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We are pleased to present you the new Lincoln Electric Europe Consumables Catalogue. This catalogue contains a complete overview of the Lincoln Electric Europe consumables portfolio. Our objective is to provide complete up-to-date information that is essential to the end user.

The catalogue has been subdivided into a general information section, Master Data Sheets (MDS) for covered electrodes, GTA and GMA welding products, tubular cored wires, welding fluxes with the associated wires, the PIPELINER® range for pipeline welding and ceramic backing products. Tabs will help you find the various sections.

The section "General Information", contains all product listings, selection tables, information about packaging and a descriptive explanation about major European Standards.

Most European Standards for the classification of welding consumables have been published. The option has been chosen to provide, if available, the AWS and EN/ISO classification for each product. The obsolete national standards such as BS, DIN have been deleted. In cases where the EN/ISO standard is not yet officially published, the classification has been based upon most recent provisional standards.

From January 1 2006, there will be a possibility for our customers to register at [www.mylincolnelectric.com](http://www.mylincolnelectric.com). Whenever there is a release of updated MDS's, we will send these new MDS's per e-mail to those who have registered.

This catalogue contains the European consumables portfolio. Not all products are available from stock.

In all Lincoln Electric Price Books, the stock designation of the consumables is mentioned.

The policy of The Lincoln Electric Company is to satisfy customer requirements, with products and services that comply with all relevant standards. The manufacturing and supply of our consumable products are in compliance with a Quality Programme which has been verified and approved by certifying authorities according ISO 9001:2000 and either VdTÜV or ABS.

Barcelona, August 2005

*All the information in this booklet is based on the best available knowledge at the time of printing and is subject to change without prior notice and can only be considered as suitable for general guidance. The listed typical mechanical properties are based on welding tests according to the European Standards, valid for the classification of products*

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## G Ceramic backing materials

## COVERED ELECTRODES FOR MILD AND FINE GRAINED STEEL

Product name	Chemical composition (typical values) in %				Classifications	
	C	Mn	Si	Others	AWS	EN
Fleetweld 5P	0.15	0.44	0.2	-	A5.1	E6010
Fleetweld 5P+	0.15	0.5	0.25	-	A5.1	E6010
Resistens 100	0.09	0.6	0.3	-	A5.1	E6012
Supra	0.12	0.5	0.6	-	A5.1	E6012
Panta	0.12	0.6	0.6	-	A5.1	E6013
Pantafix	0.09	0.5	0.4	-	A5.1	E6013
Omnia	0.07	0.5	0.5	-	A5.1	E6013
Omnia 46	0.06	0.5	0.45	-	A5.1	E6013
Cumulo	0.10	0.5	0.4	-	A5.1	E6013
Universalis	0.10	0.6	0.4	-	A5.1	E6013
Ferrod 165A	0.07	0.95	0.3	-	A5.1	E7024-1
Ferrod 120T	0.06	0.6	0.5	-	A5.1	E7024
Ferrod 135T	0.08	0.5	0.35	-	A5.1	E7024
Ferrod 160T	0.07	0.9	0.6	-	A5.1	E7024
Ferrod 170	0.07	1.1	0.5	-	A5.1	E7024
Ferrod 185T	0.11	0.9	0.5	-	A5.1	E7024
Ferrod 200T	0.06	1.1	0.5	-	A5.1	E7024
Resistens 160	0.08	1.0	0.3	-	A5.1	E7024-1
Gonia 180	0.07	1.0	0.35	-	A5.1	E7024
Geofors	0.06	0.6	0.4	-	A5.1	E7024
Baso 48SP	0.075	1.4	0.65	-	A5.1	E7018-1 H8
Baso 49	0.09	1.1	0.6	-	A5.1	E7018 H8
Baso 51P	0.06	1.3	0.5	-	A5.1	E7018 H8
Baso 100	0.08	1.0	0.5	-	A5.1	E7016 H4R
Baso 120	0.08	1.2	0.5	-	A5.1	E7018 H4R
Baso G	0.05	1.3	0.4	-	A5.1	E7018-1 H4R
Baso 26V	0.09	1.1	0.7	-	A5.1	E7048 H8
Conarc 48	0.05	1.3	0.3	-	A5.1	E7018-1 H4R
Conarc 49	0.09	1.1	0.6	-	A5.1	E7018 H4R
Conarc 49C	0.06	1.4	0.3	-	A5.1	E7018-1 H4R
Conarc 51	0.06	1.4	0.5	-	A5.1	E7016-1 H4R
Conarc L 150	0.07	0.95	0.4	-	A5.1	E7028 H4R
Conarc V 180	0.08	1.2	0.3	-	A5.1	E7028 H4R
Conarc V 250	0.08	1.3	0.45	-	A5.1	E7028 H4R
Kardo	0.03	0.4	0.25	-	A5.1	E6018*

\* for deviations consult corresponding data sheet

# Covered electrodes for low alloyed steel

(high yield, low temperature and creep resistant steel)

## COVERED ELECTRODES FOR LOW ALLOYED STEEL (HIGH YIELD, LOW TEMPERATURE AND CREEP RESISTANT STEEL)

Product name	Chemical composition (typical values) in %										Classifications	
	C	Mn	Si	Ni	Cr	Mo	Cu	V	Nb	N	AWS	EN
Shield Arc HYP	0.12	0.35	0.12	-	-	0.35	-	0.02	-	-	A5.5	E7010-G
Shield Arc 70+	0.12	0.9	0.2	0.85	0.1	-	-	0.03	-	-	A5.5	E8010-G
Shield Arc 85	0.11	0.5	0.25	-	-	0.5	-	-	-	-	A5.5	E7010-A1
Shield Arc 90	0.13	0.6	0.15	0.7	-	0.6	-	-	-	-	A5.5	E9010-G
Conarc 55 CT	0.05	1.5	0.4	0.9	-	-	0.4	-	-	-	A5.5	E8018-W2 H4R*
Conarc 60G	0.06	1.0	0.4	1.6	-	0.3	-	-	-	-	A5.5	E9018M H4
Conarc 70G	0.06	1.2	0.4	1.0	-	0.4	-	-	-	-	A5.5	E9018-G H4
Conarc 80	0.06	1.5	0.4	2.2	-	0.4	-	-	-	-	A5.5	E11018M H4
Conarc 85	0.06	1.3	0.3	2.0	0.4	0.4	-	-	-	-	A5.5	E12018-G H4
Conarc 85-150	0.06	1.5	0.4	2.5	-	1.0	-	-	-	-	A5.5	E12018-G H4
Kryo 1	0.05	1.5	0.4	0.9	-	-	-	-	-	-	A5.5	E7018-G H4R
Kryo 1N	0.07	1.7	0.5	0.9	-	-	-	-	-	-	A5.5	E8016-G H4R
Kryo 1P	0.05	1.5	0.5	0.95	-	-	-	-	-	-	A5.5	E8018-G H4
Kryo 1-180	0.07	1.2	0.3	0.9	-	-	-	-	-	-	A5.5	E8018-G H4
Kryo 2	0.05	1.6	0.3	1.5	-	-	-	-	-	-	A5.5	E9018-G H4
Kryo 3	0.05	0.7	0.3	2.5	-	-	-	-	-	-	A5.5	E8018-C1 H4
SL 12G	0.05	0.8	0.6	-	-	0.55	-	-	-	-	A5.5	E7018-A1 H4
SL 19G	0.06	0.75	0.6	-	1.1	0.5	-	-	-	-	A5.5	E8018-B2 H4
SL 19G (STC)	0.06	0.7	0.35	-	1.2	0.55	-	-	-	-	A5.5	E8018-B2 H4
SL 20G	0.06	0.8	0.6	-	2.3	1.0	-	-	-	-	A5.5	E9018-B3 H4
SL 20G (STC)	0.10	0.6	0.35	-	2.3	1.0	-	-	-	-	A5.5	E9018-B3 H4
SL 22G	0.06	0.8	0.6	-	0.5	0.5	-	0.3	-	-	A5.5	E8018-B1 H4
SL 502	0.07	0.8	0.6	-	5.3	0.6	-	-	-	-	A5.5	E8018-B6 H4
SL 9Cr (P91)	0.09	0.6	0.2	0.6	9.0	1.0	-	0.2	0.04	0.04	A5.5	E9016-B9 H4

\* for deviations consult corresponding data sheet

## COVERED ELECTRODES FOR STAINLESS AND HEAT RESISTANT STEEL

Product name	Chemical composition (typical values) in %										Classifications	
	C	Mn	Si	Cr	Ni	Mo	Nb	Cu	N	W	AWS	EN
Arosta 304L	0.020	0.8	0.8	19.5	9.7	-	-	-	-	-	A5.4	E 308L-16
Limarosta 304L	0.025	0.75	0.95	19.0	9.7	-	-	-	-	-	A5.4	E 308L-16*
Vertarosta 304L	0.020	0.8	0.7	20.0	9.8	-	-	-	-	-	A5.4	E 308L-15
Jungo 304L	0.025	1.8	0.4	19.0	10.0	-	-	-	-	-	A5.4	E 308L-15
Limarosta 304L 130	0.020	0.6	0.9	19.0	10.0	-	-	-	-	-	A5.4	E 308L-16*
Arosta 347	0.030	0.8	0.8	19.5	9.8	-	0.35	-	-	-	A5.4	E 347-16
Jungo 347	0.020	1.6	0.5	20.0	10.0	-	0.4	-	-	-	A5.4	E 347-15
Arosta 316L	0.020	0.8	0.8	18.0	11.5	2.85	-	-	-	-	A5.4	E 316L-16
Arosta 316LP	0.020	0.8	0.7	18.1	11.5	2.85	-	-	-	-	A5.4	E 316L-16
Limarosta 316L	0.020	0.8	1.0	18.0	11.5	2.8	-	-	-	-	A5.4	E 316L-16*
Vertarosta 316L	0.020	0.7	0.85	18.0	11.5	2.8	-	-	-	-	A5.4	E 316L-15
Jungo 316L	0.025	1.6	0.4	18.5	11.0	2.7	-	-	-	-	A5.4	E 316L-15
Limarosta 316L 130	0.020	0.65	1.0	18.0	11.5	2.8	-	-	-	-	A5.4	E 316L-16*
Arosta 318	0.03	0.8	0.85	18.0	11.5	2.7	0.35	-	-	-	A5.4	E 318-16
Jungo 318	0.025	1.5	0.4	18.0	11.0	2.7	0.5	-	-	-	A5.4	E 318-15*
Arosta 4439	0.020	1.3	0.8	18.0	17.0	4.6	-	-	0.18	-	-	-
Jungo 4455	0.03	7.3	0.4	20.0	16.0	3.0	-	-	0.16	-	-	E 18 16 5 N L R 32
Jungo 4465	0.03	4.5	0.4	25.0	22.0	2.2	-	-	0.13	-	-	E 20 16 3 Mn L B 22
Jungo 4500	0.020	1.2	0.9	20.0	25.0	5.0	-	1.5	-	-	A5.4	E 25 22 2 N L B 22
Arosta 4462	0.020	0.8	1.0	22.5	9.5	3.2	-	-	-	-	A5.4	E 310Mo-15*
Jungo 4462	0.025	1.6	0.5	23.5	9.0	3.0	-	-	0.16	-	A5.4	E 385-16*
Arosta 4462-145	0.025	0.7	1.0	22.5	9.5	3.0	-	-	0.15	-	A5.4	E 2209-16*
Jungo SD 2509	0.025	1.7	0.6	25.0	9.0	3.4	-	-	0.16	-	A5.4	E 2209-15
Jungo Zeron 100X	0.030	0.8	0.3	25.0	9.5	3.6	-	-	0.2	-	A5.4	E 2209-16*
Arosta 309S	0.020	0.8	0.8	23.5	12.5	-	-	-	0.2	0.7	A5.4	E 2553-15*
Limarosta 309S	0.020	0.8	1.0	23.0	12.5	-	-	-	-	-	A5.4	E 309L-16
Arosta 309Nb	0.020	0.8	0.8	23.0	12.0	-	0.5	-	-	-	A5.4	E 309L-16*
Arosta 309Mo	0.020	0.8	0.8	23.0	12.5	2.7	-	-	-	-	A5.4	E 309Cb-16*
Nichroma	0.025	0.8	1.0	20.0	9.5	2.3	-	-	-	-	A5.4	E 309MoL-16
Nichroma 160	0.050	0.7	1.0	23.7	12.8	2.4	-	-	-	-	A5.4	E 309Mo-26*
Arosta 329	0.080	0.7	1.2	25.0	4.5	-	-	-	-	-	-	-
Limarosta 312	0.110	0.9	1.0	29.0	9.0	-	-	-	-	-	A5.4	E 312-16*
Arosta 307	0.090	5.0	0.6	18.5	8.5	-	-	-	-	-	A5.4	E 307-16*
Jungo 307	0.080	5.5	0.3	19.0	8.5	-	-	-	-	-	A5.4	E 307-15*
Arosta 304H	0.050	0.75	0.85	18.5	9.5	-	-	-	-	-	A5.4	E 308H-16
Arosta 309H	0.100	0.8	1.6	22.0	11.0	-	-	-	-	-	A5.4	E 309-16*
Intherma 310	0.120	2.5	0.5	26.0	20.5	-	-	-	-	-	A5.4	E 310-16
Intherma 310B	0.100	3.0	0.3	25.0	21.0	-	-	-	-	-	A5.4	E 310-15*

\* for deviations consult corresponding data sheet

## COVERED ELECTRODES FOR NICKEL BASE ALLOYS

Product name	Chemical composition (typical values) in %										Classifications	
	C	Mn	Si	Fe	Cr	Ni	Mo	Cu	Nb	Others	AWS	EN/ISO
NiCr 31/27	0.020	0.8	0.90	bal.	27.1	31	3.5	0.9	-	-	A5.4	E383-16* EN 1600 E 27 31 4 Cu L R 12
NiCr 60/20	0.030	0.5	0.35	2.0	22.0	62	9.0	-	3.4	-	A5.11	ENiCrMo-3 ISO 14172 E NI 6625 (NiCr22Mo9Nb)
NiCr 70/15	0.020	4.4	0.45	6.0	18.0	bal.	0.8	-	1.9	-	A5.11	ENiCrFe-2* ISO 14172 E NI 6182 (NiCr15Fe6Mn)*
NiCr 70/15 Mn	0.025	5.5	0.40	-	16.0	bal.	-	-	2.0	-	A5.11	ENiCrFe-3 ISO 14172 E NI 6182 (NiCr15Fe6Mn)
NiCr 70/19	0.030	4.7	0.60	4.0	19.0	67.7	1.5	-	1.9	-	A5.11	ENiCrFe-2* ISO 14172 E NI 6082 (NiCr20Mn3Nb)
NiCrMo 60/16	0.015	0.5	0.05	6.5	15.5	bal.	16.0	-	-	3.5% W	A5.11	ENiCrMo-4 ISO 14172 E NI 6276 (NiCr15Mo15Fe6W4)
NiCrMo 59/23	0.015	0.4	0.15	1.5	22.5	59	15.5	-	-	-	A5.11	ENiCrMo-13 ISO 14172 E NI 6059 (NiCr23Mo16)
NiCu 70/30	0.020	3.0	0.40	1.75	-	bal.	-	30	-	0.35% Ti	A5.11	ENiCu-7 ISO 14172 E NI 4060 (NiCu30Mn3Ti)
Nyloid 2 SRP	0.050	3.0	0.40	6.0	13.0	68	6.0	-	1.5	1.5% W	A5.11	ENiCrMo-6 ISO 14172 E NI 6620 (NiCr14Mo7Fe)

## COVERED ELECTRODES FOR COPPER ALLOYS

Product name	Chemical composition (typical values) in %							Classifications	
	Mn	Al	Fe	Cu	Ni	SI		AWS	
RepTec Cu8	12	6.5	2	bal.	2	0.3		A5.15	ECuMnAl

## COVERED ELECTRODES FOR ALUMINIUM ALLOYS

Product name	Chemical composition (typical values) in %						Classifications	
	Al	Si	Mn				AWS	ISO
RepTec AISi5	bal.	5	-				A5.3	E4043 ISO 18273 Al 4043 A*
RepTec AISi12	bal.	12	0.1				-	ISO 18273 Al 4047 A
Al 99.8	99.8						A5.3	E1100* ISO 18273 Al 1080 A
Al Mn	bal.		1.0				A5.3	E3003* ISO 18273 Al 3103
AlSi 5	bal.	5					A5.3	E4043 ISO 18273 Al 4043 A*
AlSi 12	bal.	12	0.1				-	ISO 18273 Al 4047 A

## COVERED ELECTRODES FOR CAST IRON

Product name	Chemical composition (typical values) in %						Classifications	
	C	Fe	Cu	Ni			AWS	ISO
RepTec Cast 1	0.7	2.0	-	97			A5.15	ENiCl ISO 1071 E C Ni-Cl 1
RepTec Cast 3	0.6	40	-	bal.			A5.15	ENiFe-Cl ISO 1071 E C NiFe-Cl 1
RepTec Cast 31	0.7	45	-	bal.			A5.15	ENiFe-Cl ISO 1071 E C NiFe-Cl 1

\* for deviations consult corresponding data sheet

## COVERED ELECTRODES FOR HARDFACING APPLICATIONS

Product name	Chemical composition (typical values) in %										Classifications	
	C	Mn	Si	Cr	Mo	W	V	Co	Nb	Ni	B	DIN
Wearshield BU-30	0.2	0.8	1.0	1.5	0.5	-	-	-	-	0.1	-	DIN 8555
Wearshield Manglet (e)	0.7	15.0	-	3.7	-	-	-	-	-	-	-	DIN 8555
Wearshield 15CrMn	0.35	14.0	0.6	15.0	-	-	-	-	-	-	-	E7-UM-250-KP
Wearshield MM 40	0.2	0.5	1.3	3.4	0.5	-	-	-	-	-	-	DIN 8555
Wearshield MM	0.55	0.5	1.5	4.5	0.5	0.5	-	-	-	-	-	E1-UM-400-G*
Wearshield T & D	0.65	0.4	0.7	4.0	6.0	1.8	1.1	-	-	-	-	E2-UM-55-G*
Wearshield M(e)	0.5	0.4	1.8	9.0	-	-	-	-	-	-	-	E4-UM-60-SZ
Wearshield ABR	2.1	1.1	0.75	6.5	0.4	-	-	-	-	-	-	DIN 8555
Wearshield 44	2.0	0.16	0.9	24.2	2.5	-	-	-	-	-	-	E6-UM-60-GPS
Wearshield ME (e)	3.0	-	1.0	33.0	-	-	-	-	-	-	-	DIN 8555
Wearshield 50 MC	5.0	2.0	2.1	21.0	-	3.1	0.7	-	6.4	0.8	-	E10-UM-50-GPZ
Wearshield 60 (e)	5.0	-	4.0	35.0	-	-	-	-	-	-	-	E10-UM-45-GPZ
Wearshield 70	4.2	-	2.7	18.0	8.5	7.0	-	-	9.0	-	-	E10-UM-60-GRZ
Wearshield 420	0.5	0.3	0.4	12.4	0.4	-	-	-	-	-	-	E10-UM-65-GRZ
Wearshield C 1	2.0	-	-	28.0	-	12.0	-	bal.	-	1.0	-	E6-UM-55-RZ
Wearshield C 6	1.0	-	-	27.0	-	4.0	-	bal.	-	1.0	-	E20-UM-50-CRZ
Wearshield C 21	0.22	-	-	26.0	5.0	-	-	bal.	-	3.0	-	E20-UM-45-CRSTZ
Wearshield WC	x	-	-	-	-	x	-	-	-	-	-	E20-UM-45-CRZ
												E21-GFUM-60-G

