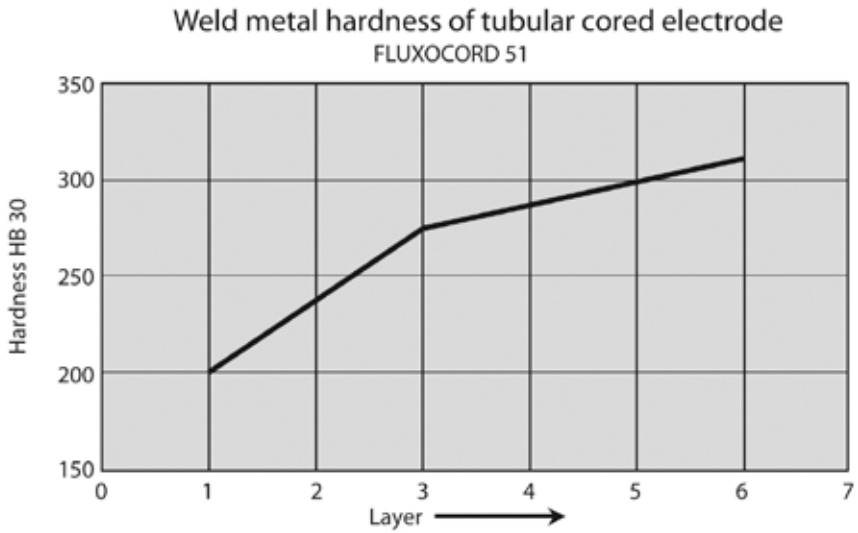
FLUXOCORD 51

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
All weld metal	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

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450	DRUM
Diam(mm) / weight(kg)	25.0	250.0
2.4	●	●
3.2	●	●
4.0	●	●

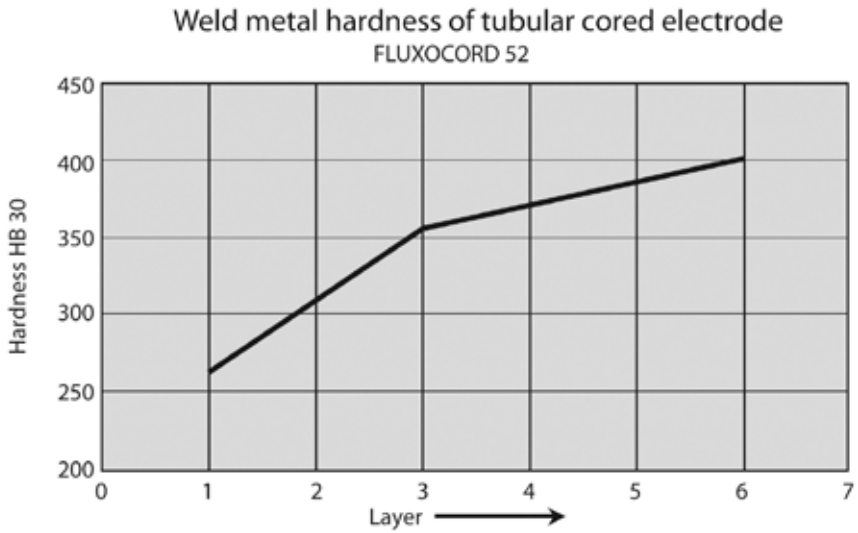
FLUXOCORD 52

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
All weld metal	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

AIR LIQUIDE

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450	DRUM
Diam(mm) / weight(kg)	25.0	250.0
2.4	●	●
3.2	●	●
4.0	●	●

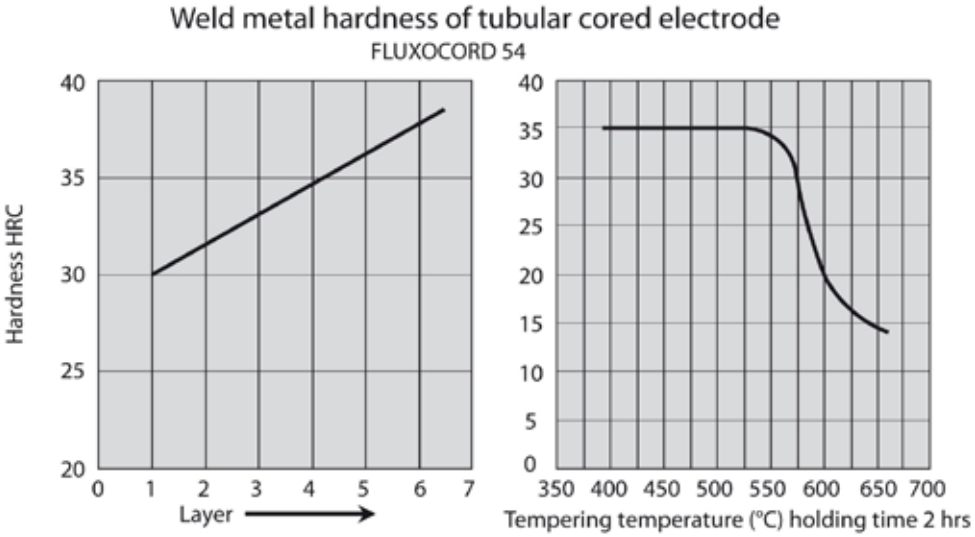
FLUXOCORD 54

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
All weld metal	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

AIR LIQUIDE

Current Conditions
AC; DC+

Packaging data

Packaging Type	B450	DRUM
Diam(mm) / weight(kg)	25.0	250.0
2.4	●	●
3.2	●	●
4.0	●	●

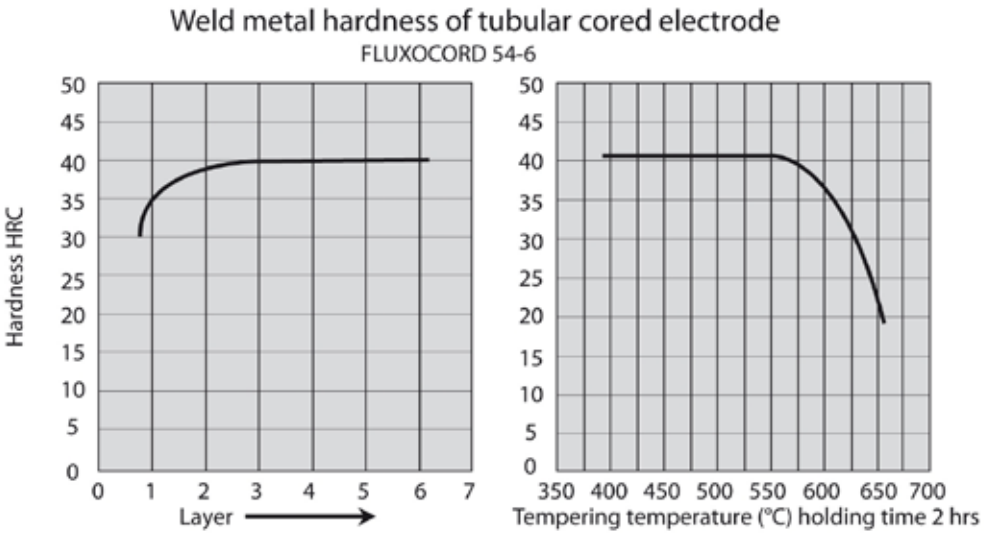
FLUXOCORD 54-6

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
All weld metal	OP 122	0.08	1.1	0.2	5	0.85