## COVERED ELECTRODES FOR REPAIR WELDING

Product name	Chemical composition (typical values) in %										Classifications	
	C	Mn	Si	Ni	Cr	Fe	Al	Mo	W	Ti	Cu	Nb
RepTec 5	0.02	3.0	0.4	bal.	-	1.75	-	-	-	0.35	30.0	-
RepTec 7	0.02	4.4	0.45	bal.	18.0	6	-	-	-	-	-	1.9
RepTec 29	0.11	0.95	1.0	9.0	29.0	-	-	-	-	-	-	-
RepTec 34	0.02	0.9	0.9	bal.	16.0	6.5	-	17	4.0	-	-	-
RepTec 46	0.12	2.5	0.5	20.5	26.0	-	-	-	-	-	-	-
RepTec 126	0.06	5.0	1.0	8.0	18.0	-	-	-	-	-	-	-
RepTec 210	0.02	0.8	0.8	11.5	18.0	-	-	2.85	-	-	-	-
RepTec Cu 8	-	12.0	0.3	2.0	-	2.0	6.5	-	-	-	bal.	-
RepTec Cast 1	0.7	-	-	97	-	2.0	-	-	-	-	-	-
RepTec Cast 3	0.6	-	-	bal.	-	40.0	-	-	-	-	-	-
RepTec Cast 31	0.7	-	-	bal.	-	45.0	-	-	-	-	-	-
RepTec AISI 5	-	-	5.0	-	-	-	bal.	-	-	-	-	-
RepTec AISI 12	-	0.1	12.0	-	-	-	bal.	-	-	-	-	-
RepTec 53 CT	cutting electrode											
RepTec 53 GR	gouging electrode											

\* for deviations consult corresponding data sheet



FILLER MATERIAL FOR GTA AND GMA WELDING  
MILD STEEL

Product name	Chemical composition (typical values) in %			Classifications					
	C	Mn	Si	AWS	EN GTAW	EN GMAW			
LNT/LNM 25	0.08	1.1	0.6	A5.18/A5.18M	ER70S-3	EN 1668	W 42 5 W2Si	EN 440	G 42 2 M G2Si
LNT/LNM 26	0.1	1.5	0.9	A5.18/A5.18M	ER70S-6	EN 1668	W 42 5 W3Si1	EN 440	G 46 4 M G3Si1
ULTRAMAG	0.07	1.45	0.85	A5.18/A5.18M	ER70S-6	EN 440	G 42 3 M G3Si	EN 440	G 42 3 M G3Si
Supra MIG	0.08	1.55	0.85	A5.18/A5.18M	ER70S-6	EN 440	G 42 4 M G3Si1/G 38 3 C G3Si1	EN 440	G 42 4 M G3Si1/G 38 3 C G3Si1
Supra MIG Ultra	0.08	1.7	0.85	A5.18/A5.18M	ER70S-6	EN 440	G 46 4 M G4Si1/G 42 3 C G4Si1	EN 440	G 46 4 M G4Si1/G 42 3 C G4Si1
LNM 27	0.08	1.7	0.85	A5.18/A5.18M	ER70S-6	EN 440	G 42 3 M G4Si1	EN 440	G 42 3 M G4Si1

LOW ALLOYED STEEL

Product name	Chemical composition (typical values) in %							Classifications		
	C	Mn	Si	Cr	Mo	Ni	others	AWS	EN GTAW	EN GMAW
LNT/LNM 28	0.1	1.4	0.75	-	-	0.8	Cu=0.3	A5.28	ER80S-G	EN 12534
LNM MnNi/a	0.08	1.7	0.44	0.23	0.3	1.35	V=0.08 Cu=0.25	A5.28	ER100S-G	
LNT/LNM Ni 1	0.09	1.2	0.6	-	-	0.9		A5.28	ER80S-Ni1	
LNT/LNM Ni 2.5	0.1	1.2	0.5	-	-	2.5		A5.28	ER80S-Ni2	
LNT/LNM 12	0.12	1.2	0.6	-	0.5	-		A5.28	ER70S-A1	
LNT/LNM 19	0.1	1.0	0.5	1.2	0.5	-		A5.28	ER80S-B2*	EN 12070
LNT/LNM 20	0.09	1.0	0.6	2.5	0.9	-		A5.28	ER90S-B3*	EN 12070
LNT 502	0.08	0.5	0.5	5.8	0.6	-		A5.28	ER80S-B6	EN 12070
LNT9Cr (P91)	0.07	0.7	0.4	8.7	0.9	0.7	N=0.05 V=0.2 Nb=0.04	A5.28	ER90S-B9*	EN 12070
									W 42 6 W3Ni1 W 46 6 W2Ni2 W MoSi W CrMo1Si W CrMo2Si W CrMo5Si W CrMo91	EN 440 EN 440 EN 440 EN 12070 EN 12070 EN 12070 EN 12070

\* nearest classification

## FILLER MATERIAL FOR GTA AND GMA WELDING HIGH ALLOYED STEEL

Product name	Chemical composition (typical values) in %										Classifications	
	C	Mn	Si	Cr	Ni	Mo	Nb	N	Others	AWS	EN	
LNT/LNM 304LSi	0.01	1.7	0.8	20.0	10.0	0.2	-	-	-	A5.9	ER308LSi	W/G 19 9 LSi
LNT/LNM 304L	0.01	1.6	0.5	20.0	10.0	0.2	-	-	-	A5.9	ER308L	W/G 19 9 L
LNT/LNM 347Si	0.04	1.3	0.9	19.2	9.9	0.3	0.6	-	-	A5.9	ER347Si	W/G 19 9 Nb Si
LNT 316L	0.01	1.5	0.5	18.5	12.0	2.7	-	-	-	A5.9	ER316L	W 19 12 3 L
LNT/LNM 316LSi	0.01	1.6	0.8	18.5	12.2	2.5	-	-	-	A5.9	ER316LSi	W/G 19 12 3 Si
LNT/LNM 318Si	0.04	1.4	0.85	18.9	11.7	2.7	0.5	-	-	A5.9	ER318*	W/G 19 12 3 Nb Si
LNT/LNM 4439Mn	0.02	7.0	0.7	19.1	16.9	4.0	-	0.15	-	-	-	W/G 18 16 5 N L*
LNT/LNM 4455	0.015	7.0	0.35	20.0	16.0	2.8	-	0.15	-	-	-	W/G 20 16 3 Mn L
LNT/LNM 4465	0.018	5.0	0.4	25.0	23.0	2.0	-	0.15	-	-	-	W/G 25 22 2 N L
LNT/LNM 4500	0.009	1.7	0.3	20.0	25.0	4.4	-	-	Cu=1.5	A5.9	ER385	W/G 20 25 5 Cu L
LNT/LNM 4462	0.018	1.5	0.5	22.7	8.5	3.0	-	0.15	-	A5.9	ER2209	W/G 22 9 3 N L
LNT/LNM Zeron 100X	0.015	0.7	0.4	25.0	9.8	3.7	-	0.22	Cu=0.6 W=0.7	-	-	W/G 25 9 4 N L
LNT/LNM 309LSi	0.01	1.8	0.8	23.3	13.8	0.14	-	-	-	A5.9	ER309LSi	W/G 23 12 LSi
LNT 309LHF	0.01	1.65	0.35	24.0	13.0	0.05	-	-	-	A5.9	ER309L	W 23 12 L
LNM 307	0.08	7.1	0.8	19.2	9.0	-	-	-	-	A5.9	ER307*	G 18 8 Mn
LNT/LNM 304H	0.05	1.8	0.5	20.0	10.0	0.2	-	-	-	A5.9	ER308H	W/G 19 9 H
LNM 309H	0.05	1.8	0.5	24.0	13.5	0.2	-	-	-	A5.9	ER309	G 23 12 L*
LNT/LNM 310	0.1	1.8	0.45	26.0	21.0	0.2	-	-	-	A5.9	ER310	W/G 25 20

\* nearest classification

## FILLER MATERIAL FOR GTA AND GMA WELDING

### NICKEL ALLOYS

Product name	Chemical composition (typical values) in %											Classifications	
	C	Mn	Si	Ni	Fe	Cr	Mo	Cu	Nb	Ti	W	AWS	ISO
LNT/LNM NiCro 60/20	0.02	0.06	0.07	64	1.7	21.9	9.0	-	3.5	-	-	A5.14	ERNiCrMo-3 18274 S Ni 6625 (NiCr22Mo9Nb)
LNT/LNM NiCro 70/19	0.03	3.1	0.08	72.5	0.8	20.5	-	0.01	2.6	-	-	A5.14	ERNiCr-3 18274 S Ni 6082 (NiCr20Mn3Nb)
LNT NiCroMo 59/23	0.015	0.5	0.06	59	1.5	23	16.0	-	-	-	-	A5.14	ERNiCroMo-13 18274 S Ni 6059 (NiCr23Mo16)
LNT/LNM NiCroMo 60/16 (NiCr15Mo16Fe6W4)	0.006	0.5	0.04	bal.	5.8	16.0	15.9	-	-	-	3.6	A5.14	ERNiCrMo-4 18274 S Ni 6276
LNT/LNM NiCu 70/30	0.1	3.3	0.6	64	1.5	-	-	29.0	-	2.4	-	A5.14	ERNiCu-7 18274 S Ni 4060 (NiCu30Mn3Ti)
LNT/LNM NiTi	0.02	0.4	0.2	bal.	0.06	-	-	-	-	3.1	-	A5.14	ERNi1 18274 S Ni 2061 (NiTi3)
LNM NiFe	0.05	0.83	0.14	54.8	bal.	-	-	0.4	-	-	-	A5.14	ERNiFe-CI 1071 S Ni Fe-CI

### COPPER ALLOYS

Product name	Chemical composition (typical values) in %											Classifications	
	Cu	Mn	Si	Ni	Al	Fe	Ti	Sn				AWS	DIN
LNM CuAl 8	bal.	0.3	-	-	8	-	-	-	-	-	-	A5.7	ERCuAl-A1 1733 SG-CuAl8
LNT/LNM CuNi 30	bal.	0.8	-	31	-	-	-	-	-	-	-	A5.7	ERCuNi 1733 SG-CuNi30Fe
LNM CuSn	bal.	0.2	0.3	0.1	-	-	-	0.8	-	-	-	A5.7	ERCu 1733 SG-CuSn
LNT CuSn 6	bal.	-	-	-	-	-	-	6.0	-	P=0.2	-	A5.7	ERCuSn-A* 1733 SG-CuSn6
LNM CuSn 12	bal.	-	-	-	-	-	-	12.0	-	P=0.2	-	1733	SG CuSn12
LNT CuSi 3	bal.	1.0	3.0	-	-	-	-	0.1	-	Zn=0.1	-	A5.7	ERCuSi-A 1733 SG-CuSi3

\* nearest classification

## FILLER MATERIAL FOR GTA AND GMA WELDING ALUMINIUM ALLOYS

Product name	Chemical composition (typical values) in %										AWS	Classifications ISO
SuperGlaze 4043	bal.	-	4.7	0.01	0.01	-	0.01	-	0.3		A5.10	R4043
SuperGlaze 5183	bal.	5	0.09	0.02	0.03	-	0.65	0.06	0.14		A5.10	R5183
SuperGlaze 5356	bal.	4.9	0.08	0.06	0.03	-	0.11	0.07	0.2		A5.10	R5356
LNT/LNM Al 99.5	bal.	-	0.05	0.04	0.02	0.04	<0.1	-	0.12		A5.10	R1100*
LNT/LNM AlMg 3	bal.	3.4	0.06	0.09	0.1	-	0.01	0.19	0.13			ISO 18273 Al 5754
LNT/LNM AlMg 5	bal.	4.9	0.08	0.06	0.03	-	0.11	0.07	0.2		A5.10	R5356
LNT/LNM AlMg 4.5Mn	bal.	5	0.09	0.02	0.03	-	0.65	0.06	0.14		A5.10	R5183
LNM AlMg 4.5MnZr	bal.	4.5	0.2	0.15	0.15	-	0.8	0.15	0.2		A5.10	ISO 18273 Al 5087
LNT/LNM AISi 5	bal.	-	4.7	0.01	0.01	-	0.01	-	0.3		A5.10	R4043
LNT/LNM AISi 12	bal.	-	11.4	0.01	0.01	-	0.01	-	0.4		A5.10	R4047

## OTHERS

Product name	Chemical composition (typical values) in %										AWS	Classifications DIN
LNM 420 FM	0.5	0.4	3	9	-	-	-	-	-			DIN 8555
LNM 4M	0.7	1.9	0.45	1	-	-	-	-	-			DIN 8555
LNG I	0.07	0.4	0.07	-	-	-	-	-	-	A5.2	R45*	MSG6-GZ-60 PS
LNG II	0.06	1.1	0.15	-	-	-	-	-	-	A5.2	R60*	MSG2-GZ-350
LNG III	0.06	1.1	0.15	-	-	-	-	-	-	A5.2	R60*	EN 12536 O I
LNG IV	0.09	1.0	0.19	-	-	-	-	-	-	A5.2	R65*	EN 12536 O II
												EN 12536 O III
												EN 12536 O IV

\* nearest classification

# Gas shielded flux cored wires for mild and low alloyed steel

## GAS SHIELDED FLUX CORED WIRES FOR MILD AND LOW ALLOYED STEEL

Product name	Shielding gas	Chemical composition (typical values) in %										Classifications	
		C	Mn	Si	P	S	Ni	Mo	Cu	AWS		EN	
Outersheild 70	C1	0.06	1.3	0.5	0.015	0.010	-	-	-	A5.20	E70T-1 H8	EN 758	T 46 0 R C 3 H10
	M21	0.06	1.7	0.35	0.015	0.010	-	-	-	A5.20	E70T-1M H8	EN 758	T 46 0 R M 3 H10
Outersheild 70-H	C1	0.06	1.45	0.7	0.015	0.010	-	-	-	A5.20	E70T-1 H4	EN 758	T 46 0 R C 3 H5
	M21	0.06	1.7	0.35	0.015	0.010	-	-	-	A5.20	E70T-1M H4	EN 758	T 46 0 R M 3 H5
Outersheild 70E-H	C1	0.04	1.4	0.6	0.013	0.010	-	-	-	A5.20	E70T-1J H4	EN 758	T 46 3 R C 1 H5
	M21	0.04	1.4	0.6	0.013	0.010	-	-	-	A5.20	E70T-1MJ H4	EN 758	T 46 3 R M 1 H5
Outersheild 71E	M21	0.05	1.25	0.7	0.015	0.015	-	-	-	A5.20	E71T-1MJ H8	EN 758	T 46 3 P M 1 H10
Outersheild 71E-H	M21	0.04	1.4	0.6	0.013	0.010	-	-	-	A5.20	E71T-1MJ H4	EN 758	T 46 3 P M 1 H5
Outersheild 71M-H	C1	0.05	1.3	0.4	0.015	0.010	-	-	-	A5.20	E71T-1J H4	EN 758	T 46 2 P C 1 H5
Outersheild T55-H	C1	0.05	1.5	0.55	0.012	0.010	-	-	-	A5.20	E71T-5J H4	EN 758	T 42 4 B C 2 H5
	M21	0.06	1.5	0.6	0.012	0.010	-	-	-	A5.20	E71T-5MJ H4	EN 758	T 42 4 B M 2 H5
Outersheild MC710-H	M21	0.05	1.35	0.6	0.015	0.023	-	-	-	A5.18/A5.18M	E70C-6M H4	EN 758	T 42 3 M M 2 H5
Outersheild MC715-H	M21	0.04	1.5	0.4	0.015	0.020	-	-	-	A5.18/A5.18M	E70C-6M H4	EN 758	T 46 4 M M 2 H5
Outersheild MC460VD-H	M21	0.05	1.25	0.6	0.015	0.015	-	-	-	A5.18/A5.18M	E70C-6M H4	EN 758	T 46 2 M M 1 H5
Outersheild 81Ni1-H	M21	0.05	1.4	0.2	0.013	0.010	0.95	-	-	A5.29	E81T1-Ni1MJ H4	EN 758	T 50 5 1Ni P M 2 H5
Outersheild 81Ni1-HSR	M21	0.06	1.4	0.2	0.013	0.010	0.95	-	-	A5.29	E81T1-Ni1MJ H4	EN 758	T 50 5 1Ni P M 2 H5
Outersheild 81K2-H	M21	0.04	1.4	0.2	0.012	0.010	1.4	-	-	A5.29	E81T1-K2MJ H4	EN 758	T 50 6 1.5Ni P M 2 H5
Outersheild 500CT-H	M21	0.04	1.3	0.2	0.01	0.01	0.84	-	0.39	A5.29	E81T1-G H4	EN 758	T 50 5 Z P M 2 H5
Outersheild 550C-H	M21	0.04	1.4	0.2	0.012	0.010	2.0	0.3	-	A5.29	E101T1-K2MJ H4	EN 12535	T 55 4 Z P M 1 H5
Outersheild 690-H	M21	0.06	1.5	0.2	0.015	0.010	2.0	0.5	-	A5.29	E111T1-K3MJ H4	EN 12535	T 69 4 Z P M 2 H5
Outersheild 690-HSR	M21	0.06	1.5	0.2	0.015	0.010	2.0	0.5	-	A5.29	E111T1-K3MJ H4	EN 12535	T 69 4 Z P M 2 H5 T

Product name	Chemical composition (typical values) in %										Classifications	
	C	P	Mn	S	Si	Al	Ni	Cr	AWS			
Innershield NR-152	0.30	0.013	0.99	0.007	0.24	1.63	-	-	A5.20			
Innershield NR-203NiC	0.06	0.004	0.83	0.003	0.05	0.73	0.57	0.08	A5.29			E71T-14
Innershield NR-203Ni1	0.08	0.008	1.1	0.003	0.27	0.85	0.9	0.04	A5.29			E61T8-K6
Innershield NR-211 MP	0.21	0.008	0.6	0.007	0.18	1.5			A5.20			E71T8-Ni
Innershield NR-232	0.18	0.006	0.65	0.004	0.27	0.55			A5.20			E71T-11
Innershield NR-233	0.16	0.010	0.65	0.003	0.21	0.6			A5.20			E71T-8
Innershield NR-204-H	0.15	0.008	0.75	0.013	0.20	0.65			A5.20			E71T-GS
Innershield NR-207	0.07	0.005	0.9	0.003	0.20	1.00	0.85		A5.29			E71T8-K6
Innershield NR-207-H	0.07	0.005	0.9	0.003	0.20	1.00	0.85		A5.29			E71T8-K6
Innershield NR-208-H	0.05	0.007	1.65	<0.003	0.25	0.85	0.8		A5.29			E91T8-G
Innershield NR-305	0.09	0.007	0.9	0.008	0.20	0.8			A5.20			E70T-6
Innershield NR-311	0.27	0.007	0.4	0.005	0.08	1.5			A5.20			E70T-7
Innershield NR-400	0.06	0.004	0.74	0.002	0.17	0.74	0.75		A5.29			E71T8-K6
Innershield NR-450-H	0.07	0.004	0.26	0.002	0.06	0.88	2.44	0.13	A5.29			E71T8-Ni2
Innershield NR-550-H	0.05	0.010	1.14	0.003	0.07	0.7	2.35		A5.29			E81T8-Ni2
Innershield NS-3M	0.23	0.006	0.45	0.006	0.26	1.4			A5.20			E70T-4
Innershield NR-431	-	-	-	-	-	-	-		A5.26/A5.26M			EG72T-1

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## SELF SHIELDING FLUX CORED WIRES FOR HARDFACING APPLICATIONS

Product name	Chemical composition (typical values) in %							Classifications	
	C	Mn	Si	Cr	Al	Mo	W	DIN	
Lincore 33	0.15	2.1	0.65	2.4	1.7	-	-	DIN 8555	MF1-GF-350-GPS
Lincore 40-0	0.2	1.5	0.7	3.5	1.8	0.4	-	DIN 8555	MF1-GF-400-GPS
Lincore 50	2.2	1.2	1.0	11	0.6	0.5	-	DIN 8555	MF6-GF-50-GP
Lincore 55	0.45	1.4	0.55	5.3	1.4	0.8	-	DIN 8555	MF2-GF-55-GP
Lincore 60-0	4.2	1.6	1.3	25.4	0.6	-	-	DIN 8555	MF10-GF-60-CG
Lincore T & D	0.65	1.5	0.8	7.0	1.8	1.4	1.6	DIN 8555	MF4-GF-60-S
Lincore 15CrMn	0.4	15	0.25	16	-	-	-	DIN 8555	MF7-GF-250-KP
Lincore 420	0.5	1.7	0.9	11	-	-	-	DIN 8555	MF6-GF-55-CGR
Lincore M	0.6	13	0.4	4.9	-	-	-	DIN 8555	MF-GF-45-KP



## SOLID AND FLUX CORED WIRES FOR SA-WELDING

## MID STEEL

Product name	Chemical composition (typical values) in %							Classifications	
	C	Mn	Si	P	S	Cr	Ni	Mo	EN
L-60 (LNS 143)	0.09	0.5	0.06	-	-	-	-	-	EL12 EN 756 S1
LNS 135	0.1	1.0	0.12	0.015	0.015	-	-	-	EM12 EN 756 S2
L-61 (LNS 129)	0.1	1.0	0.25	-	-	-	-	-	EM12K EN 756 S2Si
L 50M (LNS 133U)	0.1	1.6	0.25	-	-	-	-	-	EH12K EN 756 S3Si

## LOW ALLOYED STEEL

Product name	Chemical composition (typical values) in %							Classifications	
	C	Mn	Si	P	S	Cr	Ni	Mo	EN
LNS 140A/L-70	0.10	0.9	0.10	-	-	-	-	0.5	EA1 EN 756 S2 Mo
LNS 140TB	0.06	1.1	0.20	-	-	-	-	0.5	EG EN 756 S0
LNS 141	0.13	1.5	0.15	-	-	-	-	0.5	EA4 EN 756 S3 Mo
LNS 140	0.10	1.9	0.10	<0.025	<0.025	-	-	0.5	EA3 EN 756 S4 Mo
LNS 150	0.13	0.8	0.15	-	-	1.2	-	0.5	EB2 EN 12070 Cr Mo1
LNS 151	0.10	0.6	0.15	-	-	2.6	-	1.0	EB3 EN 12070 Cr Mo2
LNS 160	0.10	1.1	0.15	-	-	-	1.0	-	EN1 EN 756 S2 Ni1
LNS 162	0.10	1.1	0.15	-	-	-	2.2	-	EN2 EN 756 S2 Ni2
LNS 175	0.05	1.0	0.15	<0.012	<0.012	-	3.5	-	EN3 EN 756 S2 Ni3
LNS 168	0.10	1.7	0.10	-	-	0.7	1.7	0.4	- EN 756 S3 Ni1.5Mo
LUP 80Y	0.11	1.6	0.13	-	-	-	0.9	0.5	EF3 * EN 756 S3 NiMo
LNS 164	0.10	1.6	0.10	-	-	-	0.9	0.5	EF1 * EN 756 S3 Ni1Mo
LNS 165	0.10	1.4	0.20	-	-	-	1	0.2	EG EN 756 S0
LNS 167	0.13	1.0	0.20	-	-	-	0.9	0.5	EF1 * EN 756 S2 Ni1Mo
MC 100	0.08	2.2	0.40	<0.015	<0.010	0.1	1.6	0.4	ECG EN 756 -
MC-120S-55	0.09	2.2	0.40	<0.015	<0.010	0.15	1.7	0.4	ECG EN 756 -
LNS T55/860 **	0.06	1.8	0.7	<0.020	<0.015	-	-	-	-
LNS T55/P230 **	0.07	1.8	0.8	<0.020	<0.015	-	-	-	-
LNS T55/8500 **	0.08	1.7	0.7	<0.015	<0.015	-	-	-	-
LNS T690/8500 **	0.06	1.75	0.75	<0.015	<0.010	-	2.0	0.4	-

\* nearest classifications

\*\* flux cored wires

SOLID WIRES FOR SA-WELDING  
STAINLESS STEEL

Product name	Chemical composition (typical values) in %										Classifications	
	C	Mn	Si	Cr	Ni	Mo	Nb	N	others	W.Nr.	AWS	EN
LNS 304L	0.015	1.8	0.4	20	10	0.1	-	-	-	1.4316	A5.9	ER308L EN 12072
LNS 304H	0.05	1.2	0.6	20.1	10.5	-	-	-	-	-	A5.9	ER308H EN 12072
LNS 309L	0.01	1.8	0.4	23.4	13.8	0.07	-	-	-	1.4332	A5.9	ER309L EN 12072
LNS 316L	0.015	1.75	0.4	18.5	12	2.75	-	-	-	1.4430	A5.9	ER316L EN 12072
LNS 318	0.04	1.8	0.4	19.5	11.3	2.6	0.5	-	-	1.4576	A5.9	ER318 EN 12072
LNS 329	0.09	1.8	1.2	25.5	5.6	-	-	-	-	-	-	S 25 4 EN 12072
LNS 347	0.03	1.6	0.4	19.5	9.7	0.1	0.6	-	-	1.4451	A5.9	ER347 EN 12072
LNS 4455	0.01	7.0	0.4	20	16	2.7	-	0.16	-	1.4455	-	S 20 16 3 Mn L EN 12072
LNS 4462	0.015	1.6	0.5	23	8.6	3.1	-	0.16	-	1.4462*	A5.9	S 22 9 3 N L EN 12072
LNS 4500	0.01	1.8	0.3	20	25.2	4.6	-	-	Cu=1.5	1.4539	A5.9	ER385 EN 12072
LNS Zeron 100X	0.02	0.7	0.3	25	9.3	3.7	-	0.23	Cu=0.6 W=0.6	-	A5.9	ER2553* EN 12072
LNS CrMn 18/7	0.07	7.0	0.6	19	8.9	-	-	-	-	1.4370	A5.9	ER307* EN 12072

## NICKEL ALLOYS

Product name	Chemical composition (typical values) in %										Classifications	
	C	Mn	Si	Cr	Ni	Mo	Nb	N	others	W.Nr.	ISO	
LNS NiCr 60/20	0.05	0.02	0.1	22	65	8.7	3.7	-	Fe=0.1	2.4831	ERNiCrMo-3 ISO 18274	S Ni 6625
LNS NiCrMo 60/16	0.006	0.5	0.04	16.0	58	16	-	-	W=3.6 Fe=5.5	2.4886	ERNiCrMo-4 ISO 18274	S Ni 6276





\* nearest classifications

**PIPELINER RANGE**

Product name	Chemical composition (typical values) in %										Classifications	
	C	Mn	Si	Ni	Cr	Mo	V	Al	N	AWS	EN	
PIPELINER 6P+	0.11	0.55	0.18							A5.1 E 6010	EN 499	E 35 3 C 25
PIPELINER 8P+	0.17	0.7	0.25	0.8		0.2				A5.5 E8010-P1	EN 499	E 46 4 1Ni C 25
PIPELINER 16P	0.06	1.3	0.5							A5.1 E7016 H4	EN 499	E 42 3 B 12 H5
PIPELINER 18P	0.05	1.5	0.5	0.95						A5.5 E8018-G H4	EN 499	E 50 6 Mn1Ni B 32 H5
PIPELINER LH-D80	0.07	1.35	0.55							A5.5 E8018-G	EN 757	E 46 5 B 35
PIPELINER LH-D90	0.07	1.55	0.50	0.70						A5.5 E9018-G	EN 757	E 55 5 Mn1Ni B 35
PIPELINER LH-D100	0.06	1.55	0.50	0.9		0.25				A5.5 E10018-G	EN 757	E 62 5 Mn1Ni B 35
PIPELINER 70S-G	0.07	1.25	0.55							A5.18 ER70S-G	EN 440	G 38 3 M G2Si / G 38 3 C G2Si
PIPELINER 80S-G	0.09	1.72	0.61			0.45				A5.18 ER80S-G	EN 440	G 50 3 M G4Si
PIPELINER G70M	0.05	1.60	0.45	0.36						A5.20 E71T-1MJ H8 / E71T-9MJ H8	EN 758	T 46 4 P M 2 H10
PIPELINER G80M	0.04	1.75	0.4	1.0	0.11	0.25				A5.29 E101T1-GM H8	EN 12535	T 62 3 Z P M 2 H10
PIPELINER NR-207+	0.04	1.22	0.25	0.82				1.1		A5.29 E71T8-K6		
PIPELINER NR-207XP	0.04	1.15	0.07	0.68				1.0		A5.29 E71T8-K6		

\* for deviations consult corresponding data sheet

## COVERED ELECTRODES

	GTA Rods	GMAW wires
CONSUMABLES FOR UN-ALLOYED AND FINE GRAINED STEEL		
Fleetweld 5P		
Fleetweld 5P+		
Resistens 100		
Supra		
Panta		
Pantafix		
Omnia		
Omnia 46		
Cumulo		
Universalis		
Ferrod 165A	LNT 25 - LNT 26	 LNM 25 LNM 26 LNM 27 SupraMIG SupraMIG Ultra ULTRAMAG
Ferrod 120T		
Ferrod 135T		
Ferrod 160T		
Ferrod 170		
Ferrod 185T		
Ferrod 200T		
Ferrod 160		
Gonia 180		
Geofors		
Baso 48 SP		
Baso 49		
Baso 51P		
Baso 100		
Baso 120		
Baso G		
Baso 26 V		
Conarc 48		
Conarc 49		
Conarc 49C		
Conarc 51		
Conarc L150		
Conarc V180		
Conarc V250		
Kardo		

<b>CONSUMABLES FOR LOW ALLOYED STEEL (High strength, low temperature and creep resistant steel)</b>		
Shield Arc Hyp	LNT 25 - LNT 26	LNM 25 - LNM 26
Shield Arc 70+	LNT Ni 1	LNM Ni 1
Shield Arc 85	LNT 12	LNM 12
Shield Arc 90	-	LA-100
Conarc 55CT	LNT 28	LNM 28
Conarc 60 G	LNT Ni 2,5	LNM Ni1 / LNM 28
Conarc 70 G	LNT Ni 2,5	-
Conarc 80	-	LA-100
Conarc 85	-	LNM MoNiVa
Kryo 1	LNT Ni 1	LNM Ni 1
Kryo 1P	LNT Ni 1	LNM Ni 1
Kryo 1-180	LNT Ni 1	LNM Ni 1
Kryo 2	LNT Ni 2,5	LNM Ni 2,5
Kryo 3	LNT Ni 2,5	LNM Ni 2,5
SL 12 G	LNT 12	LNM 12
SL 19 G	LNT 19	LNM 19
SL 19 (STC)	LNT 19	LNM 19
SL 20 G	LNT 20	LNM 20
SL 20 (STC)	LNT 20	LNM 20
SL 22 G	-	-
SL 502	LNT 502	-
SL 9 Cr (P91)	LNT 9 Cr (P91)	-

Gas Shielded	Self Shielding	SAW wires		
	NR-204-H + NR-207-(H)			
	NR-204-H + NR-207-(H)			
	NR-211 MP		L60 (LNS 143)	
				NR-232
				NR-233
	LNS 135		Wires to combine with fluxes:	
				NR-232
				NR-311
	NS-3M		Lincolnweld 761	
	NR-232		Lincolnweld 780 / 781	
				NR-311
				NS-3M
	NR-232		Lincolnweld 960 / 980	
				NR-311
				NS-3M
	NR-203 Ni 1		L61 (LNS 129)	
				NR-203 Ni C
				NR-204H (root only)
	NR-207-H		LNS 135	
	NR-208-H		LNS 133 U	
NR-400	LNS 140A			
NR-203 Ni C	LNS T-55			
		NR-203 Ni C		
		NR-204H (root only)		
NR-207-H	LNS T-55			
NR-208-H	Wires to combine with fluxes:			
NR-400	Lincolnweld 860 / 960 / 8500 / 888			
NR-203 Ni C	P 230 / P 230 / P 240			
		NR-203 Ni C		
		NR-204H (root only)		
NR-207-H	LNS 143 / P 240			
NR-208-H				
NR-400				
NR-203 Ni C				
NR-204-H + NR-208-H	LNS 135 / LNS 140A			
NR-204-H + NR-208-H	Lincolnweld 780 / 860 / P 230			
NR-204-H + NR-208-H	LNS 141 - LNS 167			
NR-204-H + NR-450-H	P 230 - P 240 - 8500 - 888			
NR-450-H	LNS 164 / P 240 - 8500 - 888			
-	LNS 168 / P 230 - P 240 - 8500 - 888			
-	LNS 168 / P 230 - P 240 - 8500 - 888			
NR-203 Ni1	LNS 160 / LNS 165			
NR-203 NiC	P 230 - P 240			
NR-400	Lincolnweld 860 - 8500 - 888			
NR-450-H	LNS 162 / P 230 - P 240 - 8500 - 888			
-	LNS 162 / P 240 - 8500 - 888			
-	LNS 140A / 860 / P 230			
-	LNS 150 / 860 - P 230 - P 240 - 8500 - 888			
-	LA-92 / 880M - MIL800-H			
-	LNS 151 / P 230 - P 240 - 8500 - 888			
-	LA-93 / 880M - MIL800-H			
-				
-	LNS 502 / P 230 - P 240 - 8500 - 888			
-	-			
-	-			

## COVERED ELECTRODES

	GTA Rods	GMAW wires
<b>CONSUMABLES FOR STAINLESS AND HEAT RESISTANT STEEL</b>		
Arosta 304 L	LNT 304 LSi	LNМ 304 LSi
Limarosta 304 L	LNT 304 LSi	LNМ 304 LSi
Vertarosta 304 L	LNT 304 LSi	LNМ 304 LSi
Jungo 304 L	LNT 304 L	LNМ 304 L
Limarosta 304L-130	LNT 304 LSi	LNМ 304 LSi
Arosta 347	LNT 347 Si	LNМ 347 Si
Jungo 347	LNT 347 Si	LNМ 347 Si
Arosta 316 L	LNT 316 LSi	LNМ 316 LSi
Limarosta 316 L	LNT 316 LSi	LNМ 316 LSi
Vertarosta 316 L	LNT 316 LSi	LNМ 316 LSi
Jungo 316 L	LNT 316 L	LNМ 316 LSi
Limarosta 316L-130	LNT 316 LSi	LNМ 316 LSi
Arosta 318	LNT 318 Si	LNМ 318 Si
Jungo 318	LNT 318 Si	LNМ 318 Si
Arosta 4439	LNT 4439 Mn	LNМ 4439 Mn
Jungo 4455	LNT 4455	LNМ 4455
Jungo 4465	LNT 4465	LNМ 4465
Jungo 4500	LNT 4500	LNМ 4500
Arosta 4462	LNT 4462	LNМ 4462
Jungo 4462	LNT 4462	LNМ 4462
Arosta 4462-145	LNT 4462	LNМ 4462
Jungo Zeron 100 X	LNT Zeron 100X	LNМ Zeron 100 X
Jungo SD 2509	LNT Zeron 100X	LNМ Zeron 100 X
Arosta 309 S	LNT 309 LSi (309 LHF)	LNМ 309 LSi
Limarosta 309 S	LNT 309 LSi	LNМ 309 LSi
Arosta 309 Nb	-	-
Arosta 309 Mo	-	-
Nichroma	LNT 309 LSi	LNМ 309 LSi
Nichroma 160	LNT 309 LSi	LNМ 309 LSi
Arosta 329	-	-
Limarosta 312	-	-
Arosta 307	-	LNМ 307
Jungo 307	-	LNМ 307
Arosta 304 H	LNT 304 H	LNМ 304 H
Arosta 309 H	-	LNМ 309 H
Intherma 310	LNT 310	LNМ 310
Intherma 310 B	LNT 310	LNМ 310
<b>CONSUMABLES FOR NICKEL BASE ALLOYS</b>		
Nicro 31/27	-	-
Nicro 60/20	LNT NiCro 60/20	LNМ NiCro 60/20
Nicro 70/15	LNT NiCro 70/19	LNМ NiCro 70/19
Nicro 70/15 Mn	LNT NiCro 70/19	LNМ NiCro 70/19
Nicro 70/19	LNT NiCro 70/19	LNМ NiCro 70/19
NiCroMo 59/23	LNT NiCroMo 59/23	LNМ NiCroMo 59/23
NiCroMo 60/15	LNT NiCroMo 60/16	LNМ NiCroMo 60/16
Nickel 96	LNT NiTi	LNМ NiTi
NiCu 70/30	LNT NiCu 70/30	LNМ NiCu 70/30
Nyloid 2 SRP	LNT NiCro 60/20	LNМ NiCro 60/20