All-weld metal Mechanical Properties

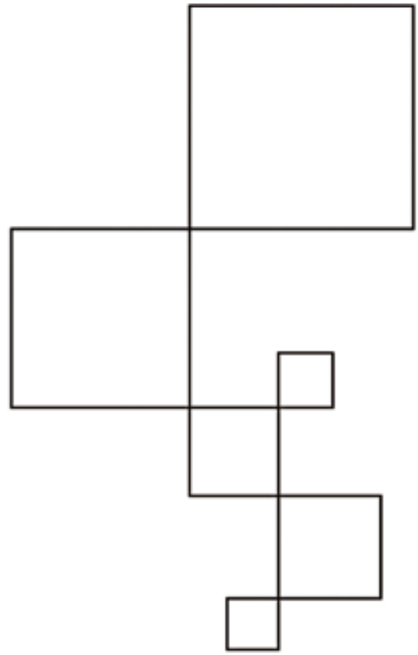
	Heat Treatment	Hardness
OP 122	As Welded	37-42 HRC

AIR LIQUIDE

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 Strip / Cladding			
Product name	AWS	EN / EN ISO / DIN	Page
SUPRASTRIP 19 9 L	A5.9: EQ308L	14343-A: B 19 9 L	592
SUPRASTRIP 24 13 L	A5.9: EQ309L	14343-A: B 23 12 L	592
SUPRASTRIP 19 9 LNb	A5.9: EQ 347	14343-A: B 19 9 Nb	592
SUPRASTRIP 21 11 LNb	A5.9: ~EQ347	14343-A: B 21 11 Nb	592
SUPRASTRIP 24 13 LNb	SFA 5.9: ~EQ 309 LNb	14343-A: B Z	592
SUPRASTRIP 19 12 3 L	A5.9: EQ 316L	14343-A: B 19 12 3 L	593
SUPRASTRIP 21 13 3 L	A5.9: ~EQ 309LMo	14343-A: B Z	593
SUPRASTRIP 625	A5.14: EQ NiCrMo-3	18274: Ni 6625	593
SUPRASTRIP 825	A5.14: EQ NiFeCr-1	18274: Ni 8065	593

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 %)

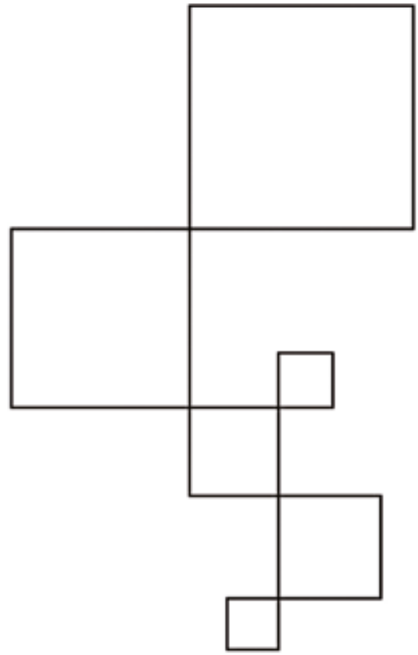
C	Mn	Si	Cr	Ni	Mo	Nb	Cu
0.02	0.2	0.1	22	bal	9	3.8	0.4

SUPRASTRIP 825

Classification	
EN	18274: Ni 8065
AWS	A5.14: EQ NiFeCr-1

Chemical analysis (Typical values in %)

C	Mn	Si	Cr	Ni	Mo	Nb	Cu	Fe	Ti
0.01	0.8	0.25	22	39	3	0.25	2	32	0.7



NOTES FOR THE USER

OERLIKON

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.

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.

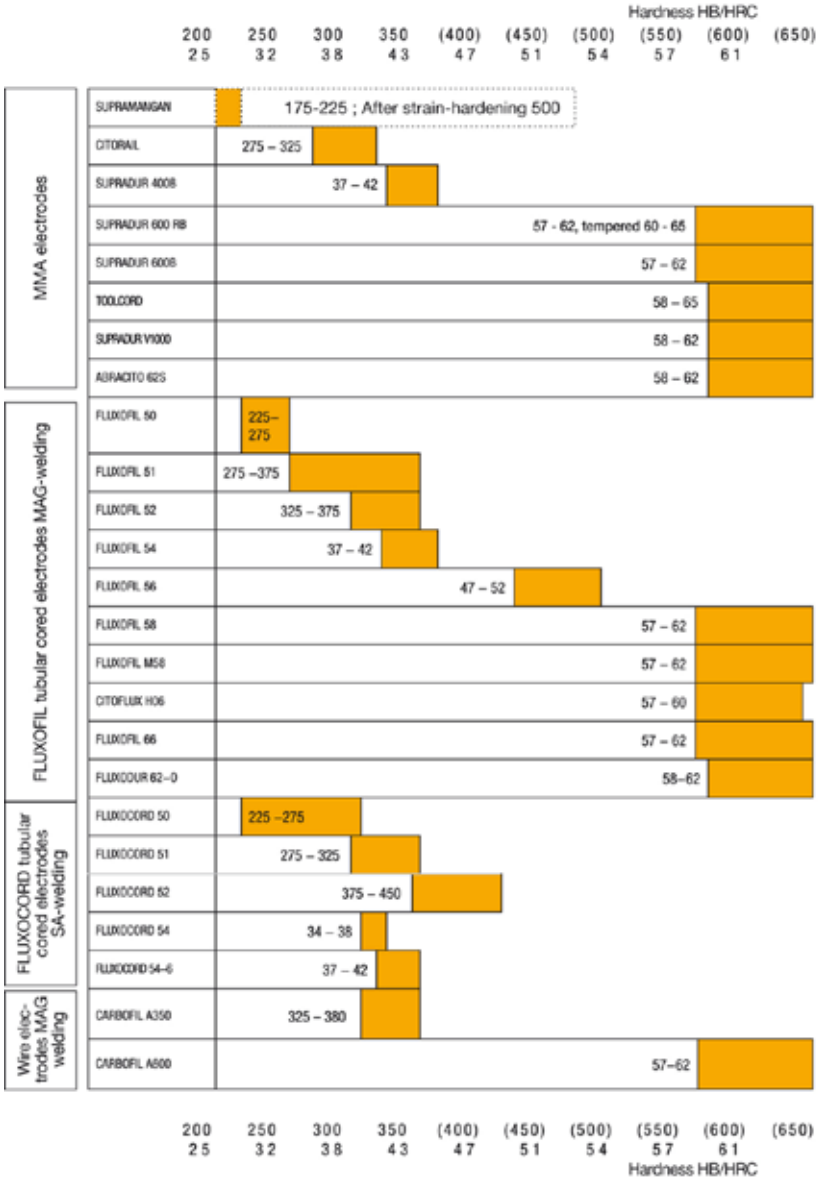
Preparation of the workpiece :