## Flux cored wires

Gas Shielded	Self Shielding	SAW wires
Cor-A-Rosta (P)304L	-	LNS 304L / P 2000
Cor-A-Rosta 304L	-	LNS 304L / P 2000
Cor-A-Rosta P304L	-	LNS 304L / P 2000
Cor-A-Rosta (P)304L	-	LNS 304L / P 2000
Cor-A-Rosta 304L	-	LNS 304L / P 2000
-	-	LNS 347 / P 2000
-	-	LNS 347 / P 2000
Cor-A-Rosta (P)316L	-	LNS 316L / P2000
Cor-A-Rosta 316L	-	LNS 316L / P 2000
Cor-A-Rosta P316L	-	LNS 316L / P 2000
Cor-A-Rosta (P)316L	-	LNS 316L / P 2000
Cor-A-Rosta 316L	-	LNS 316L / P 2000
-	-	LNS 318 / P 2000
-	-	LNS 318 / P 2000
-	-	LNS 4439Mn / P 2000
-	-	LNS 4455 / P 2000
-	-	LNS 4465 / P 2000
-	-	LNS 4500 / P 2000
Cor-A-Rosta (P)4462	-	LNS 4462 / P 2000 (S)
Cor-A-Rosta (P)4462	-	LNS 4462 / P 2000 (S)
Cor-A-Rosta 4462	-	LNS 4462 / P 2000 (S)
-	-	LNS Zeron 100X P 2000 (S)
-	-	LNS Zeron 100X P 2000 (S)
Cor-A-Rosta (P)309L	-	LNS 309L / P 2000 (S)
Cor-A-Rosta 309L	-	LNS 309L / P 2000 (S)
-	-	-
Cor-A-Rosta (P)309MoL	-	LNS 4462 / P 2000 (S)
Cor-A-Rosta (P)309(Mo)L	-	LNS 309L / P 2000 (S)
Cor-A-Rosta 309 (Mo)L	-	LNS 309L / P 2000 (S)
-	-	LNS 329 / P 2000
-	-	-
-	-	LNS CrMn 18/7 LNS 307 / P 2000 (S)
-	-	LNS CrMn 18/7 LNS 307 / P 2000 (S)
-	-	LNS 304 H / MIL 800H
-	-	-
-	-	LNS 310 / P 2000
-	-	LNS 310 / P 2000
-	-	-
-	-	-
-	-	LNS NiCro 60/20 / P 2000
-	-	LNS NiCro 70/19 / P 2000
-	-	LNS NiCro 70/19 / P 2000
-	-	LNS NiCro 70/19 / P 2000
-	-	LNS NiCroMo 59/23 / P 2000 (P 7000)
-	-	LNS NiCroMo 60/16 / P 200
-	-	LNS NiTi / P 7000
-	-	-
-	-	LNS NiCro 60/20 / P 2000

## COVERED ELECTRODES

	GTA Rods	GMAW wires
<b>CONSUMABLES FOR COPPER ALLOYS</b>		
RepTec Cu 8	-	LNM CuAl 8
-	LNT CuNi 30	LNM CuNi 30
-	-	LNM CuSn
-	LNT CuSn 6	-
-	-	LNM CuSn 12
-	LNT CuSi 3	-
<b>CONSUMABLES FOR ALUMINIUM ALLOYS</b>		
AL99.5	LNT Al 99.5	LNM Al 99.5
-	LNT AlMg 3	LNM AlMg 3
-	} SuperGlaze 5183	} SuperGlaze 5183
-	} LNT AlMg 4,5 Mn	} LNM AlMg 4,5 Mn
andere LKD elektrode	-	LNM AlMg 4,5 MnZr
-	} SuperGlaze 5356	} SuperGlaze 5356
-	} LNT AlMg 5	} LNM AlMg 5
RepTec AlSi 5	} SuperGlaze 4043	} SuperGlaze 4043
AlSi??	} LNT AlSi 5	} LNM AlSi 5
RepTec AlSi 12	LNT AlSi 12	LNM AlSi 12
<b>CONSUMABLES FOR CAST IRON</b>		
RepTec Cast 1	LNT NiTi	LNM NiTi
RepTec Cast 3	-	LNM NiFe
RepTec Cast 31	-	LNM NiFe
<b>CONSUMABLES FOR HARDFACING APPLICATION</b>		
Wearshield BU 30	-	-
Wearshield Mangjet (e)	-	-
Wearshield 15 CrMn	-	-
Wearshield 22Mn5Cr	-	-
Wearshield MM 40	-	LNM 4M
Wearshield MM	-	-
Wearshield T&D	-	-
Wearshield MI (e)	-	-
Wearshield ABR	-	-
Wearshield 44	-	-
Wearshield ME (e)	-	-
Wearshield 60 (e)	-	-
Wearshield 50 MC	-	-
Wearshield 70	-	-
Wearshield 420	-	LNM 420FM
Wearshield C 1	-	-
Wearshield C 6	LNT Wearshield C6	-
Wearshield C 21	-	-
Wearshield WC	(LNT Wearshield WC)	-
<b>CONSUMABLES FOR REPAIR WELDING</b>		
RepTec 5	LNT NiCu 70/30	LNM NiCu 70/30
RepTec 7	LNT NiCro 70/19	LNM NiCro 70/19
RepTec 29	-	-
RepTec 34	-	-
RepTec 46	LNT 310	LNM 310
RepTec 126	-	LNM 307
RepTec 210	LNT 316 LSi	LNM 316 LSi
RepTec Cu 8	-	LNM CuAl 8
RepTec Cast 1	LNT NiTi	LNM NiTi
RepTec Cast 3	-	LNM NiFe
RepTec Cast 31	-	LNM NiFe
RepTec AlSi 5	} SuperGlaze 4043	} SuperGlaze 4043
	} LNT AlSi 5	} LNM AlSi 5
RepTec AlSi 12	LNT AlSi 12	LNM AlSi 12
RepTec 53 CT	-	-
RepTec 53 GR	-	-



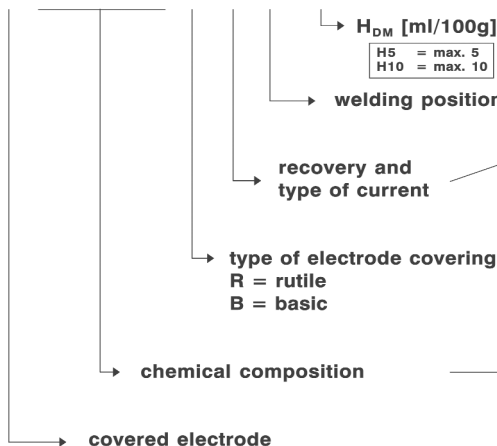
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## EN 1599 - 97

### Classification of covered electrodes for Manual Metal Arc Welding of creep-resisting steels

**E CrMo2 B 3 2 H5**

**SL 20G**



- 1 = all positions
- 2 = all positions except vertical down
- 3 = flat and horizontal-vertical butt / fillet weld
- 4 = flat butt and fillet weld
- 5 = vertical down and according to symbol 3

symbol	recovery	current type
1	≤105	AC + DC
2		DC
3	>105 ≤125	AC + DC
4		DC

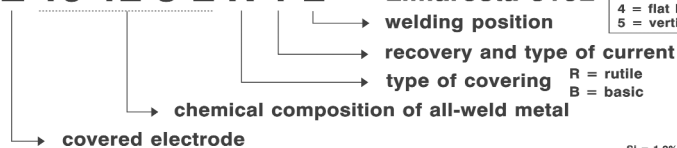
symbol	Cr	Mo	V	others
Mo	-	0,40-0,70	-	-
MoV	0,30-0,60	0,80-1,20	0,25-0,60	-
CrMo0,5	0,40-0,65	0,40-0,65	-	-
CrMo1	0,90-1,40	0,45-0,70	-	-
CrMo1L	0,90-1,40	0,45-0,70	-	C < 0,05
CrMoV1	0,90-1,30	0,90-1,30	0,10-0,35	-
CrMo2	2,0-2,6	0,90-1,30	-	-
CrMo2L	2,0-2,6	0,90-1,30	-	C < 0,05
CrMo5	4,0-6,0	0,40-0,70	-	-
CrMo9	8,0-10,0	0,90-1,20	0,15	Ni ≤ 1,0
CrMo91	8,0-10,5	0,80-1,20	0,15-0,30	Ni 0,40-1,0
CrMoWV12	10,0-12,0	0,80-1,20	0,20-0,40	Nb 0,03-0,10
Z				W 0,02-0,07
				Ni ≤ 0,8
				W 0,40-0,60
				any other agreed composition

## EN 1600 - 97

### Classification of covered electrodes for Manual Metal Arc Welding of stainless and heat-resisting steels

**E 19 12 3 L R 1 2**

**Limarosta 316L**



- 1 = all positions
- 2 = all positions, except vertical down
- 3 = flat and horizontal-vertical butt / fillet weld
- 4 = flat butt and fillet weld
- 5 = vertical down and according to symbol 3

symbol	recovery	current type
1	≤105	AC + DC
2		DC
3	>105 ≤125	AC + DC
4		DC
5	>125 ≤160	AC + DC
6		DC

Si = 1.2%, except of the mart./ferr. group and 16 8 2, max. 1.0%

Symbol	C	Mn	Cr	Ni	Mo	others	Symbol	C	Mn	Cr	Ni	Mo	others
Martensitic/Ferritic							20 25 5 CuN L	0.04	1-4	19-22	24-27	4 - 7	-
13	0.12	1.5	11-14	-	-	-	20 16 3 MnN L	0.04	5-8	18-21	15-18	2 <sup>5</sup> - 3 <sup>5</sup>	0.20N
13 4	0.06	1.5	11-14 <sup>5</sup>	3-5	0.4-1	-	25 22 2 N L	0.04	1-5	24-27	20-23	2 - 3	0.20N
17	0.12	1.5	16-18	-	-	-	27 31 4 Cu L	0.04	2.5	26-29	30-33	3 - 4 <sup>5</sup>	-
Austenitic							Special types						
19 9	0.08	2.0	18-21	9-11	-	-	18 8 Mn	0.20	4 <sup>5</sup> -7 <sup>5</sup>	17-20	7-10	-	-
19 9 L	0.04	2.0	18-21	9-11	-	-	18 9 MnMo	0.04-0.14	3-5	18-21 <sup>5</sup>	9-11	0.5-1 <sup>5</sup>	-
19 9 Nb	0.08	2.0	18-21	9-11	-	Nb	20 10 3	0.10	2.5	18-21	9-12	1 <sup>5</sup> -3 <sup>5</sup>	-
19 12 2	0.08	2.0	17-20	10-13	2-3	-	23 12 L	0.04	2.5	22-25	11-14	-	-
19 12 3 L	0.04	2.0	17-20	10-13	25-3	-	23 12 Nb	0.10	2.5	22-25	11-14	-	Nb
19 12 3 Nb	0.08	2.0	17-20	10-13	25-3	Nb	23 12 2 L	0.04	2.5	22-25	11-14	2 - 3	-
19 13 4 N L	0.04	1-5	17-20	12-15	3-4.5	0.20N	29 9	0.15	2.5	27-31	8-12	-	-
Austenitic/Ferritic, high corrosion resistance							Heat resisting						
22 9 3 N L	0.04	2.5	21-24	75-105	25-4	1)	16 8 2	0.08	2.5	14 <sup>5</sup> -16 <sup>5</sup>	7 <sup>5</sup> -9 <sup>5</sup>	1 <sup>5</sup> -2 <sup>5</sup>	-
25 7 2 N L	0.04	2.0	24-28	6-8	1-3	0.20N	19 9 H	0.04-0.08	2.0	18-21	9-11	-	-
25 9 3 CuN L	0.04	2.5	24-27	7 <sup>5</sup> -10 <sup>5</sup>	2 <sup>5</sup> -4 <sup>5</sup>	2)	25 4	0.15	2.5	24-27	4-6	-	-
25 9 4 N L	0.04	2.5	24-27	8-10 <sup>5</sup>	2 <sup>5</sup> -4 <sup>5</sup>	3)	22 12	0.15	2.5	20-23	10-13	-	-
Fully-austenitic, high corrosion resistance							25 20	0.06-0.20	1-5	23-27	18-22	-	-
18 15 3 L	0.04	1-4	16 <sup>5</sup> -19 <sup>5</sup>	14-17	2 <sup>5</sup> -3 <sup>5</sup>	-	25 20 H	0.35-0.45	2.5	23-27	18-22	-	-
18 16 5 N L	0.04	1-4	17-20	15 <sup>5</sup> -19	3 <sup>5</sup> -5	0.20N	18 36	0.25	2.5	14-18	33-37	-	-

<sup>1)</sup> 0.08-0.20N  
<sup>2)</sup> 0.10-0.25N  
<sup>3)</sup> 1.5-3.5Cu  
<sup>4)</sup> 0.20-0.30N  
<sup>5)</sup> 1.5Cu, 1.0W  
<sup>6)</sup> 1-2Cu, 0.25N  
<sup>7)</sup> 0.6-1.5Cu

## EN 499 - 95

### Classification of covered electrodes for manual metal arc welding of non alloy and fine grain steels

**E 50 6 Mn1Ni B 3 2 H5**

H5 = max. 5  
H10 = max. 10  
H15 = max. 15

1 = all positions  
2 = all positions except vertical down  
3 = flat and horizontal vertical butt / fillet weld  
4 = flat butt and fillet weld  
5 = vertical down and according to symbol 3

Z = no requirment.  
A = +20°C  
0 = 0°C  
2 = -20°C  
3 = -30°C  
4 = -40°C  
5 = -50°C  
6 = -60°C

→  $H_{DM}$  [ml/100g]

→ welding position

→ recovery and type of current

→ type of electrode covering

→ chemical composition

→ min. impact of avg. 47 Joule at

→ min. yield strength [N/mm<sup>2</sup>]

→ covered electrode

symbol	recovery	current type
1	≤105	AC + DC
2		DC
3	>105 ≤125	AC + DC
4		DC
5	>125 ≤160	AC + DC
6		DC
7	>160	AC + DC
8		DC

symbol	type of electrode covering
A	acid
C	cellulosic
R	rutile
RR	rutile thick coated
RC	rutile cellulosic
RB	rutile basic
B	basic

symbol	Mn	Ni	Mo
no	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	0,6-1,2	0,3-0,6

any other agreed composition

## EN 757 - 97

### Classification of covered electrodes for Manual Metal Arc Welding of high strength steels

**E 55 4 1NiMo B 3 2 H5 T**

**Conarc 70G**

stress relieved  
1h / 560-600°C

H5 = max. 5  
H10 = max. 10

Z = no requirment.  
A = +20°C  
0 = 0°C  
2 = -20°C  
3 = -30°C  
4 = -40°C  
5 = -50°C  
6 = -60°C  
7 = -70°C  
8 = -80°C

→  $H_{DM}$  [ml/100g]

→ welding position

→ recovery and type of current

→ type of electrode covering basic (B)

→ chemical composition

→ min. impact of avg. 47 Joule at

→ min. yield strength [N/mm<sup>2</sup>]

→ covered electrode

1 = all positions  
2 = all positions except vertical down  
3 = flat and horizontal vertical butt / fillet weld  
4 = flat butt and fillet weld  
5 = vertical down and according to symbol 3

symbol	recovery	current type
1	≤105	AC + DC
2		DC
3	>105 ≤125	AC + DC
4		DC
5	>125 ≤160	AC + DC
6		DC
7	>160	AC + DC
8		DC

symbol	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

any other agreed composition

## EN 440 - 95

Classification of solid wires and deposits for GMA-  
Welding of non alloy and fine grain steels

**G 46 3 M G3Si1 LNM 26**

Z = no requirment.  
A = +20°C  
0 = 0°C  
2 = -20°C  
3 = -30°C  
4 = -40°C  
5 = -50°C  
6 = -60°C

chemical composition  
wire

type of shielding gas

min. impact of avg. 47 Joule at

min. yield strength [N/mm<sup>2</sup>]

solid wire for GMAW-process

symbol	Si	Mn	Ni	Mo
G0	any other agreed composition			
G2Si	0,50-0,80	0,90-1,30	0,15	0,15
G3Si1	0,70-1,00	1,30-1,60	0,15	0,15
G4Si1	0,80-1,20	1,60-1,90	0,15	0,15
G3Si2	1,00-1,30	1,30-1,60	0,15	0,15
G2Ti	0,40-0,80	0,90-1,40	0,05-0,20	0,05-0,25
G3Ni1	0,50-0,90	1,00-1,60	0,80-1,50	0,15
G2Ni2	0,40-0,80	0,80-1,40	2,10-2,70	0,15
G2Mo	0,30-0,70	0,90-1,30	0,15	0,40-0,60
G4Mo	0,50-0,80	1,70-2,10	0,15	0,40-0,60
G2Al	0,30-0,50	0,90-1,30	0,15	0,35-0,75

As described in EN 439  
M = M2 mixed shielding gas (without helium)  
C = 100% CO<sub>2</sub>

symbol	yield	tensile	A <sub>5</sub>
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%

## EN 1668 - 97

Classification of rods, wires and deposits for Tungsten  
Inert Gas welding of non alloy and fine grain steels

**W 46 3 W2Si LNT 25**

chemical composition  
wire

min. impact of avg. 47 Joule at

min. yield strength [N/mm<sup>2</sup>]

GTAW-process, wire and weld metal

symbol	Si	Mn	Ni	Mo
W0	any other agreed composition			
W2Si	0,50-0,80	0,90-1,30		
W3Si1	0,70-1,00	1,30-1,60		
W4Si1	0,80-1,20	1,60-1,90		
W2Ti	0,40-0,80	0,90-1,40	0,05-0,20	0,05-0,25
W3Ni1	0,50-0,90	1,00-1,60	0,80-1,50	
W2Ni2	0,40-0,80	0,80-1,40	2,10-2,70	
W2Mo	0,30-0,70	0,90-1,30		0,40-0,60

Z = no requirment.  
A = +20°C  
0 = 0°C  
2 = -20°C  
3 = -30°C  
4 = -40°C  
5 = -50°C  
6 = -60°C

symbol	yield	tensile	A <sub>5</sub>
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%

## EN 12072 - 99

Classification of wire electrodes, wires and rods for arc welding of stainless and heat-resisting steels

**G 19 12 3 L Si LNM 316LSi**

G = GMAW  
W = GTAW  
P = PAW  
S = SAW

Si classification if  
Si = 0.65 - 1.2%

chemical composition of wire electrode

solid wire for:

Symbol	C	Si	Mn	Cr	Ni	Mo	Symbol	C	Si	Mn	Cr	Ni	Mo
Martensitic/Ferritic							20 16 3 Mn L	0.03	1.0	5-9	19-22	15-18	2 <sup>5</sup> -4 <sup>5</sup>
13	0.15	1.0	1.0	12-15	-	-	25 22 2 N L <sup>1)</sup>	0.03	1.0	3 <sup>5</sup> -6 <sup>5</sup>	24-27	21-24	1 <sup>5</sup> -3
13 L	0.05	1.0	1.0	12-15	-	-	27 31 4 Cu L <sup>4)</sup>	0.03	1.0	1-3	26-29	30-33	3-4 <sup>5</sup>
13 4	0.05	1.0	1.0	11-14	3-5	0.4-1	Special types						
17	0.12	1.0	1.0	16-19	-	-	18 8 Mn	0.20	1.2	5-8	17-20	7-10	-
Austenitic							20 10 3	0.12	1.0	1-2 <sup>5</sup>	18-21	8-12	1 <sup>5</sup> -3 <sup>5</sup>
19 9 L	0.03	0.65	1-2 <sup>5</sup>	19-21	9-11	-	23 12 L	0.03	0.65	1-2 <sup>5</sup>	22-25	11-14	-
19 9 Nb <sup>1)</sup>	0.08	0.65	1-2 <sup>5</sup>	19-21	9-11	-	23 12 Nb <sup>1)</sup>	0.08	1.0	1-2 <sup>5</sup>	22-25	11-14	-
19 12 3 L	0.03	0.65	1-2 <sup>5</sup>	18-20	11-14	2 <sup>5</sup> -3	23 12 2 L	0.03	1.0	1-2 <sup>5</sup>	21-25	11-15 <sup>5</sup>	2-3 <sup>5</sup>
19 12 3 Nb <sup>1)</sup>	0.08	0.65	1-2 <sup>5</sup>	18-20	11-14	2 <sup>5</sup> -3	29 9	0.15	1.0	1-2 <sup>5</sup>	28-32	8-12	-
Austenitic/Ferritic, high corrosion resistance							Heat resisting						
22 9 3 N L <sup>2)</sup>	0.03	1.0	2.5	21-24	7-10	2 <sup>5</sup> -4	16 8 2	0.10	1.0	1-2 <sup>5</sup>	14 <sup>5</sup> -16 <sup>5</sup>	7 <sup>5</sup> -9 <sup>5</sup>	1-2 <sup>5</sup>
25 7 2 L	0.03	1.0	2.5	24-27	8-8	1 <sup>5</sup> -2 <sup>5</sup>	19 9 H	.04-.08	1.0	1-2 <sup>5</sup>	18-21	9-11	-
25 9 3 Cu N L <sup>3)</sup>	0.03	1.0	2.5	24-27	8-11	2 <sup>5</sup> -4	19 12 3 H	.04-.08	1.0	1-2 <sup>5</sup>	18-20	11-14	2-3
25 9 4 N L <sup>4)</sup>	0.03	1.0	2.5	24-27	8-10 <sup>5</sup>	2 <sup>5</sup> -4 <sup>5</sup>	22 12 H	.04-.15	2.0	1-2 <sup>5</sup>	21-24	11-14	-
Fully-austenitic, high corrosion resistance							25 4	0.15	2.0	1-2 <sup>5</sup>	24-27	4-6	-
18 15 3 L	0.03	1.0	1-4	17-20	13-16	2 <sup>5</sup> -4	25 20	.08-.15	2.0	2 <sup>5</sup> -5	24-27	18-22	-
18 16 5 N L <sup>2)</sup>	0.03	1.0	1-4	17-20	16-19	3 <sup>5</sup> -5	25 20 Mn	.08-.15	2.0	2 <sup>5</sup> -5	24-27	18-22	-
19 13 4 L	0.03	1.0	1-5	17-20	12-15	3-4 <sup>5</sup>	25 20 H	.35-.45	2.0	1-2 <sup>5</sup>	24-27	18-22	-
20 25 5 Cu L <sup>5)</sup>	0.03	1.0	1-5	19-22	24-27	4-6	18 36 H	.18-.25	.40-2	1-2 <sup>5</sup>	15-19	33-37	-

<sup>1)</sup> Nb  
<sup>2)</sup> 0.10-0.20N  
<sup>3)</sup> 0.10-0.20N, 1.5-2.5Cu  
<sup>4)</sup> 0.20-0.30N, 1.5Cu, 1.0W  
<sup>5)</sup> 1-2Cu  
<sup>6)</sup> 0.7-1.5Cu

## EN 758 - 97

Classification of tubular electrodes for metal arc welding with or without a gas shield of non alloy and fine grain steels

**T 50 5 1Ni P M 2 H5**

H5 = max. 5  
H10 = max. 10  
H15 = max. 15

1 = all positions  
2 = all positions except vertical down  
3 = flat and horizontal-vertical butt / fillet weld  
4 = flat butt and fillet weld  
5 = vertical down and according to symbol 3

**Outershield 81Ni1-H**

H<sub>DM</sub> [ml/100g]

As described in EN 439  
M = M2 mixed shielding gas (without helium)  
C = 100% CO<sub>2</sub>  
N = without a shielding gas

Z = no requirement.  
A = +20°C  
0 = 0°C  
2 = -20°C  
3 = -30°C  
4 = -40°C  
5 = -50°C  
6 = -60°C

welding position

type of shielding gas

type of electrode core

chemical composition

min. impact of avg. 47 Joule at

min. yield strength  
[N/mm<sup>2</sup>]

flux cored wire

symbol	characteristics
With shielding gas (C en M2)	
R	rutile, slow freezing slag
P	rutile, fast freezing slag
B	basic
M	metal powder
Without shielding gas	
V	rutile or basic/fluoride
W	basic/fluoride, slow freezing slag
Y	basic/fluoride, fast freezing slag
S	other types

symbol	yield	tensile	A <sub>5</sub>
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%

symbol	Mn	Ni	Mo
no	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	-
1,5Ni	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 agreed composition		

## EN 760 - 96

### Classification of fluxes for Submerged Arc Welding

**S A FB 1 54 AC H5**

**Lincolnweld 8500**

→  $H_{DM}$  [ml/100g]

→ Type of current

AC (AC or DC)  
DC only

→ metallurgical  
behaviour

→ applications

→ type of flux

→ method of manufacture

→ submerged arc welding

F = fused  
A = agglomerated  
M = mixed

applications	metallurgical behaviour	
1 = structural steels, HSLA, etc.	burn-out ↑	1 > 0,7
2 = stainless and/or nickel and nickel-based alloys		2 > 0,5 - 0,7
3 = surfacing wear-resisting weld		3 > 0,3 - 0,5
		4 > 0,1 - 0,3
	neutral	5 0 - 0,1
	pick-up ↓	6 > 0,1 - 0,3
		7 > 0,3 - 0,5
		8 > 0,5 - 0,7
		9 > 0,7

MS	manganese-silicate	MnO + SiO <sub>2</sub>	≥ 50
		CaO	≤ 15
CS	calcium-silicate	CaO + MgO + SiO <sub>2</sub>	≥ 55
		CaO + MgO	≤ 15
ZS	zirconium-silicate	ZrO <sub>2</sub> + SiO <sub>2</sub> + MnO	≥ 45
		ZrO <sub>2</sub>	≤ 15
RS	rutile-silicate	TiO <sub>2</sub> + SiO <sub>2</sub>	≥ 50
		TiO <sub>2</sub>	≤ 20
AR	aluminate-rutile	Al <sub>2</sub> O <sub>3</sub> + TiO <sub>2</sub>	≥ 40
		Al <sub>2</sub> O <sub>3</sub> + SiO <sub>2</sub> + MgO	≥ 40
AB	aluminate-basic	Al <sub>2</sub> O <sub>3</sub>	≥ 20
		CaF <sub>2</sub>	≥ 22
		Al <sub>2</sub> O <sub>3</sub> + SiO <sub>2</sub> + ZrO <sub>2</sub>	≥ 40
AS	aluminate-silicate	CaF <sub>2</sub> + MgO	≥ 30
		ZrO <sub>2</sub>	≥ 5
AF	aluminate-fluoride basic	Al <sub>2</sub> O <sub>3</sub> + CaF <sub>2</sub>	≥ 70
		CaO + MgO + CaF <sub>2</sub> + MnO	≥ 50
FB	fluoride-basic	SiO <sub>2</sub>	≥ 20
		CaF <sub>2</sub>	≥ 15
Z	any other composition		

## EN 756 - 95

### Classification of wire and wire/flux combinations for Submerged Arc Welding of non alloy and fine grain steels

**S 42 5 AB S3Si**

Z = no requirement.  
A = +20°C  
0 = 0°C  
2 = -20°C  
3 = -30°C  
4 = -40°C  
5 = -50°C  
6 = -60°C  
7 = -70°C  
8 = -80°C

→ chemical composition  
wire

→ type of flux

→ min. impact of avg. 47 Joule at

→ min. yield strength  
[N/mm<sup>2</sup>]

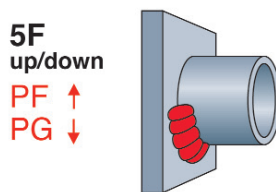
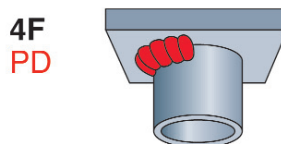
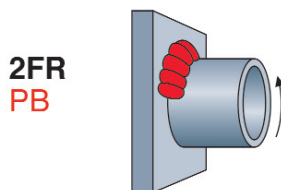
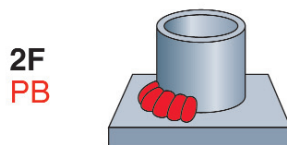
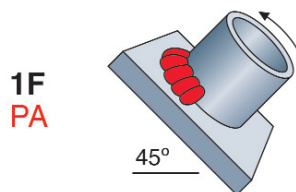
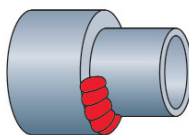
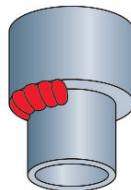
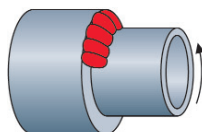
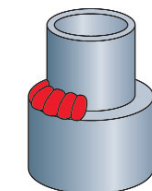
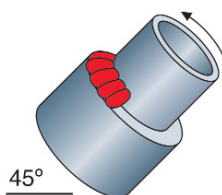
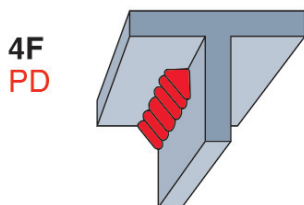
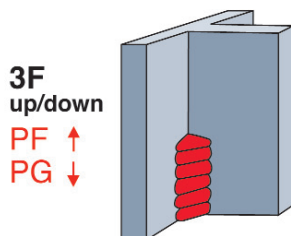
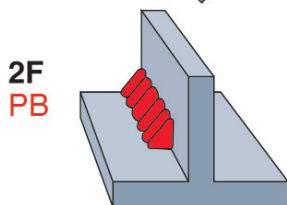
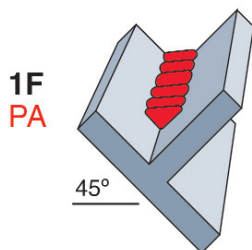
→ submerged arc welding

**LNS 133 U / P 230**

symbol	Si	Mn	Ni	Mo
S0	any other agreed composition			
S1		0,35-0,60		
S2	0,15	0,80-1,30		
S3		1,31-1,75		
S4		1,76-2,25		
S1Si	0,15-0,40	0,35-0,60		
S2Si	0,15-0,40	0,80-1,30		
S2Si2	0,40-0,60	0,80-1,30		
S3Si	0,15-0,40	1,31-1,85		
S4Si	0,15-0,40	1,86-2,25		
S1Mo		0,35-0,60		0,45-0,65
S2Mo	0,05-0,25	0,80-1,30		0,45-0,65
S3Mo		1,31-1,75		0,45-0,65
S4Mo		1,76-2,25		0,45-0,65
S2Ni1		0,80-1,30	0,80-1,20	
S2Ni1,5		0,80-1,30	1,21-1,80	
S2Ni2		0,80-1,30	1,81-2,40	
S2Ni3		0,80-1,30	2,81-3,70	
S2Ni1Mo	0,05-0,25	0,80-1,30	0,80-1,20	0,45-0,65
S3Ni1,5		1,31-1,70	1,21-1,80	
S3Ni1Mo		1,31-1,80	0,80-1,20	0,45-0,65
S3Ni1,5Mo		1,20-1,80	1,20-1,80	0,30-0,50

two ron technique				symbol	type of flux
symbol	Re	Rm			
3T	≥ 355	≥ 470		MS	manganese-silicate
4T	≥ 420	≥ 520		CS	calcium-silicate
5T	≥ 500	≥ 600		ZS	zirconium-silicate
				RS	rutile-silicate
				AR	aluminate-rutile
				AB	aluminate-basic
				AS	aluminate-silicate
				AF	aluminate-fluorid basic
				FB	fluorid-basic
				Z	any other type

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## Qualification test

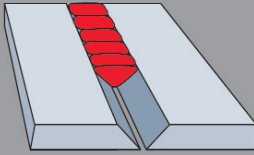
## Qualified for fillet welds

	Position	Plate	Pipe
Plate-fillet	1F	1F	1F
	2F	1F, 2F	1F, 2F, 2FR
	3F	1F, 2F, 3F	1F, 2F, 2FR
	4F	1F, 2F, 4F	1F, 2F, 2FR, 4F
	3F + 4F	All qualifications	All qualifications
Pipe-fillet	1F	1F	1F
	2F	1F, 2F	1F, 2F, 2FR
	2FR		1F, 2FR
	4F	1F, 2F, 4F	1F, 2F, 2FR, 4F
	5F	All qualifications	All qualifications

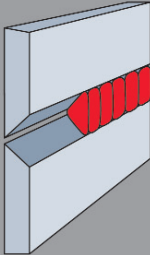


# Welding positions according ASME and ISO 6947

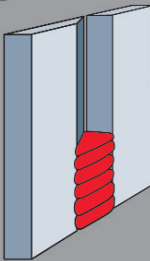
**1G**  
PA



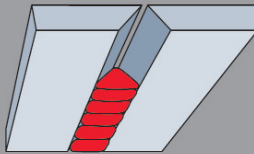
**2G**  
PC



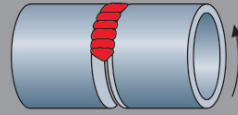
**3G**  
up/down  
PF ↑  
PG ↓



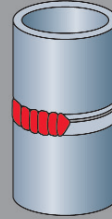
**4G**  
PE



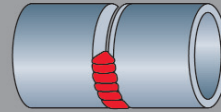
**1G**  
PA



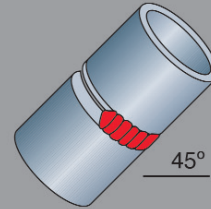
**2G**  
PC



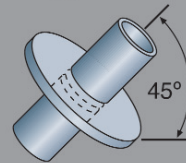
**5G**  
up/down  
PF ↑  
PG ↓



**6G**  
H-L045



**6GR**



## Qualification test

## Qualified for groove welds

## Quality for fillet welds

	Position	Plate	Pipe	Plate	Pipe
Plate-groove	1G	1G	1G	1F	1F
	2G	1G, 2G	1G, 2G	1F, 2F	1F, 2F, 2FR
	3G	1G, 3G		1F, 2F, 3F	1F, 2F, 2FR
	4G	1G, 4G		1F, 2F, 4F	1F, 2F, 2FR, 4F
Pipe-groove	1G	1G	1G	1F	1F
	2G	1G, 2G	1G, 2G	1F, 2F	1F, 2F
	5G	1G, 3G, 4G	1G, 2G	1F, 2F, 3F, 4F	All qualifications
	6G + 6GR	All qualifications	All qualifications	All qualifications	All qualifications
	2G + 5G	All qualifications	All qualifications	All qualifications	All qualifications

## Selection table for fillet welds

Actual throat "a" mm	electrode type	Ø mm	per electrode		per meter weld	
			welding length cm	arc time sec	number of electrodes	arc time sec
3	Resistens 100	4.0	46	80	2.2	176
	Ferrod 120T	4.0	56	89	1.8	160
	Ferrod 135T	4.0	65	92	1.5	138
	<b>Ferrod 135T</b>	<b>4.5</b>	<b>74</b>	<b>88</b>	<b>1.4</b>	<b>123</b>
	<b>Ferrod 165A</b>	<b>4.0</b>	<b>77</b>	<b>70</b>	<b>1.3</b>	<b>91</b>
	Geofors a3		90	135	1.1	149
3.5	Resistens 100	5.0	54	78	1.9	148
	Ferrod 120T	5.0	65	90	1.5	135
	<b>Ferrod 135T</b>	<b>5.0</b>	<b>73</b>	<b>86</b>	<b>1.4</b>	<b>120</b>
	<b>Ferrod 165A</b>	<b>4.0</b>	<b>57</b>	<b>70</b>	<b>1.8</b>	<b>126</b>
	Ferrod 160T	4.0	54	99	1.9	188
	Ferrod 185T	4.0	64	75	1.6	120
	Geofors a 3,5		90	135	1.1	149
4	Resistens 100	5.0	42	78	2.4	187
	Ferrod 120T	5.0	50	90	2.0	180
	Ferrod 135T	5.0	57	86	1.8	155
	<b>Ferrod 165A</b>	<b>5.0</b>	<b>67</b>	<b>75</b>	<b>1.5</b>	<b>113</b>
	<b>Ferrod 160T</b>	<b>5.0</b>	<b>67</b>	<b>96</b>	<b>1.5</b>	<b>144</b>
	Ferrod 185T	5.0	76	88	1.3	114
	Geofors a 4		90	130	1.1	143
4.5	Ferrod 165A	5.0	52	75	1.9	143
	<b>Ferrod 165A</b>	<b>6.0</b>	<b>75</b>	<b>83</b>	<b>1.3</b>	<b>108</b>
	Ferrod 160T	5.0	52	96	1.9	182
	Ferrod 185T	5.0	60	88	1.7	150
	Geofors a 4,5		90	150	1.1	165
5	<b>Ferrod 165A</b>	<b>6.0</b>	<b>61</b>	<b>83</b>	<b>1.6</b>	<b>133</b>
	<b>Ferrod 185T</b>	<b>6.3</b>	<b>66</b>	<b>91</b>	<b>1.5</b>	<b>137</b>
	Geofors a 5		88	155	1.1	171
5.5	<b>Ferrod 165A</b>	<b>6.0</b>	<b>50</b>	<b>83</b>	<b>2.0</b>	<b>166</b>
	<b>Ferrod 185T</b>	<b>6.3</b>	<b>55</b>	<b>91</b>	<b>1.8</b>	<b>164</b>
	Geofors a 5,5		85	162	1.2	194
6	<b>Ferrod 185T</b>	<b>6.3</b>	<b>46</b>	<b>91</b>	<b>2.2</b>	<b>200</b>
	<b>Ferrod 165A</b>	<b>6.0</b>	<b>42</b>	<b>83</b>	<b>2.4</b>	<b>199</b>
	Geofors a 5,5		67	162	1.5	243

In bold type = preference

Note: figures are based on practical experience

# Selection table *(Applications in low temperature steel)*

## WELDING CONSUMABLES FOR LOW TEMPERATURE SERVICES

Application	Type of gas	Boiling Point °C    K	Consumables					
			Applicable down to °C    K	SMAW	GMAW	GTAW	FCAW	SAW
Fine grained steel with increasing strength	CO2 (to 1.5 ato)	-28    245		Baso G  Conarc 49C/51/V180	LNM 26 Supra MIG	LNT 25  LNT 26	Outersheild MC710-H Outersheild T55-H Outersheild 81NiTi-H	L61(LNS 129) / P230(-20°C)  LNS 135 / P230 (-20°C) L50M/LNS 133U / P230
	Propane	-42    231	-40    233	Conarc 60G/70G/80/85			Outersheild 81K2-H	LNS 160 / P230/P240
			-51    222	Kryo1/Kryo1-180 Kryo2	LNM Ni1	LNT Ni1		LNS 162 / P230/P240
12 Ni 14	CO2 (solid)	-78    195	-60    213	Kryo3	LNM Ni2.5	LNT Ni2.5		
	Acetylene	-84    189	-80    193					LNS 4455 / P 2000
	Ethane Ethylene	-88    185 -104    169	-105    168	Nyloid 2 SRP	LNM NiCro 70/19	LNT NiCro 70/19		LNS NiCro60/20 / P 2000 LNS 4455 / P 2000
X12 Ni 5	Krypton Methane	-153    120 -161    112	-165    108	Nyloid 2 SRP	LNM NiCro 70/19	LNT NiCro 70/19		LNS NiCro 60/20 / P 2000 LNS 4455 / P 2000
				Nyloid 2 SRP	LNM NiCro 70/19	LNT NiCro 70/19		LNS NiCro 60/20 / P 2000 LNS 4455 / P 2000 LNS 304L / P 2000
	X8 Ni 9 Austenitic CrNi steel AISI 304 AISI 316 LN AISI 317 LN	-183    90 -186    87 -196    77	-196    77	Jungo 304L NiCro 70/15 NiCro 70/19 NiCro 60/20	LNM 4455 LNM 304LSi LNM NiCro 70/19 LNM NiCro 60/20	LNT 4455 LNT 304L LNT NiCro 70/19 LNT NiCro 60/20		LNS NiCro 60/20 / P 2000 LNM 4439Mn
X2 CrNi 19-11 X2 CrNiMo 17-12-2	Hydrogen Helium	-253    -20 -269    4	-196    77	Arosta 4439 Jungo 4455	LNM 4439Mn LNM 4455	LNT 4439Mn LNT 4455		