- 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.

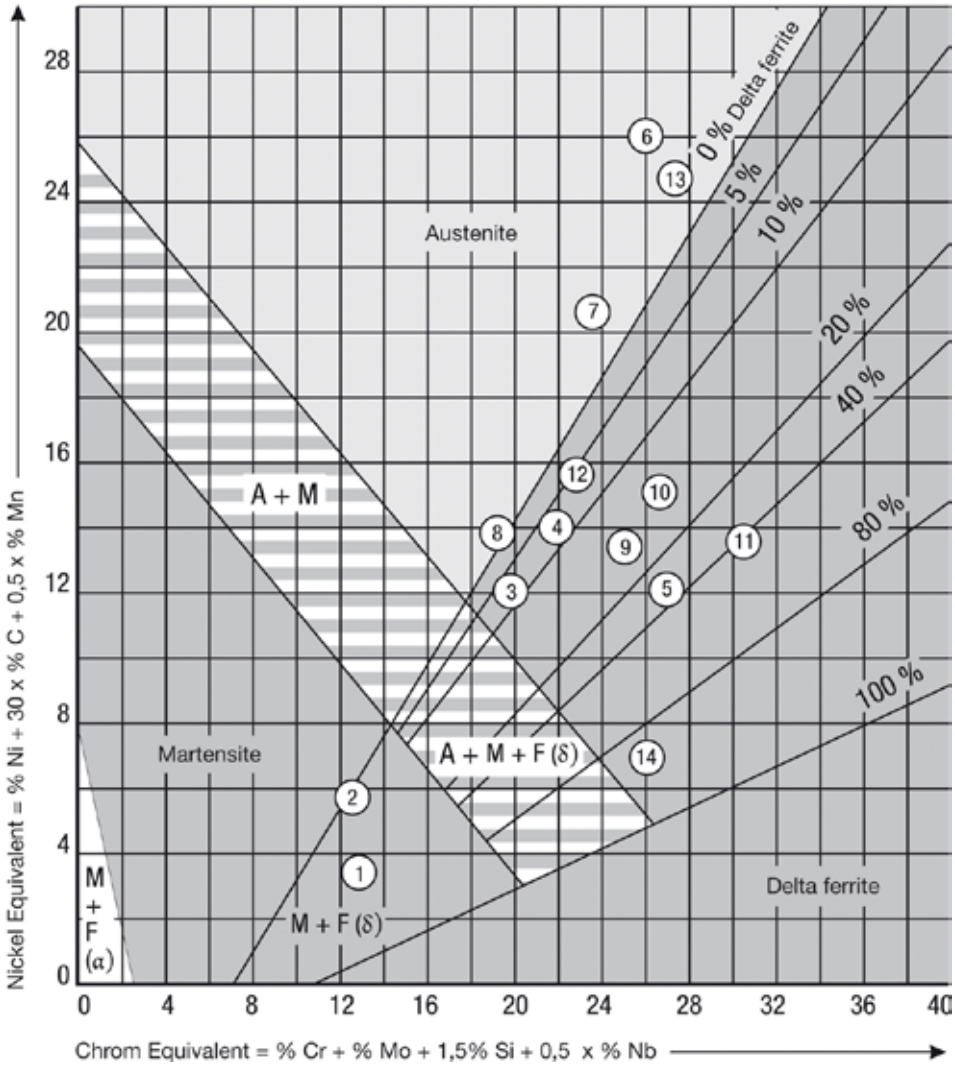
Schaeffler-DeLong-WCR diagrams

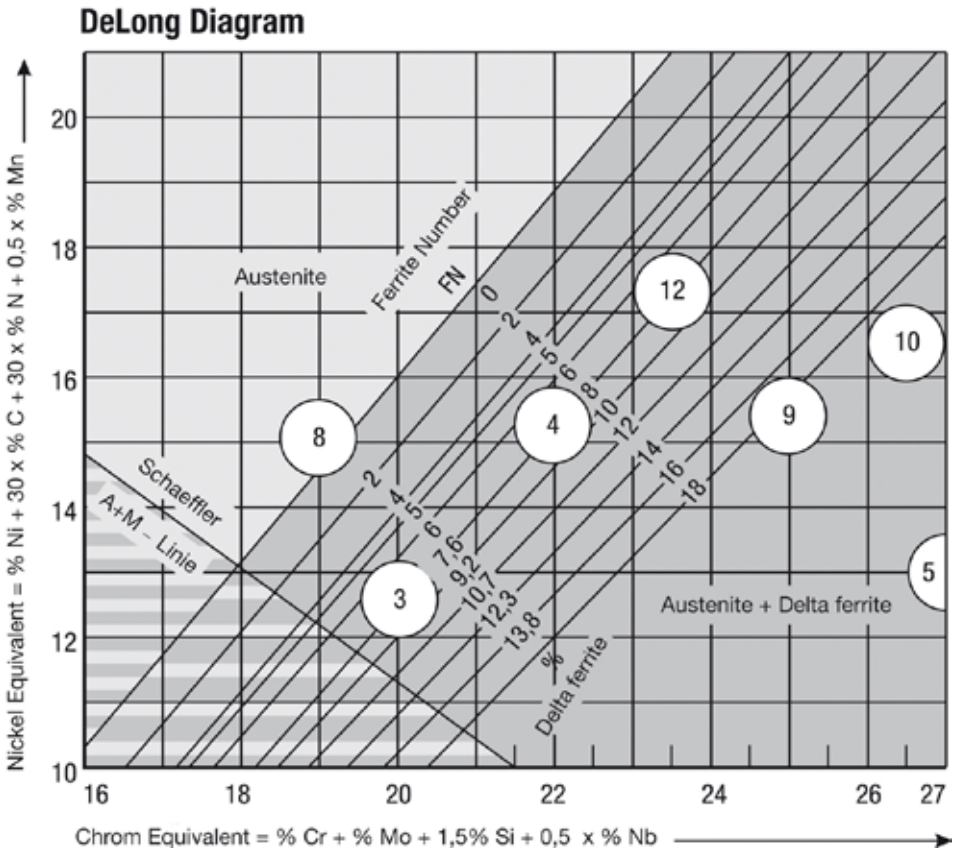
1	**13 1 - 1.4018 - 410 mod.**
	BASINOX 410 S
2	**13 4 - 1.4351 - 410 NiMo**
	BASINOX 410 NiMo S
	INERTROD 410 NiMo
	INERTFIL 410 NiMo
3	**19 9 L - 1.4316 - 308 L**
	SUPRANOX 308 L
	BASINOX 308 L
	INERTROD 308 L Si
	INERTFIL 308 L Si
	FLUXINOX 308 L / FLUXINOX 308 L-PF
	OE-308 L + OP 33 / OP 76
	19 9 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