Max. service temp. weld metal (°C)	500	550	550	600	600	600	600	700	700	750	900
	EN	EN/DIN	DIN	EN/DIN	DIN	DIN	EN/DIN	EN/DIN	EN/DIN	DIN	DIN
Base materials	P295 GH	130CrMo4-5	14Mo V6-3	10CrMo9-10	12CrMo19-5	X12CrMo9-1	X20CrMoV12-1	X6CrNi18-11	X6CrNiMo17-13	X3CrNi18-11	X10NiCrAlTi3220 a)
	1.0481	1.7335	1.7715	1.7380	1.7362	1.7386	1.4922	1.4948	1.4919	1.4949	1.4876 1)
	P355 GH	16CrMo4-4	17MnMoV6-4	12CrMo9-10			X20CrMoV12-1	X4CrNi18-10	X3CrNiMo17-13		(Alloy 800H)
	1.0473	1.7337	1.5403	1.7375			1.4935	1.4301	1.4910		NiCr 15 Fe 2)
	16Mo3	22CrMo4-4	10CrSiMoV7	10CrSiMoV7	10CrSiMoV7			GX3CrNi19-10	X4CrNiMo17-12-2		(Alloy 600)
	1.5415	1.7350	1.8075	1.8075	1.8075			1.4308	1.4401		NiCr 23 Fe 3)
	17Mo3	GS-22CrMo54		17CrMoV10				X3CrNi18-11			(Alloy 601 (H))
	(1.5415)	1.7354		1.7766			1.4949				
	14Mo6	25CrMo4									
	1.5423	1.7218									
P265 GH											
1.0425											
	ASTM	ASTM	ASTM	ASTM	ASTM	ASTM	ASTM	ASTM	ASTM	ASTM	ASTM
A286GrA/B/C	A387Gr11/12	A405Gr P24	A213GrT22	A182GrF5	A199GrT91	A200GrT91	TP304H	TP316H		B163GrMo6 2)	
A299	A213GrT12/13		A335GrP22	A199GrT5	A200GrT91	A200GrT5	TP304	TP316		B163GrMo8 1)	
A414GrB-F	A335GrP12/11		A182GrF22	A200GrT5	A335GrP91	A335GrP91				B167GrMo0 2)	
A515	A336GrF12/11				A336GrF91	A336GrF91				B407Gr610 1)	
A516 gr. 70	A182GrF11/12/12		A199GrT22	A213GrT5			ASTM				
A662 gr. B			A200GrT22	A335GrP5	SA182F91	SA182F91	A351GrCF8				
A 537 gr. 1	A356Gr6		A336GrF22	A336GrF5	SA213T91	SA213T91	A296GrCF8				
A161 gr. T1			A387Gr 22	A357							
A182 gr. F1	A519Gr4130			A369GrFP5	SA369FP91	SA369FP91					
A204 gr. A-C				A473TP501	SA437GrG91	SA437GrG91					
A369 gr. FP1				A473TP502							
				SA51TP501							
				SA51TP502							
				SAE51501							
				SAE51502							
SAW	SI 19G	SL 19G	SL 22G	SL 20G	SL502	SL9Cr(P91)	Arosta 304H			Arosta 304H	NiCr 70/15Mn 2)
		SL 19STC		SL 20STC							NiCr 70/19 3)
							SL4935				NiCr 60/20 1,2,3)
GTAW	LNT 12	LNT 19	LNT 20	LNT 20	LNT 502	LNT9Cr(P91)	LNT304H			LNT304H	LNT NiCr 70/19
TIG											LNT NiCr 60/20
GMAG	LNM 12	LNM 19	LNM 20	LNM 20	LNM 20	LNM 20	LNM 304H			LNM 304H	LNM NiCr 70/19
MIG/MAG											LNM NiCr 60/20
SAW	LNS 140A	LNS 150	LNS 151	LNS 151	LNS 151	LNS 151	LNS NiCr 60/20			LNS NiCr 60/20	LNS NiCr 60/20
wire-flux	P230	P230	P240/8500	P240/8500	P240/8500	P240/8500	P2000/P7000			P2000/P7000	P2000/P7000

1) 2) 3) corresponding base and welding materials a) solution annealed, tempered at max. 600 °C b) pressure vessels max. 450 °C

# Selection table (Applications in heat resistant steel)

Max. service temp. weld metal (°C)	1000	1050	1100	1100	1100	1100	1100	1200
	steel with approximately 22%Cr, 12%Ni	steel with approximately 25%Cr, 4%Ni 0.4%C	steel with approximately 25%Cr, 20%Ni	steel with approximately 36%Ni, 18%Cr	steel with approximately 36%Ni, 25%Cr	steel with approximately 25%Cr, 20%Ni		
Base materials	EN	ENVDN	DIN	DIN	DIN	ENVDN	DIN	ENVDN
	NiCr22Mo 9Nb 2.4586 1) (Alloy 62.5)	X15 CrNiSi 20-12 1.4828 1)	X20 CrNiSi 25-4 1.4821	GX40 CrNiSi 25-20 1.4848	X12 NiCrSi 36-16 1.4864	GX40 NiCrSi35-25 1.4857	X15 CrNiSi25-20 1.4841	
	X2 NiCrAlTi 32 20	X12 CrNiTi 18-9 1.4588 2) (Alloy 800L)	GX40 CrNi 24-5 1.4822	GX40 NiCrSi 25-12 1.4837	GX40 NiCrSi 36-18 1.4865	GX40 NiCrSiNb 38-25 1.4852	X12 CrNi 25-21 1.4845	
	X10 NiCrAlTi 32 20	GX40 CrNiSi 22-9 1.4826 1)	GX40 CrNiSi 27-4 1.4823		GX40 NiCrSiNb 35-25 1.4852	GX40 NiCrSiNb 38-18 1.4849	GX15 CrNi 25-20 1.4840	
		GX25 CrNiSi 20-14 1.4876 2)	X10 CrAl 7 1.4713		X15 NiCrNb 32-21 1.4850			
		GX25 CrNiSi 18-9 1.4825 1)	X10 CrAl 13 1.4724					
		GX30 CrSi 13 1.4710 2)	X10 CrAl 18 1.4742					
		GX40 CrSi 13 1.4729 2)	X10 CrAl 24 1.4762					
		GX40 CrSi 17 1.4740 2)						
Welding consumables	ASTM	ASTM	ASTM	ASTM	ASTM	ASTM	ASTM	ASTM
	B163GN08 2) B407G810 2)	309 G 1) TP302 B 1) TP321 1)	TP 327	314	TP 330	310	TP310 TP314	
			ASTM	ASTM	ASTM	ASTM		
			A297/GHC	A297/GHK A297/GHH	A297/GHU A351GH130	A351GCK20		
	SMWV covered electrodes	NiCr 60/20 1)	Arosta 309H 1.2) Arosta 329 2)	NiCr 70/19* NiCr 70/15* NiCr 70/15Mn*	NiCr 70/19* NiCr 70/15* NiCr 70/15Mn*	NiCr 70/19* NiCr 70/15* NiCr 70/15Mn*	Intherma 310	
	GTAW TIG	LNT NiCr 60/20					LNT 310	
	GMWV MIG/MAG	LNM NiCr 60/20					LNM 310	
	SAW wire-flux	LNS NiCr 60/20 P 2000/P 7000					LNS NiCr 60/20 P2000/P7000	

1), 2) corresponding base- and weld materials  
\* only for repair welding

## COVERED ELECTRODE SELECTION TABLE FOR STAINLESS STEEL AND NICKEL BASE ALLOYS

Materialnumber En Code		Electrode type		Remarks
		First choice	Second choice	
<b>Ferritic chromium steel</b>		Arosta 309 S  Limarosta 309 S	Arosta 329  Nichroma  Arosta 309 Mo	Arosta 329, when low Ni-content is required, for heavy material possibly only the capping layer
1.4000	X6Cr13			
1.4001	*X7Cr14			
1.4002	X6CrAl13			
1.4006	X12Cr13			
1.4008	*GX8CrNi13			
1.4016	*X6Cr17			
1.4021	X20Cr13			
1.4024	*X15Cr13			
1.4027	*GX20Cr14			
<b>Martensitic chromium steel</b>		Nichroma  Arosta 309 Mo	Arosta 329  Arosta 309S  Limarosta 309S	Arosta 329, when low Ni-content is required, for heavy material possibly only the capping layer
1.4113	X6CrMo17 1			
1.4120	*X20CrMo13			
<b>Austenitic chromium-nickel steel</b>		Arosta 304L  Limarosta 304L 130  Limarosta 304L 130  Vertarosta 304L	Arosta 347	
1.4301	X4CrNi18-10			
1.4303	X4CrNi18-12			
1.4306	X2CrNi19-11			
1.4308	GX5CrNi18-10			
1.4310	X10CrNi18-8			
1.4311	X2CrNiN18-10			
1.4312	*GX10CrNi18-8			
1.4318	X2CrNiN18-7			
1.4335	X1CrNi25-21	Jungo 4465	-	
1.4347	*GX8CrNi26-7	Jungo Zeron 100X	Jungo 4462	
1.4362	X2CrNiN23-4	Arosta 4462	Jungo 4462	

\* DIN/SEW

## COVERED ELECTRODE SELECTION TABLE FOR STAINLESS STEEL

Material number En Code		Electrode type		Remarks
		First choice	Second choice	
<b>Austenitic chromium-nickel steel</b>		Arosta 316L Limarosta 316L 130 Limarosta 316L Vertarosta 316L	Arosta 4439	Arosta 4439, when weld metal ferrite should not exceed <0,5% or when an increased Mo-content is required
1.4401	X4CrNiMo 17-12-2			
1.4404	X2CrNiMo 17-12-2			
1.4406	X2CrNiMoN 17-11-2			
1.4408	GX5CrNiMo 19-11			
1.4410	*GX10CrNiMo 18-9			
1.4428	X2CrNiMo 18-12-3			
1.4429	X2CrNiMoN 17-13-3			
1.4432	X2CrNiMo 17-12-3			
1.4435	X2CrNiMo 18-14-3			
1.4436	X4CrNiMo 17-13-3			
1.4438	X2CrNiMo 18-15-4	Arosta 4439	-	
1.4439	X2CrNiMoN 17-13-5			
1.4446	GX2CrNiMoN 17-13-4			
1.4448	GX6CrNiMo 17-13			
1.4460	X3CrNiMoN 27-5-2	Jungo Zeron 100X		
1.4462	X2CrNiMoN 22-5-3	Arosta 4462/ Jungo 4462	Jungo Zeron 100X	
1.4463	*GX6CrNiMo 24-8-2	Jungo Zeron 100X		
1.4464	*GX40CrNiMo 27-5			
1.4463	*GX6CrNiMo 24-8-2	Jungo Zeron 100X		
1.4464	*GX40CrNiMo 27-5			
1.4465	X1CrNiMoN 25-25-2	Jungo 4465	-	
1.4466	X1CrNiMoN 25-22-2			
1.4468	*GX3CrNiMoN26-6-3	Jungo Zeron 100X		
1.4469	*GX2CrNiMoN26-7-4			

\*DIN/SEW

# Selection table *(Applications in stainless steel and nickel base alloys)*

**COVERED ELECTRODE SELECTION TABLE FOR STAINLESS STEEL AND NICKEL BASE ALLOYS**

Materialnumber EN Code/*SEW code		Electrode type		Remarks
		First choice	Second choice	
Austenitic chromium-nickel steel				
1.4500	GX7NiCrMoCuNb 25-20	Jungo 4500	NiCro 31/27	
1.4503	X3NiCrMoTi 27-23	NiCro 31/27	NiCro 60/20	
1.4505	X4NiCrMoCuNb 20-18-2	Jungo 4500	NiCro 31/27	
1.4506	X5NiCrMoCuTi 20-18			
1.4510	X3CrTi17	Arosta 309 S	Arosta 329	Arosta 329, when low Ni-content is required, for heavy material only the capping layer
1.4511	X3CrNb17	Limarosta 309 S	Nichroma	
1.4512	X6CrTi12		Arosta 309 Mo	
1.4513	X6CrMo 17-1			
1.4515	*GX3CrNiMoCuN 26-6-3	Jungo Zeron 100X	-	
1.4517	*GX3CrNiMoCuN 26-6-3-3			
1.4529	X1NiCrMoCuN 25-20-7	NiCro 60/20	NiCroMo 59/23	
1.4531	GX2NiCrMoCuN 20-18		NiCro 31/27	
1.4536	GX2NiCrMoCuN 25-20	Jungo 4500	NiCro 60/20	
1.4539	X1NiCrMoCu 25-20-5			
1.4541	X6CrNiTi 18-10		Limarosta 304L 130	Type 304L, TÜV approval for service temperatures up to 350°C
1.4550	X6CrNiNb 18-10	Arosta 347	Limarosta 304L	
1.4552	GX5CrNiNb 18-9		Vertarosta 304L	(intergranular corrosion)
1.4558	*X2NiCrAlTi 32-20		repair welding	
1.4559	*GX7NiCrMoCuNb 42-2	NiCro 60/20	NiCro 70/19	
1.4563	X1NiCrMoCu 31-27-4	NiCro 31/27	NiCro 60/20	
		Arosta 316L Limarosta 316L 130 Arosta 318	Type 316L, TÜV approval for Limarosta 316L Vertarosta 316L	services temperatures up to 400°C (intergranular corrosion)
1.4571	X6CrNiMoTi 17-12-2			
1.4573	*X10CrNiMoTi 18-12			
1.4577	X3CrNiMoTi 25-25	Jungo 4465	-	
1.4580	X6CrNiMoNb 17-12-2		Arosta 316L	Arosta 4439, when weld metal ferrite should not exceed <0,5%
1.4581	*GX5CrNiMoNb 18-10	Arosta 318	Limarosta 316L 130	
1.4583	*X10CrNiMoNb 18-12	Arosta 4439	Limarosta 316L 130	
		Vertarosta 316L	Type 316L:TÜV approval for service temperatures up to 400°C (intergranular corrosion)	

\*for repair welding



## COVERED ELECTRODE SELECTION TABLE FOR STAINLESS STEEL AND NICKEL BASE ALLOYS

Materialnumber EN Code/*SEW code	Electrode type		Remarks
	First choice	Second choice	
1.4585 GX7CrNiMoCuNb18-18 1.4586 X5NiCrMoCuNb22-18	Jungo 4500	NiCro 31/27	
<b>Heat resistant steels</b>			
1.4712 X10CrSi 6 1.4713 X10CrAl 7 1.4724 X10CrAl 13 1.4742 X10CrAl 18 1.4746 X8CrTi 25 1.4762 X10CrAl 24	Arosta 309 S Limarosta 309 S	Arosta 329	Arosta 329, when low Ni-content is required, for heavy material possibly only the capping layer
1.4821 X20CrNiSi 25-4 1.4822 GX40CrNi 24-5 1.4823 GX40CrNiSi 27-4	Arosta 329	Arosta 309 S Limarosta 309 S	
1.4825 GX25CrNiSi 18-9 1.4826 GX40CrNiSi 22-9 1.4828 X15CrNiSi 20-12 1.4832 GX25CrNiSi 20-14 1.4833 X7CrNi 23-14	Arosta 309H	NiCro 70/15 Mn NiCro 70/15 Mn NiCro 70/19	NiCro depends on service temperature
1.4837 GX40CrNiSi 25-12	NiCro 70/15 NiCro 70/19	Arosta 309H	Arosta 309H depends on service temperature
1.4840 GX15CrNi 25-20 1.4841 X15CrNiSi 25-20 1.4845 X12CrNi 25-21 1.4847 X8CrNiAlTi 20-20	Intherma 310	-	
1.4846 X40CrNi 25-21 GX40CrNiSi 25-20 GX40NiCrSiNb 38-18	NiCro 70/15*	NiCro 70/15 Mn*	
1.4850 X15NiCrNb 32-21		NiCro 70/15	repair welding
1.4852 GX40NiCrNb 35-25 GX30CrNiSiNb 24-24 GX40NiCrSi 35-25	NiCro 70/15*	NiCro 70/15Mn*	
1.4859 GX10NiCrNb 32-20 1.4861 X10NiCr 32-20		NiCro 70/15*	
1.4864 X12NiCrSi 36-16 1.4865 GX40NiCrSi 36-18	NiCro 70/15	NiCro 70/19 NiCro 70/15Mn	
1.4876 X10NiCrAlTi 32-20	NiCro 60/20	NiCro 70/15 NiCro 70/19	
1.4878 X12CrNiTi 18-9	Arosta 309H	Arosta 347	

\*for repair welding

## COVERED ELECTRODE SELECTION TABLE FOR NICKEL BASE ALLOYS

Materialnumber DIN/SEW code		Electrode type		Remarks
		First choice	Second choice	
<b>Creep resistant chromium-</b>		NiCro 70/19	-	
1.6901	GX8CrNi 18-10			
1.6902	GX6CrNi 18-10			
1.6905	GX5CrNiNb 18-10			
1.6907	X3CrNiN 18-10			
<b>Nickel</b>		Nickel 96	-	
2.4060	Ni99.6			
2.4061	LC-Ni99.6			
2.4062	Ni99.4Fe			
2.4066	Ni99.2			
2.4068	LC-Ni99.2			
2.4106	NiMn1			
2.4110	NiMn2			
2.4116	NiMn5			
2.4122	NiMn3Al			
2.4170	G-Ni95			
2.4175	G-Ni93C			
<b>Nickel-Copper-Iron-alloys</b>		NiCu 70/30	-	
2.4360	NiCu30Fe			
2.4361	LC-NiCu30Fe			
2.4365	G-NiCu30Nb			
2.4375	NiCu30Al			
<b>Nickel-Chromium-Molybdenum-Iron-Alloys</b>		NiCroMo 59/23 NiCroMo 60/16	-	
2.4602	NiCr21Mo14W (alloy C22)			
2.4605	NiCr23Mo16Al (alloy C59)	NiCroMo 59/23	-	
2.4610	NiMo16Cr16Ti (alloy C4)	NiCroMo 59/23 NiCroMo 60/16	-	
2.4618	NiCr22Mo6Cu	NiCro 60/20	-	
2.4619	NiCr22Mo7Cu			
2.4641	NiCr21Mo6Cu			