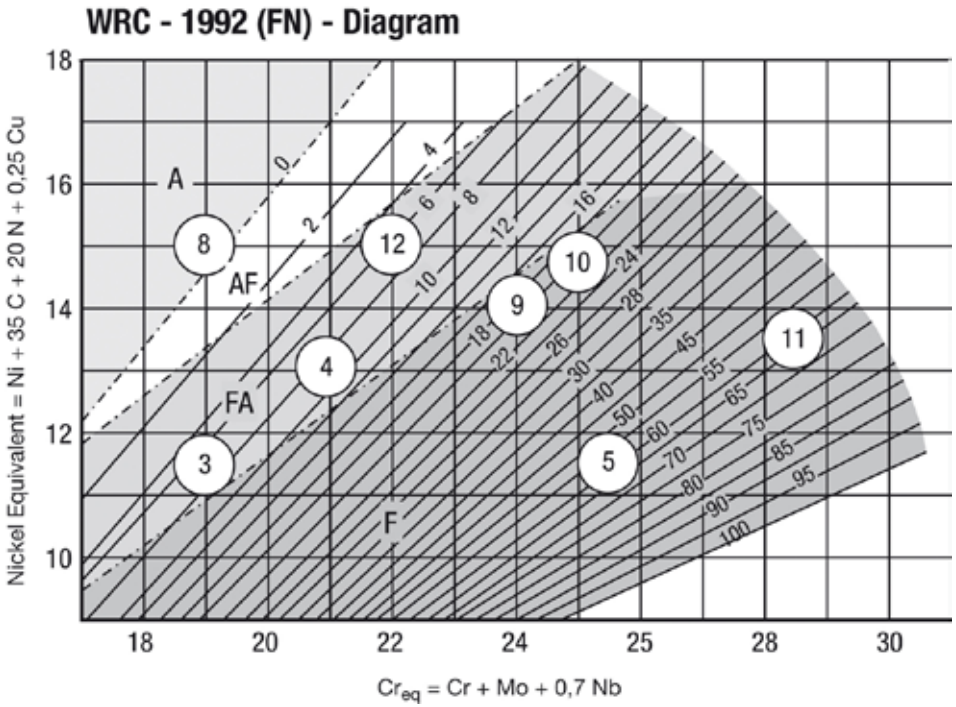

Hardness HB/HRC
200 25
250 32
300 38
350 43
(400) 47
(450) 51
(500) 54
(550) 57
(600) 61
(650)
MMA electrodes
SUPRAMANGAN
175-225 ; After strain-hardening 500
CITORAIL
275 – 325
SUPRADUR 400B
37 – 42
SUPRADUR 600 RB
57 - 62, tempered 60 - 65
SUPRADUR 600B
57 – 62
TOOLCORD
58 – 65
SUPRADUR V1000
58 – 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

Schaeffler Diagram

(Valid till 0,2% C - 4,0% Mn - 1,0% Si - 3,0% Mo - 1,5 Nb)




DeLong Diagram
Nickel Equivalent = % Ni + 30 x % C + 30 x % N + 0,5 x % Mn
Chrom Equivalent = % Cr + % Mo + 1,5% Si + 0,5 x % Nb
Austenite
Ferrite Number
FN
Schaeffler
A+M - Linie
Austenite + Delta ferrite
% Delta ferrite
20
18
16
14
12
10
16
18
20
22
24
26
27
0
2
4
5
6
8
10
12
14
16
18
7,6
9,2
10,7
12,3
13,8
8
4
3
12
10
9
5


WRC - 1992 (FN) - Diagram
Nickel Equivalent = Ni + 35 C + 20 N + 0,25 Cu
Cr_eq = Cr + Mo + 0,7 Nb
A
AF
FA
F
0
2
4
6
8
10
12
16
18
22
24
26
28
30
35
40
45
50
55
60
65
70
75
80
85
90
95
100
3
4
5
8
9
10
11
12
18
20
22
24
25
28
30
10
12
14
16
18

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.

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	-	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.

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

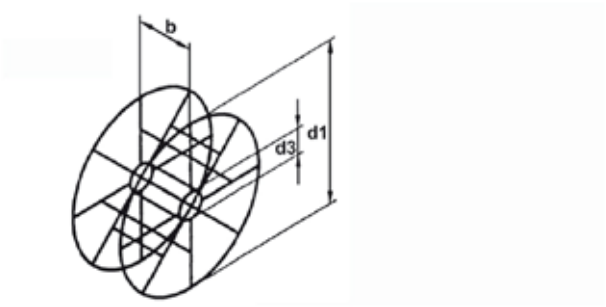
Vacuum package (aluminium, plastic, composite)

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)