## Selection table *(Applications in nickel base alloys)*

### COVERED ELECTRODE SELECTION TABLE FOR NICKEL BASE ALLOYS

Materialnumber DIN/SEW code		Electrode type		Remarks
		First choice	Second choice	
2.4816	NiCr15Fe	NiCro 70/15	NiCro 60/20	
2.4817	LC-NiCr15Fe	NiCro 70/15Mn		
2.4819	NiMo16Cr15W (alloy C276)	NiCroMo 59/23 NiCroMo 60/16	-	
2.4851	NiCr23Fe	NiCro 70/19	NiCro 60/20	
2.4856	NiCr22Mo9Nb	NiCro 60/20	NiCroMo 59/23	NiCroMo 59/23 only higher corrosion resistance
2.4858	NiCr21Mo	NiCro 60/20	-	
2.4867	NiCr60 15	NiCro 70/15 NiCro 70/15Mn	-	
2.4869	NiCr80 20			
2.4951	NiCr20Ti			
2.4952	NiCr20TiAl			
2.4975	NiFeCr12Mo	NiCro 60/20	-	
2.4976	NiCr20Mo			

## Selection table *(Electrodes for dissimilar joints -1)*

Type			NiCrFe alloys	High temperature CrNi-steel	Stainless CrNiMo-steel	Stainless CrNi-steel
	EN code (DIN)	W.nr.	NiCr15Fe (Inconel 600) NiCrAlTi (Incoloy 800)	X15CrNiSi 20 12 X15CrNiSi 25 20	X5CrNiMo 17-12-2 X2CrNiMo 18-14-3 X10CrNiMoNb 18-12	X5CrNi 18-10 X2CrNi 19-11 X6CrNiNb 18-10
Un-alloyed steel Re< 360 N/mm-	S235-S355 P235-P355		NiCro 70/15 NiCro 70/15Mn NiCro 70/19	Arosta 309S  NiCro 70/15 NiCro 60/20	Nichroma Arosta 309S Arosta 309Mo NiCro 70/19	Nichroma Arosta 309S Arosta 309Mo Arosta 307
Un-alloyed fine grained steel Re 360-500 N/mm-	S420-S500		NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	Arosta 309S  NiCro 70/15 NiCro 70/19	Nichroma Arosta 309S Arosta 309Mo	Nichroma Arosta 309S Arosta 309Mo Arosta 307
Mo-alloyed steel	16Mo3	1.5415	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	Arosta 309S  NiCro 70/15 NiCro 70/19	Nichroma Arosta 309S NiCro 70/15	Nichroma Arosta 309S  Arosta 307
CrMo MoV creep resistant steel	13CrMo4-5 14MoV63 (DIN)	1.7335 1.7715	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20
CrMo creep resisting steel	10CrMo9-10 (DIN) 12CrMo19-5 (DIN)	1.7380 1.7362	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20
Martensitic Cr-steel	X20CrMoV12-1 (DIN) X24CrMoV12-1 (DIN)	1.4922 1.4936	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20
Ferritic Cr-steel	X12Cr13 X6Cr17 X10CrAl24 (DIN)	1.4006 1.4016 1.4762	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	Arosta 309S Arosta 309Mo  NiCro 70/15 NiCro 70/19	Nichroma Arosta 309S Arosta 309Mo	Nichroma Arosta 309S Arosta 309Mo
Stainless CrNi-steel	X5CrNi18-10 X2CrNi19-11 X6CrNiNb18-10	1.4301 1.4306 1.4550	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	Arosta 309S  Nichroma	Arosta 304L  Arosta 316L	Arosta 304L  Arosta 347
Stainless CrNiMo-steel	X5CrNiMo17-12-2 X2 CrNiMo18-14-3 X10CrNiMoNb18-12 (DIN)	1.4401 1.4435 1.4583	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	Arosta 309S  Arosta 309Mo	Arosta 316L  Arosta 318	
High temperature CrNi-steel	X15CrNiSi20-12 (DIN) X15CrNiSi 25-20 (DIN)	1.4828 1.4841	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	  Intherma 310 NiCro 70/19		
NiCrFe-alloys	NiCr15Fe(DIN) (Alloy 600) NiCrAlTi (DIN) (Alloy 800)	2.4816 1.4876	NiCro 70/15 NiCro 70/15Mn NiCro 60/20			

## Selection table *(Electrodes for dissimilar joints -2)*

Ferritic Cr-steel	Creep resistant steels with Mo/Cr Mo/Cr Mo V				C-Mn-steel Yield strength - Re 360-500 N/mm <sup>2</sup>	C-steel Yield strength - Re <360 N/mm <sup>2</sup>
X12Cr13 X6Cr17 X10CrAl24	X20CrMoV 12 I X24CrMoV 12 I	10CrMo9-10 12CrMo19-5	13CrMo4-5 14MoV63	16Mo3	S420-500	S235-S355 P235-355
Nichroma Arosta 309Mo Arosta 309S Arosta 307	NiCro 70/15 NiCro 70/15Mn NiCro 60/20	Conarc 49C SL 12G SL 19G SL 20G	SL 12G SL 19G SL 502	Conarc 49C Baso 100  Baso 120	Conarc 49C SL 12G  Conarc 60G SL 12G	Conarc 49C Baso 100  Baso 120
Arosta 309S Arosta 309Mo Nichroma Arosta 307	NiCo 70/15 NiCro 70/15Mn  NiCro 60/20	SL 12G SL 19G SL 20G SL 502	SL 12G  SL 19G	SL 12G  Conarc 60G	Conarc 49C SL 12G Conarc 60G Conarc 70G	
Nichroma Arosta 309S  Arosta 307	NiCro 70/15 NiCro 70/15Mn NiCro 60/20	SL 12G  SL 19G	SL12G  SL 502	SL12G		
NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	SL 19G  SL 20G	SL 19G			
NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	SL 20G  SL 502				
NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20	NiCro 70/15 NiCro 70/15Mn NiCro 70/19 NiCro 60/20					
Arosta 329  Arosta 309S						

preheating 150-250°C

Preheating and stress relieving

# Calculation of cost price for welding non-alloyed and low alloyed steels

Type	Field of application	Deposit in cm <sup>3</sup> per electrode			
		Ø 3.2	4.0	5.0	6.0/6.3 mm
<b>Resistens 100</b>	Brittle rutile slag, releases easily. Fillet welds, filling and rusty materials	3.4	5.0	8.0	
<b>Ferrod 165A</b>	As Resistens 100. Higher welding speed. 160% recovery	5.1	8.5	12.7	18.2
<b>Ferrod 120T</b>	High recovery electrodes for fillet welds and horizontal V- and X-welds. Smooth weld appearance. High welding speed through high recovery of 120, 135, 160, 180%	4.1	5.8	9.1	
<b>Ferrod 135T</b>		4.7	7.1	11.6	
<b>Ferrod 160T</b>			8.5	12.7	21.2
<b>Ferrod 185T</b>		6.1	9.1	14.2	21.2
<b>Universalis</b>	Rutile type, especially for down hand fillet welding and filling in structural steel. Very smooth appearance.	2.7 <sup>1</sup> 3.5 <sup>2</sup>	3.9 <sup>1</sup> 5.1 <sup>2</sup>	8.5	
<b>Cumulo</b>	All positions fillet welding and filling f.i. for pipewelding (except vertical-down)	2.5	3.5		
<b>Pantafix</b>	Rutile all position electrode for most widely application. General construction, pipewelding, including vertical-down.	2.4	3.4		
<b>Omnia/Panta</b>	General purpose all position electrode. Low open circuit, small diameters for hobby market.	2.4/2.4	3.4/3.4	8.0	
<b>Supra</b>	All position rutile, excellent vertical down properties. Shipbuilding repairs.	2.4	3.3	4.9	
<b>Kardo</b>	Basic electrode, low yield, low tensile, high impact.	3.0	4.4		
<b>Baso 48SP</b>	Rutile-basic electrode, excellent weldability, start and restart.	3.0	5.3		
<b>Baso 100</b>	Basic electrode for welding under difficult conditions	2.5 <sup>1</sup>	3.7 <sup>1</sup>	8.0	
<b>Baso 120</b>	Basic electrode, 120% efficiency, for fast filling in all positions in difficult construction work	2.9 <sup>1</sup> 3.9 <sup>2</sup>	4.0 <sup>1</sup> 5.8 <sup>2</sup>	9.1	
<b>Baso G</b>	Basic DC(arc) electrode, 120% efficiency, for fast filling in alle positions.	3.0 <sup>1</sup> 3.9 <sup>2</sup>	4.5 <sup>1</sup> 5.8 <sup>2</sup>	9.1	
<b>Conarc 48</b>	Basic electrode, 130% efficiency, Very good notch toughness at low temperatures.	3.2 <sup>1</sup>	4.9 <sup>1</sup> 6.1 <sup>2</sup>		
<b>Conarc 49C</b>	Basic electrode, 115% efficiency. Very good notch toughness at low temperatures.	2.8	4.2 <sup>1</sup> 6.1 <sup>2</sup>	8.5	12.7
<b>Baso 26V</b>	Basic electrode for vertical-down welding	2.7	5.3	8.5	
<b>Conarc 51</b>	Basic electrode. All positions. Very good notch toughness at low temperatures	2.2	3.4	9.8	
<b>Conarc L150</b>	Basic electrode for horizontal fillet welds and filling. 150% efficiency	4.9	7.5	11.6	15.9
<b>Conarc V 180</b>	Basic electrode with approx.. 180% efficiency for fillet welds and very fast filling of horizontal grooves.	6.1	9.1	12.7	21.2
<b>Conarc V 250</b>	Basic electrode with approx. 250% efficiency for high deposition rate downhand filling.		12.7	18.2	31.8
<b>Geofors</b>	Rutile, especially for gravity welding. High recovery. Also suitable for high speed manual arc welding Welding 90 cm. recovery 110-165%.	"a" = 3 11.6 "a" = 4.5 22.7	3.5 14.5 5.0 26.5	4.0 18.2 5.5 31.1	

# Calculation of cost price for welding non-alloyed and low alloyed steels

0	Arc time in seconds per electrode			
	3.2	4.0	5.0	6.0/6.3 mm
68		80	78	
75		65	68	73
76		89	90	
85		92	86	
		90	90	119
71		69	78	80
57 <sup>1</sup>		55 <sup>1</sup>		
69 <sup>2</sup>		69 <sup>2</sup>	83	
66		62		
66		72		
59/65		59/72	106	
64		66	77	
84		79		
75		95		
62 <sup>1</sup>		64 <sup>1</sup>	91	
62 <sup>1</sup>		63 <sup>1</sup>		
74 <sup>2</sup>		85 <sup>2</sup>	99	
70 <sup>1</sup>		75 <sup>1</sup>		
79 <sup>2</sup>		96 <sup>2</sup>	114	
67 <sup>1</sup>		83 <sup>1</sup>	95 <sup>2</sup>	
		75 <sup>1</sup>		
65		100 <sup>2</sup>	90	106
51		70	86	
62		71	104	
84		80	75	
73		70	75	83
		70	73	72
"a" =	3.0	3.5	4	
	138	153	127	
"a" =	4.5	5.0	5.5	
	131	127	116	

## Weld metal volume per meter (L=1000mm)

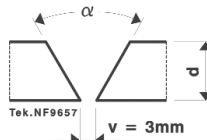
fillet size "a" in mm	theoretical content in cm <sup>3</sup>
3	9
3.5	12.3
4	16
4.5	20.3
5	25
5.5	30.3
6	36
8	64
10	100

Formula:  
 $(a^2 \times L)$  "a" in mm



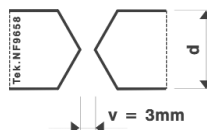
thickness "t" in mm	theoretical content in cm <sup>3</sup>		
	V50°	V60°	V70°
6	35	39	43
8	54	61	69
10	77	88	100
12	103	119	137
14	133	155	179
16	167	196	227
18	205	241	281
20	246	291	340

Formula:  
V50° :  $d (0.466d + v) L$   
V60° :  $d (0.577d + v) L$   
V70° :  $d (0.700d + v) L$



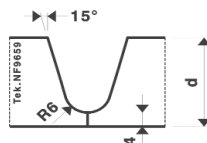
thickness "t" in mm	theoretical content in cm <sup>3</sup>		
	X50°	X60°	X70°
14	88	98	111
16	108	122	138
18	129	147	167
20	153	175	200
25	220	255	294
30	300	349	405
35	390	458	534
40	493	581	680

Formula:  
X50° :  $d (0.233d + v) L$   
X60° :  $d (0.228d + v) L$   
X70° :  $d (0.350d + v) L$



fillet size "a" in mm	theoretical content in cm <sup>3</sup>
20	194
25	288
30	395
35	516
40	650

Formula:  
 $((d-10)^2 \times 0,27 + 12d - 73)$



## DETERMINATION OF WELDING COSTS

weld content deposit per electrode	=	number of electrodes
price per electrode x number	=	costs of electrodes
number of electrodes x arc time	=	total arc time
total arc time x 100 percentage duty cycle	=	total work time
total work time x hourly wage	=	wage costs
costs of electrodes + wage costs	=	total costs

Note: the percentage of duty cycle depends on practical conditions, and may vary between 15-45%  
1) L = 350mm 2) L = 450mm

## Ferrite Number

To facilitate international communication (specifications, certifications), the internationally accepted term Ferrite Number (FN) has been introduced to indicate a delta-ferrite content in stainless steel weld metal.

The Ferrite Number is often used as an indicator of resistance to weld metal hot cracking. This aspect and other engineering properties have been correlated with the FN value of the weld metal. For various service conditions the following typical levels reflect good experiences:

- fully austenitic weld metal:
  - high corrosion resistance in severe oxidizing and reducing acidic and chloride containing media: FN < 0.5
  - fully austenitic CrNiMoN weld metal, non-magnetic: FN < 0.5
  - low ferrite CrNiN and CrNiMoN weld metal, cryogenic applications: FN 3-6 or < 0.5
- general purpose stainless steel weld metal with corrosion resistance and high resistance to hot cracking and microfissures: FN 6-15
- buffer layer of austenitic/ferritic weld deposits for dissimilar joints and buffer layers in clad steel: FN 15-35
- austenitic/ferritic weld metal with high stress and pitting corrosion resistance as well as a balanced structure for toughness and corrosion: FN 30-70

**Control of welding of constructions often requires the determination of the Ferrite Number (FN).**

## Ferrite Measurement

An internationally accepted standardized method to determine the ferrite content is based upon an arbitrarily defined relationship between a magnetic force and weld ferrite content. This is necessary because an absolute and correct determination of the ferrite content is not available as a result of inherent inaccuracy of metallographic examination and the nonexistence of a calibration method for the absolute ferrite content in stainless steel. The attracting force between a defined permanent magnet and weld metal, containing delta-ferrite is measured by means of a torsion balance. The values are in fact compared with the values obtained in measurements using the same magnet, attracting a carbon steel base plate with a nonmagnetic copper coating of a specified thickness. A calibration method provides the necessary linear relation. The principles are accepted as the international standard ISO 8249 and AWS A4.2-91. The European Standardization will adopt the ISO standard.

The range in the revised standards has been extended to 100FN (originally 0-28FN).

Coated thickness standards are available from the "U.S. National Institute of Standards and Technology" (NIST). A precision torsion balance or the commercially available "Magne Gage" (fig.3) are suitable for the determination of the Ferrite Number under laboratory conditions (horizontal position). A permanent magnet of defined dimensions and magnetic strength, according ISO 8249, shall be used.

Secondary standards for the checking and calibration of field equipment in the range 0-100FN are available from NIST.

## Calculation of ferrite content

The ferrite content is estimated on the basis of calculation, using the as deposited weld metal chemical composition. The Cr- and Ni-equivalent is plotted in diagrams, based on the metallographic studies, such as:

- the Schaeffler Diagram<sup>1)</sup>, published in 1949, is considered as most suitable for a general picture of weld metal structures for a wide range of compositions, but not accurate for ferrite containing austenitic weld metals;
- the DeLong Diagram (1973)<sup>2)</sup>, widely used up to 1985, for a limited range of CrNi (Mo, N)-stainless steel weld metal grades;
- the WRC 1992 Constitution Diagram (1992), published by Kotecki and Siewert (1992)<sup>3)</sup> has been based upon the WRC 1988 Constitution Diagram, earlier published by Siewert, McCowan and Olson<sup>4)</sup> as a result of a review and of more than 950 weld metal sample analyses and FN determinations (including data from Lincoln Electric). For this diagram, a better accuracy has been reported due to the accurate determination of the effect of Mn, Si, C, N and Nb.
- Also reference is made to the ESPY Diagram<sup>5)</sup> for the calculation of the ferrite content.



Application of Ferrite Diagrams

The various ferrite diagrams are suitable to estimate the Ferrite Number in weld metal. Ongoing verifications indicate that the new WRC 1992 Constitution Diagram provides the best estimate. The old Schaeffler diagram still provide useful information in a wide range of weld metal compositions. It provides guidelines for dissimilar joints and welding clad steel, calculation of composition and position of the diluted weld metal.

The following pages contain a reprint of a combination of the Schaeffler and the WRC 1992 Constitution Diagram (fig. 1) and the standard WRC 1992 Constitution Diagram on full scale (fig. 2). In using these diagrams for the estimation of weld metal structure, one should always take into account the effects of different welding conditions (temperature/time-cycles, welding parameters, surface effects) which usually influence FN values, compared with measurements on all weld metal deposit samples.