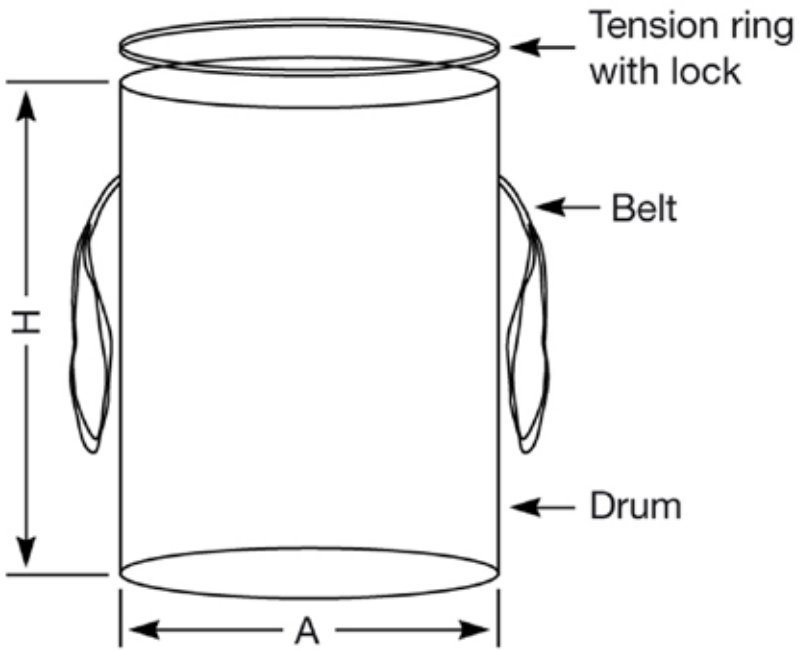
Designation	Short	Approx. Weight (kg)	Cans per carton	Note
Can	MCAN	9	2	FLEXAL Electrode
Can	TUBM	2	6	ALCORD Electrode

Metallic spool with hub



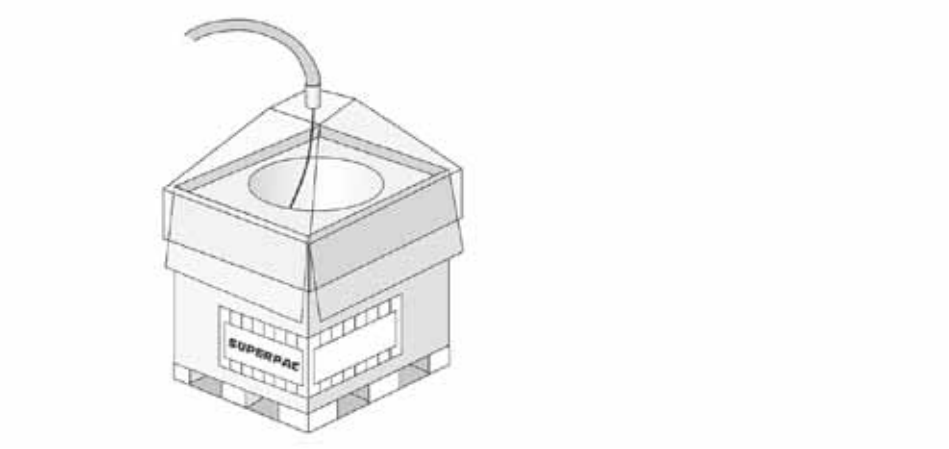
Designation	Spool weight (kg)	Outside diameter d1 (mm)	External width b (mm)	Mandrel hole diameter d3 (mm)	EN ISO 544
BS300	7-15	300	103	51.5	BS300

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						

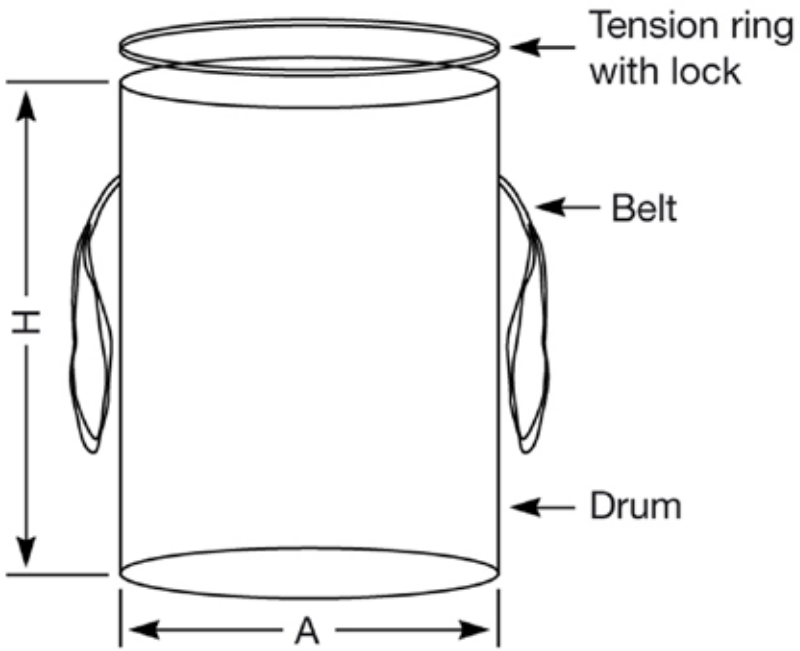
SUPERPAC



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

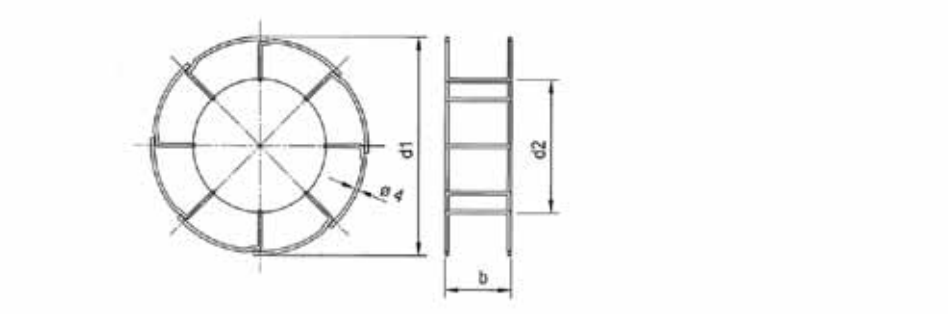
* option as "endless" (24 / 7)- variant by connecting the end of the wire and the beginning of an other wire with two barrels, special hood and accessories needed

Drum



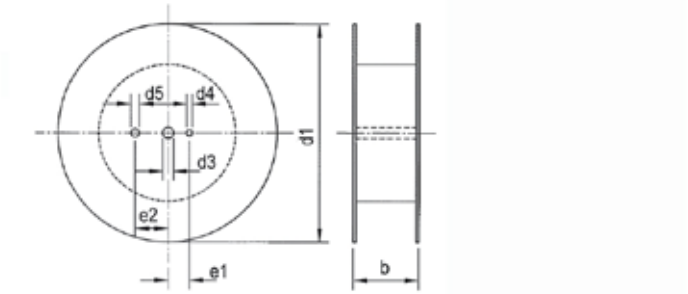
Oerlikon designation	Drum weight (kg)	Drum diameter A (mm)	Drum height H (mm)	Core diameter (mm)	Remarks
Drum 250	250	570	770	-	Flux cored wire
Drum 300	300	585	800	315	Solid wire
Drum 380	380	585	1000	315	Solid wire
Other forms of bulk packaging available on request					

Metallic spool (B)



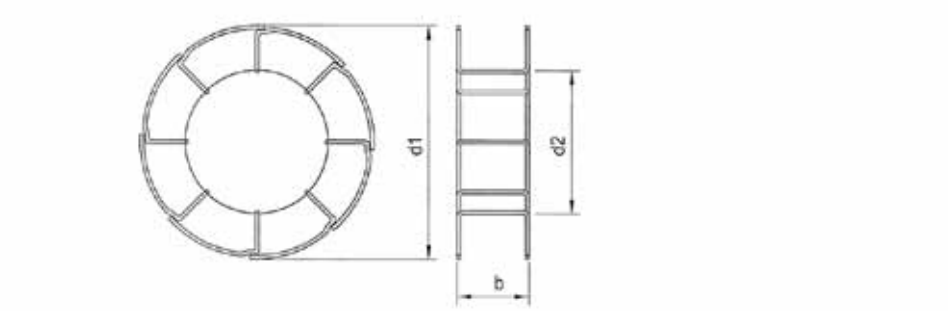
Designation	Spool weight (kg)	Outside diameter d1	Inside diameter d2	External width b (mm)	EN ISO 544
B200	5	200	90	55	-
B300	7-20	300	180	100	B 300

Plastic spool (S)



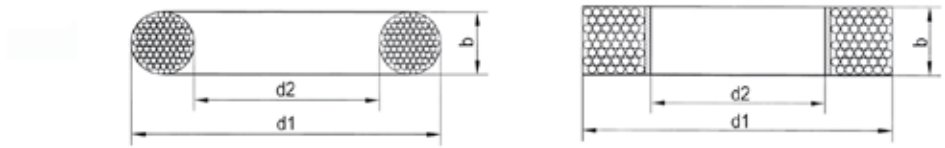
Designation	Spool weight (kg)	Outside diameter d1	External diameter b	Spool hole diameter d3	EN ISO 544
S200	5	200	55	50.5	S 200
S300	7-15	300	100	50.5	S 300
D 760	300	760	310	45	-

Metallic spool & 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

Index

[A] **ALCORD 12Si** - 193
ALCORD 5Si - 192
ALCORD Al - 191
ALUFIL Al99.5Ti - 281
ALUFIL AlMg4.5Mn - 285
ALUFIL AlMg5 - 284
ALUFIL AlMg5Mn - 286
ALUFIL AlSi12 - 283
ALUFIL AlSi5 - 282
ALUROD Al99.5Ti - 340
ALUROD AlMg4.5Mn - 344
ALUROD AlMg5 - 343
ALUROD AlSi12 - 342
ALUROD AlSi5 - 341
AMPCOTRODE G10 - 277
AMPCOTRODE G150 - 278
AMPCOTRODE T150 - 338
AST 300 - 543
AST 347 - 544
AST 600 - 545

[B] **BASINOX 22 12 H** - 162
BASINOX 22 9 3 N - 155
BASINOX 307 - 175
BASINOX 308H - 160
BASINOX 308L - 140
BASINOX 308L T - 141
BASINOX 309L - 170
BASINOX 309Mo - 173
BASINOX 309Nb - 174
BASINOX 310 - 164
BASINOX 310Mo - 165
BASINOX 316L - 148
BASINOX 316L T - 149
BASINOX 318 - 152
BASINOX 347 - 144
BASINOX 410 NiMo S - 135
BASINOX 410 S - 134
BASINOX 430 S - 136
BASINOX 904L - 158
BASINOX EB 25 10 4 N - 156

[C] **CARBOCAST NiFe** - 275
CARBOFIL - 219
CARBOFIL 1 - 220
CARBOFIL 1 GOLD - 222
CARBOFIL 1A - 224
CARBOFIL 1A GOLD - 226
CARBOFIL 2NiMoCr - 247
CARBOFIL A 350 - 287
CARBOFIL A 600 - 288
CARBOFIL CrMo1 - 234
CARBOFIL CrMo2 - 236
CARBOFIL CrMo5 - 238
CARBOFIL CrMo9 - 239
CARBOFIL GALVA - 229
CARBOFIL KV3 - 237
CARBOFIL KV5 - 235
CARBOFIL KV7M - 240
CARBOFIL MnMo - 243
CARBOFIL MnNiMoCr - 245
CARBOFIL Mo - 233
CARBOFIL Ni1 - 230
CARBOFIL Ni2 - 232
CARBOFIL NiCu - 241
CARBOFIL NiMo1 - 244
CARBOFIL NiMoCr - 246
CARBOPIPE 70 - 228
CARBOPIPE 80Ni - 231
CARBOROD - 293
CARBOROD 1 - 294
CARBOROD 1A - 295
CARBOROD CrMo1 - 301
CARBOROD CrMo2 - 303
CARBOROD CrMo5 - 306
CARBOROD CrMo9 - 307
CARBOROD GALVA - 296
CARBOROD KV3 - 304
CARBOROD KV5 - 302
CARBOROD KV7M - 308
CARBOROD MnMo - 310
CARBOROD Mo - 300
CARBOROD Ni1 - 297
CARBOROD Ni2 - 298
CARBOROD Ni3 - 299
CARBOROD NiCu - 309
CARBOROD NiMo1 - 311
CARBOROD NiMoCr - 312
CARBOROD W 225V - 305
CITOBRONZE Sn - 186

CITOFLUX B00 - 400
CITOFLUX B13-0 - 405
CITOFLUX GALVA - 382
CITOFLUX H06 - 459
CITOFLUX M00 - 378
CITOFLUX M20 - 380
CITOFLUX M60 - 377
CITOFLUX M60A - 374
CITOFLUX R00 - 386
CITOFLUX R00C - 391
CITOFLUX R00Ni - 390
CITOFLUX R00NiC - 393
CITOFLUX R111 - 394
CITOFLUX R550 - 411
CITOFLUX R620 - 412
CITOFLUX R620 Ni2 - 413
CITOFLUX R82 - 397
CITOFLUX R82 SR - 398
COPPERFIL 70/30 - 280
COPPERFIL CuAl8 - 276
COPPERFIL CuSi3 - 279
CRISTAL E308L - 139
CRISTAL E309L - 169
CRISTAL E316L - 147
CRISTAL F206 - 375
CROMO E225 - 123
CROMO E225V - 124
CROMOCORD 10M - 132
CROMOCORD 2 STC - 120
CROMOCORD 23 - 125
CROMOCORD 5 - 126
CROMOCORD 55 - 116
CROMOCORD 5L - 127
CROMOCORD 9 - 128
CROMOCORD 91 - 130
CROMOCORD 92 - 131
CROMOCORD 9M - 129
CROMOCORD Kb - 117
CROMOCORD N125 - 133
CUPRONIC 70 - 187
CUROD - 337

[D] **DW 312** - 176
DW RSP - 166

[E] **ELT 300** - 550
ELT 300S - 551
ELT 316-1 - 553
ELT 347-1 - 552
ELT 600 - 554
ELT 600S - 555
ELT 825-1 - 556
ETC PH 35S - 94
ETC PH 35S DRY - 95

[F] **FEBAMATIC 160S** - 91
FERROMATIC 130 - 84
FERROMATIC 160 - 85
FERROMATIC 180 - 86
FERROMATIC 200 - 87
FINCORD - 79
FINCORD M - 73
FLEXAL 60 - 81
FLEXAL 70 - 82
FLEXAL 80 - 83
FLUXINOX 22 9 3 L - 434
FLUXINOX 22 9 3 L PF - 435
FLUXINOX 25 4 - 448
FLUXINOX 25 4 PF - 450
FLUXINOX 307 - 436
FLUXINOX 307 PF - 437
FLUXINOX 308H - 427
FLUXINOX 308L - 425
FLUXINOX 308L PF - 426
FLUXINOX 309H - 446
FLUXINOX 309H PF - 447
FLUXINOX 309L - 438
FLUXINOX 309L PF - 439
FLUXINOX 309MoL - 440
FLUXINOX 309MoL PF - 441
FLUXINOX 310 - 444
FLUXINOX 310 PF - 445
FLUXINOX 312 - 442
FLUXINOX 312 PF - 443
FLUXINOX 316L - 430
FLUXINOX 316L PF - 431
FLUXINOX 318 - 432
FLUXINOX 318 PF - 433
FLUXINOX 347 - 428
FLUXINOX 347 PF - 429
FLUXINOX 430Ti - 424

FLUXINOX 625 - 451
FLUXINOX 904L - 449
FLUXOCORD 31HD - 572
FLUXOCORD 41HD - 574
FLUXOCORD 42 - 575
FLUXOCORD 43.1 - 576
FLUXOCORD 48HD - 577
FLUXOCORD 50 - 578
FLUXOCORD 51 - 580
FLUXOCORD 52 - 582
FLUXOCORD 54 - 584
FLUXOCORD 54-6 - 586
FLUXODUR 62-O - 461
FLUXOFIL 14 - 383
FLUXOFIL 14 HD - 384
FLUXOFIL 14 HD S - 388
FLUXOFIL 140 mod. - 402
FLUXOFIL 18 HD - 407
FLUXOFIL 19 HD S - 392
FLUXOFIL 20 HD - 395
FLUXOFIL 21 HD - 396
FLUXOFIL 25 - 419
FLUXOFIL 29 HD - 414
FLUXOFIL 31 - 399
FLUXOFIL 35 - 420
FLUXOFIL 36 - 421
FLUXOFIL 37 - 422
FLUXOFIL 38 C - 423
FLUXOFIL 40 - 401
FLUXOFIL 41 - 410
FLUXOFIL 42 - 416
FLUXOFIL 43.1 - 404
FLUXOFIL 44 - 403
FLUXOFIL 45 - 417
FLUXOFIL 48 - 408
FLUXOFIL 50 - 452
FLUXOFIL 51 - 453
FLUXOFIL 52 - 454
FLUXOFIL 54 - 455
FLUXOFIL 56 - 456
FLUXOFIL 58 - 457
FLUXOFIL 66 - 460
FLUXOFIL 70 - 418
FLUXOFIL M 10 - 376
FLUXOFIL M 10 PG - 381
FLUXOFIL M 10 S - 379
FLUXOFIL M 41 - 409
FLUXOFIL M 42 - 415
FLUXOFIL M 48 - 406
FLUXOFIL M 58 - 458
FLUXOFIL M 8 - 373
FREEZAL ENi3 - 103
FREEZAL ENi9 - 183

[I]
INERTFIL 20 16 L - 265
INERTFIL 22 9 3 - 266
INERTFIL 25 10 4 - 267
INERTFIL 307 - 262
INERTFIL 308H - 258
INERTFIL 308LSi - 253
INERTFIL 309LMo - 261
INERTFIL 309LSi - 260
INERTFIL 310 - 259
INERTFIL 312 - 263
INERTFIL 316LSi - 256
INERTFIL 318Si - 257
INERTFIL 347Si - 255
INERTFIL 410 - 248
INERTFIL 410NiMo - 249
INERTFIL 420 - 250
INERTFIL 430 - 251
INERTFIL 430LNb - 252
INERTFIL 904L - 264
INERTROD 20 16 L - 328
INERTROD 22 9 3 - 329
INERTROD 25 10 4 - 330
INERTROD 307 - 325
INERTROD 308H - 321
INERTROD 308L - 317
INERTROD 309L - 323
INERTROD 309LMo - 324
INERTROD 310 - 322
INERTROD 312 - 326
INERTROD 316L - 319
INERTROD 318 - 320
INERTROD 347 - 318
INERTROD 410 - 313
INERTROD 410NiMo - 314
INERTROD 420 - 315
INERTROD 430 - 316

INERTROD 904L - 327

[M] **MOLYCORD Kb** - 113
MOLYCORD Ti - 112

[N] **NIFIL 59** - 273
NIFIL 600 - 269
NIFIL 625 - 270
NIFIL C276 - 272
NIFIL Ni1 - 268
NIFIL NiCu7 - 274
NIROD 59 - 339
NIROD 600 - 332
NIROD 625 - 333
NIROD C276 - 335
NIROD Ni1 - 331
NIROD NiCu7 - 336

[O] **OE-20 16 L** - 567
OE-22 12 H - 567
OE-308L - 565
OE-309L - 566
OE-309LMo - 566
OE-316L - 565
OE-318 - 566
OE-347 - 565
OE-410 - 565
OE-430 - 565
OE-904L - 567
OE-CROMO S225 - 564
OE-CROMO S225V - 564
OE-CRYO 75 H - 100
OE-CRYO 87 - 99
OE-KV2HR - 115
OE-KV2L - 114
OE-KV3HR - 122
OE-KV3L - 121
OE-KV5HR - 119
OE-KV5L - 118
OE-NIFIL 600 - 568
OE-NIFIL 625 - 568
OE-NIFIL C276 - 568
OE-S 22 09 - 566
OE-S 25 10 - 566
OE-S1 - 560
OE-S1 CrMo2 - 563
OE-S1 CrMo5 - 564
OE-S1 CrMo91 - 564
OE-S2 - 560
OE-S2 CrMo1 - 563
OE-S2 Mo - 561
OE-S2 Ni1 - 561
OE-S2 Ni2 - 561
OE-S2 Ni3 - 561
OE-S2 NiCu - 561
OE-S3 - 560
OE-S4 - 560
OE-S4 Mo - 562
OE-SD2 1NiCrMo - 562
OE-SD3 - 560
OE-SD3 1Ni ¼Mo - 562
OE-SD3 1Ni ½Mo - 562
OE-SD3 2NiCrMo - 563
OE-SD3 Mo - 562
OE-TIBOR 22 - 563
OE-TIBOR 33 - 563
OP 100 - 497
OP 10U - 540
OP 119 - 486
OP 121TT - 515
OP 121TTW - 519
OP 122 - 522
OP 1250A - 536
OP 1300A - 537
OP 132 - 507
OP 1350A - 538
OP 139 - 510
OP 143 - 488
OP 1450A - 539
OP 160 - 500
OP 176 - 478
OP 180S - 501
OP 181 - 490
OP 191 - 493
OP 192 - 504
OP 33 - 527
OP 41TT - 512
OP 76 - 529
OP 87 - 541
OP CROMO F537 - 524
OP F500 - 533

OP F55 - 480
OP F72 - 484
OP F77 - 532
OP XNi - 535
OVERCORD - 78
OVERCORD S - 75

[P] **PIE 18** - 482

[S] **SPEZIAL** - 88
SUPERCORD - 74
SUPERCORD 42 - 76
SUPERCORD 45 - 77
SUPERCUT - 205
SUPERFONTE BM - 190
SUPERFONTE Ni - 188
SUPERFONTE NiFe - 189
SUPRADUR 2015 - 195
SUPRADUR 345B - 196
SUPRADUR 400 - 197
SUPRADUR 400B - 198
SUPRADUR 600 - 199
SUPRADUR 600B - 201
SUPRADUR 600RB - 200
SUPRADUR V1000 - 202
SUPRADUR VF1000 - 203
SUPRAMANGAN - 194
SUPRANEL - 179
SUPRANEL 600 - 180
SUPRANEL 625 - 181
SUPRANEL 690 - 184
SUPRANEL C276 - 182
SUPRANEL Ni1 - 177
SUPRANEL NiCu7 - 185
SUPRANEL SR - 178
SUPRANOX 308H - 159
SUPRANOX 308L - 137
SUPRANOX 309L - 167
SUPRANOX 309MoL - 171
SUPRANOX 316L - 145
SUPRANOX 317 - 150
SUPRANOX 318 - 151
SUPRANOX 347 - 142
SUPRANOX 904L - 157
SUPRANOX E 22 9 3 N - 153
SUPRANOX RS 22 9 3 L - 154
SUPRANOX RS 308H - 161
SUPRANOX RS 308L - 138
SUPRANOX RS 309L - 168
SUPRANOX RS 309Mo - 172
SUPRANOX RS 310 - 163
SUPRANOX RS 316L - 146
SUPRANOX RS 347 - 143
SUPRASTRIP 19 12 3 L - 593
SUPRASTRIP 19 9 L - 592
SUPRASTRIP 19 9 LNb - 592
SUPRASTRIP 21 11 LNb - 592
SUPRASTRIP 21 13 3 L - 593
SUPRASTRIP 24 13 L - 592
SUPRASTRIP 24 13 LNb - 592
SUPRASTRIP 625 - 593
SUPRASTRIP 825 - 593

[T] **TENAX 118-M** - 109
TENAX 128-M - 110
TENAX 140 - 111
TENAX 55H - 96
TENAX 56S - 89
TENAX 56ST (ETC PH 56ST) - 97
TENAX 58S - 92
TENAX 76S - 98
TENAX 77 (ETC PH 77) - 93
TENAX 88S - 101
TENAX 88S HR - 102
TENAX 98M - 108
TENCORD 85 CP - 107
TENCORD Kb - 106
TOOLCORD - 204

[U] **UNIFLUX D1** - 495
UNIVERS - 90

[V] **VERTICORD 80** - 104
VERTICORD 90 - 105

Contatti

ETC OERLIKON S.p.A.
Via Vo' di Placca, 56
35020 Due Carrare (PD) - ITALY
Tel. +39 045 82.91.511
Fax +39 045 82.91.500
info.saldatura@airliquide.com
www.oerlikon.it

FILIALE NORD-EST
Via Vò di Placca, 56
35020 Due Carrare (PD)
Tel. 049 9199430
Fax. 049 9199453
filiale.nordest@airliquide.com

FILIALE NORD-OVEST
Via Giotto, 26
20032 Cormano (MI)
Tel. 02 38004121
Fax. 02 38001510
filiale.nordovest@airliquide.com

FILIALE CENTRO
Viale Palmiro Togliatti, 1587
00155 ROMA
Tel. 06 40801093
Fax. 06 4071341
filiale.centro@airliquide.com

RECAPITO DI BARI
Via Palmentullo Z.I.
70023 Gioa del Colle (BA)
Tel. 080 3481274
Fax 080 3481379
filiale.sud@airliquide.com

FILIALE SUD
Via Ferrante Imparato, 198
80146 Napoli
Tel. 0815590562 - 5591028
Fax. 0815590486
filiale.sud@airliquide.com

AIR LIQUIDE
www.airliquide.com

Air Liquide è il leader mondiale dei gas per l'industria, la sanità e l'ambiente, ed è presente in oltre **80 Paesi** con **43 600 collaboratori.** Ossigeno, azoto, idrogeno e gas rari sono al cuore dell'attività di Air Liquide, fin dalla sua creazione nel 1902. A partire da queste molecole, Air Liquide reinventa costantemente la sua attività per anticipare i bisogni dei suoi mercati presenti e futuri. Il Gruppo innova per favorire il progresso, al fine di unire crescita dinamica e regolarità delle sue performance. Air Liquide combina i suoi numerosi prodotti a differenti tecnologie per sviluppare applicazioni e servizi a forte valore aggiunto, per i suoi clienti e per la società.

ETC OERLIKON S.p.A. si riserva il diritto di modificare i suoi prodotti senza preavviso. Le informazioni contenute in questo documento sono concepite per aiutare l'utente nella sua scelta del prodotto. L'utente dovrebbe controllare che il prodotto da lui scelto sia idoneo all'applicazione che prevede per il medesimo.

© ALW - 03 2012 - cod. W000374507 - PLDB 7674