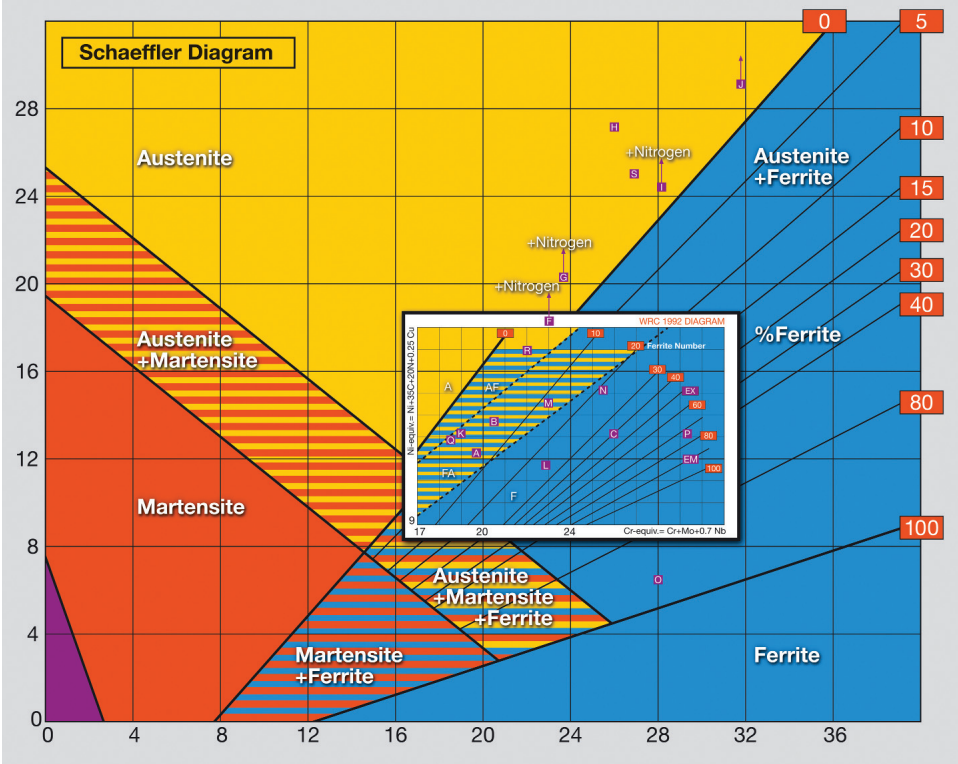


Fig. 1 Combined Schaeffler / WRC 1992 Constitution Diagram

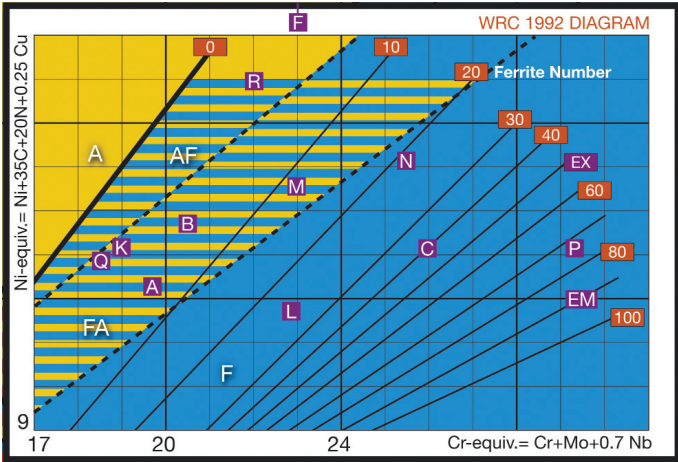


Fig. 2 WRC 1992 Constitution Diagram

Position of welding consumables

The position of representative Lincoln Electric Europe welding consumables (table 1) has been marked in the combined Schaeffler-WRC 1992 Diagram (figure 1) and in the original WRC Diagram.

Table 1 Cr- and Ni-equivalent, calculated according Schaeffler and the WRC'92 Constitution Diagram

ident.	Product	WRC'92		Schaeffler		ident.	product	WRC'92		Schaeffler	
		Cr-eq.	Ni-eq.	Cr-eq.	Ni-eq.			Cr-eq.	Ni-eq.	Cr-eq.	Ni-eq.
A	Jungo Zeron 100X	28.6	15.0	29.1	10.5	I	Jungo 4500	25.0	27.3	26.4	26.2
B	Jungo 4462	26.0	13.3	26.9	10.9	J	Jungo 4465	27.2	25.7	28.1	25.2
C	Arosta 304L	19.5	11.9	20.6	11.0	K	NiCro 31/27	30.5	33.2	31.7	32.0
D	Arosta 347	20.3	12.2	21.4	11.3	L	Arosta 309S	23.6	14.2	24.6	13.3
E	Arosta 316L	20.8	13.4	22.0	12.5	M	Arosta 309Mo	25.4	14.5	26.7	13.5
F	Arosta 318	21.5	13.8	22.7	12.8	N	Arosta 307	17.8	13.3	18.7	14.2
G	Arosta 4439	22.6	21.3	23.8	18.2	O	Arosta 329	25.4	8.6	27.2	7.4
H	Jungo 4455	23.0	19.9	23.5	20.3	P	Limarosta 312	28.8	13.9	30.3	12.7

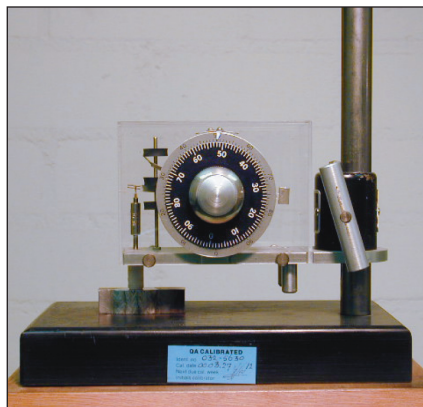


Fig. 3 Magne Gage

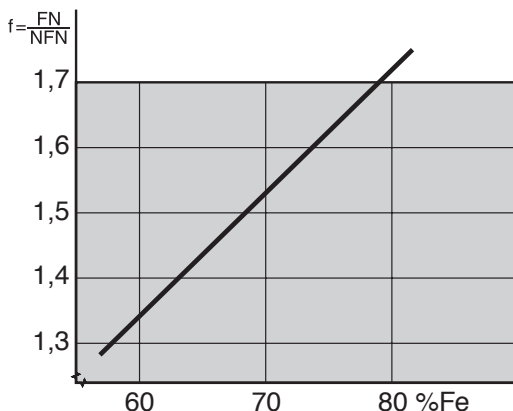


Fig. 4 Iron content versus factor  $f$

## Ferrite Number versus Ferrite Content

The Ferrite Number is not equal to the volumetric ferrite content (%). Although an absolute ferrite content can not be measured accurately, a reasonable estimate of the ferrite content can be made by dividing the Ferrite Number by the factor  $f$  (% ferrite =  $FN / f$ ) which is dependant of the iron content in the weld metal as shown in figure 4.

## Limitations

With the practice of measuring the Ferrite Number or ferrite content, welding conditions deviating from the standardized conditions have always to be taken into account. Furthermore, comparison tests showed that the accuracy between measurements in various laboratories may show differences up to +/- 10%.

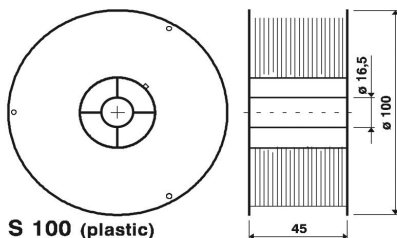
## Lincoln Electric laboratories

Since 1966 the Lincoln Electric and Lincoln Smitweld R&D departments have always been involved in the international development of ferrite determinations. The laboratories are equipped with calibrated Magne Gages and on site measurement equipment. Primary coating thickness standards and secondary standards are available for contract calibration work.

## References

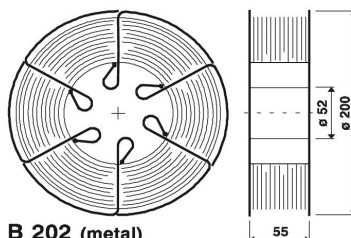
- 1) Schaeffler A.E., Metal Progress 56 (1949) p680-680s
- 2) DeLong W.T., Welding Journal 53 (1974) p273s-286s
- 3) Kotecki D.J., Siewert T.A., Welding Journal (1992) p171s-178s
- 4) Siewert T.A., McCowan C.N., Olson D.L., Welding Journal (1988) p289s-298s
- 5) Espy R.H., Welding Journal 61 (1982) p149s-156s

**Plastic spool**

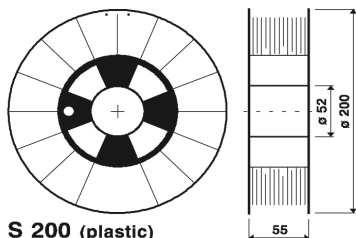


**S 100 (plastic)**

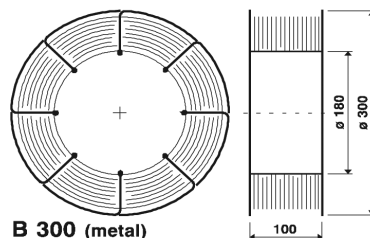
**Basket spool**



**B 202 (metal)**

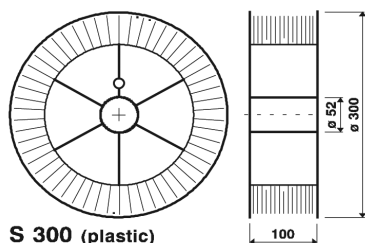


**S 200 (plastic)**

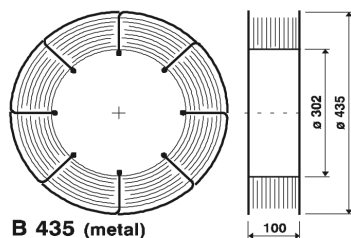


**B 300 (metal)**

*Adapter: 2158341*

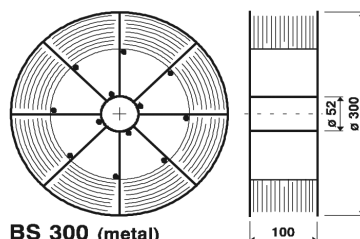


**S 300 (plastic)**



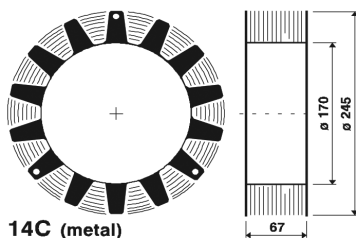
**B 435 (metal)**

*Adapter: K10205-25*



**BS 300 (metal)**

## Wire Basket



**14C (metal)**

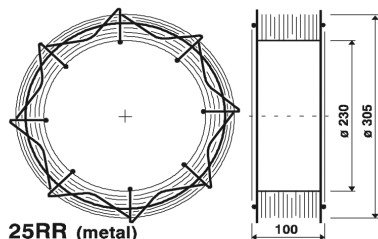
### 50C (metal)

Inner diameter  
Outer diameter  
Outer width

300 mm  
420 mm  
110 mm

Adapter: K10075 (axis 25 mm)

Adapter: K435 (axis 50 mm)



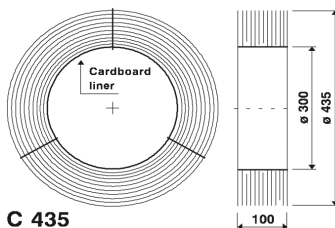
**25RR (metal)**

### 22RR (metal)

Inner diameter  
Outer diameter  
Outer width

230 mm  
305 mm  
96 mm

Adapter: K363P



**C 435**

### C400

Inner diameter  
Outer diameter  
Outer width

300 mm  
400 mm  
70 mm

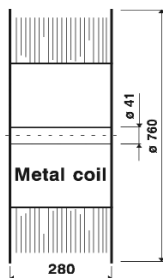
Adapter: K10205-25

### C420

Inner diameter  
Outer diameter  
Outer width

300 mm  
420 mm  
85 mm

Adapter: K10205-25

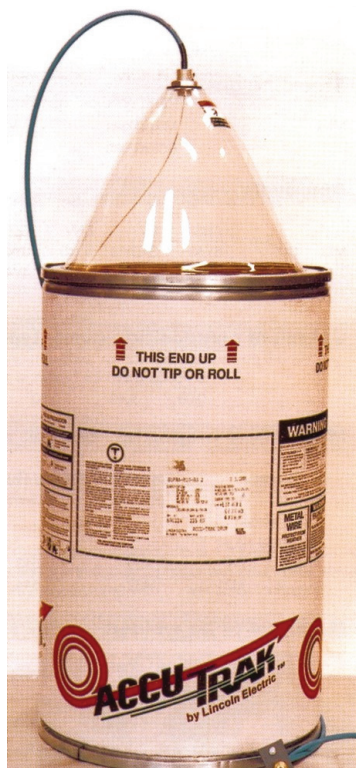


Decoiling unit DA 100/300Z

or:

Decoiling unit: TR 100/300

## Accu-Trak®



### Decoiling unit

Hood:	K884-3	
Liner:	1,8 mtr	2105120
	2,1 mtr	2105121
	2,7 mtr	2105122
	6,9 mtr	2105180
	9,3 mtr	2105181

### Dimensions AccuTrak

Diameter:	Ø 510 mm
Height	800 mm

### Advantages:

#### User friendly

- Easy to use
- No need for spool adapters
- Easy adopting to all equipment

#### High productivity

- Minimum down time
- Easy handling

#### Service:

- Reduced maintenance cost, and saving on spare parts

#### Handling and storage:

- Safe handling
- Clean wire, no shop dust and dirt

Accu-Trak®

**NEW!**



**Advantages**

High capacity packaging for high deposition rate process

Low change-over-time

No turning table needed

Trouble free operation by minimum wire distortion

Wire protection in order to prevent dust penetration

2-level stackable

Fully recyclable

**Drum dimension  $\varnothing$  x H (mm) : 1020 x 1055**

**Wire Capacity (kg) : 1000**

**Wire diameters (mm) : 2,4 - 3,2 - 4,0**

**Wire grade : Non and low alloyed**

## Sahara ReadyPack®: Warehouse and quiver in pocket format

Electrodes in Sahara ReadyPack really save time and money. For these electrodes there is no need to store in a conditioned warehouse or to use redry ovens and quivers. This innovation on an industrial scale has been a success for many years now. Millions of the well known Sahara ReadyPack have been consumed in ship building, chemical industry and in offshore projects.

The moisture resistant vacuum packaging fits well with the advantages of the remarkable EMR-Sahara concept. EMR-Sahara covered electrodes are designed to be low in moisture and show a very low moisture absorption. The internationally (IIV) agreed moisture resistance test demonstrates that the electrodes remain, after exposure during 24 hours at 27°C and 70% R.H., below a maximum hydrogen content of 5 ml/100g which is the criterium to call the electrodes MR: moisture resistant. Even more important is the fact that the electrodes can be consumed from a opened Sahara ReadyPack within 12 hours, and still prove to produce a weld deposit with a very low in hydrogen content ( $H_{DM} < 5 \text{ ml/100g}$ ). For a number of EMR-Sahara electrodes the maximum  $H_{DM}$  level is even 3 ml/100g.

A Sahara ReadyPack actually replace the functions of a conditioned warehouse and a redry oven, all in pocket format. Storage in a conditioned warehouse is no longer needed; most efficient is a small storage room at the job site. The use of a redry oven is not recommended. Up to the moment you open the Sahara ReadyPack, and during the following period of 12 hours, EMR-Sahara electrodes keep their initial quality. The convenient packages are easily carried to the welding place. The content of one or two package is usually good for one working day. A real cost saving is demonstrated in many cases, mainly because maintenance of quivers and quality control on redrying procedures is no longer needed. Not to mention the loss of unproductive time in transportation from the redry oven to the job site. The reliable Sahara ReadyPack has indeed set a trend in the welding industry.

## Properties of the Sahara ReadyPack and its content, the EMR-Sahara (basic) electrodes in summary:

- Diffusible hydrogen level  $H_{DM}$  less than 5 ml/100g; a new generation provides even less than 3 ml/100g
- Low moisture pick-up of the EMR-Sahara electrode coating; 12 hours after opening of the Sahara ReadyPack still provides electrodes with a hydrogen content of maximum 5 and 3 ml/100g respectively
- Storage doesn't need a conditioned warehouse
- Intermediate storage in a dry cabinet or quiver is not needed, even not recommended
- No mix-up of electrodes, as may happen with electrodes outside the packaging for redrying
- A most efficient handling procedure; cost savings can easily be calculated.

## The range of electrodes in the Sahara ReadyPack

Currently the following moisture resistant very low hydrogen electrodes (basic EMR-Sahara electrodes) can be supplied in Sahara ReadyPack:

Type	$H_{DM}$ max. 5 ml/100 g	$H_{DM}$ max. 3 ml/100 g	Type	$H_{DM}$ max. 5 ml/100 g	$H_{DM}$ max. 3 ml/100 g
Baso G.....		*	Kryo 1 .....		*
Conarc 49C .....		*	Kryo 1P .....		*
Conarc 51 .....		*	Kryo 1180 .....		*
Conarc L150.....	*		Kryo 2 .....		*
Conarc V180.....		*	Kryo 3 .....		*
Kardo .....		*	Arosta 304L .....		
Conarc 55CT .....		*	Arosta 316L .....		
Conarc 60G .....		*	Arosta 4462 .....		
Conarc 70G .....		*	Arosta 4462-145.....		
Conarc 80.....		*	Jungo 4462.....		
Conarc 85 .....		*	Jungo SD2509.....		
SL12G.....	*		Jungo Zeron 100X.....		
SL19G.....	*		Limarosta 304L.....		
SL19G / SL19G(STC).....	*		Limarosta 304L-130 .....		
SL20G / SL20G(STC).....	*		Limarosta 309S .....		
SL22G.....	*		Limarosta 312.....		
SL502.....	*		Limarosta 316L.....		
SL9r(P91).....	*		Limarosta 316L-130 .....		
			Nyloid 2.....		



## 1. Scope

Covered arc welding electrodes, manufactured by Lincoln Electric Europe, delivered in their original packaging. The packaging consists of either:

- cardboard boxes in outer carton for rutile mild steel electrodes.
- foil protected cardboard boxes in outer carton for all other electrodes.
- plastic (PE) boxes with sealed cap, suitable for reclosing
- hermetically vacuum sealed foil packs (Sahara ReadyPack) in outer carton for
  - basic EMR-SAHARA electrodes <sup>1) 2)</sup> for → mild steel
    - low alloyed high strength steel
    - low temperature fine grain steel
    - creep resistant steel
  - duplex- and superduplex stainless steel electrodes <sup>1)</sup>
  - Ni-base electrodes for 5-9% Ni-steel (Nyloid 2 SRP)

<sup>1)</sup> some types also packed in foil protected cardboard boxes

<sup>2)</sup> for electrodes with a very low hydrogen content in the weld metal (H<sub>DM</sub>):

H<sub>DM</sub> max. 3ml/100g weld metal (only valid for electrodes in Sahara ReadyPack)

## 2. Storage

2a. Storage of electrodes in cardboard boxes requires humidity and temperature controlled storage areas.

In general, recommended storage conditions include:

- temperature 17-27°C, relative humidity max. 60%
- temperature 27-37°C, relative humidity max. 50%.
- Maximum storage period: 3 years.
- Electrode boxes may be stored in layers to a maximum of 5.

2b. Plastic boxes require storage conditions suitable to cardboard boxes

2c. No temperature and humidity requirements are applicable for electrodes in Sahara ReadyPacks, providing that vacuum is present in undamaged packs. Sahara ReadyPacks in outer cartons can be stored in layers to a maximum of 5. Prevent damage and heating above 60°C.

## 3. Handling

3a. Redrying and subsequential holding, as recommended in table 1, is required for products in the following conditions: rutile electrodes, being humidified for any reason;

- basic low hydrogen electrodes in cardboard boxes;
- basic low hydrogen electrodes, returned from shop floor or damaged Sahara ReadyPacks;
- stainless steel and Ni-base electrodes after long and unknown storage conditions (deviating from recommendations).
- RepTec and Wearshield electrodes in plastic (PE) boxes, stored for more than 1 year under conditions as described under section 2a. Or earlier when the conditions deviate from those recommended.

3b. Electrodes in Sahara ReadyPack can be used without redrying, providing that vacuum is present in the undamaged packaging.

The electrodes can be consumed in the as received condition, direct from the packaging within a period of 8 hours after opening under the conditions of max. 35°C and max. 90% RH, with the electrodes remaining in the opened packaging and protected against excessive conditions as condensation, rain, etc.

If vacuum is not present, the electrodes shall follow the redry and holding procedure as recommended in table 1 for the EMR Sahara Range.

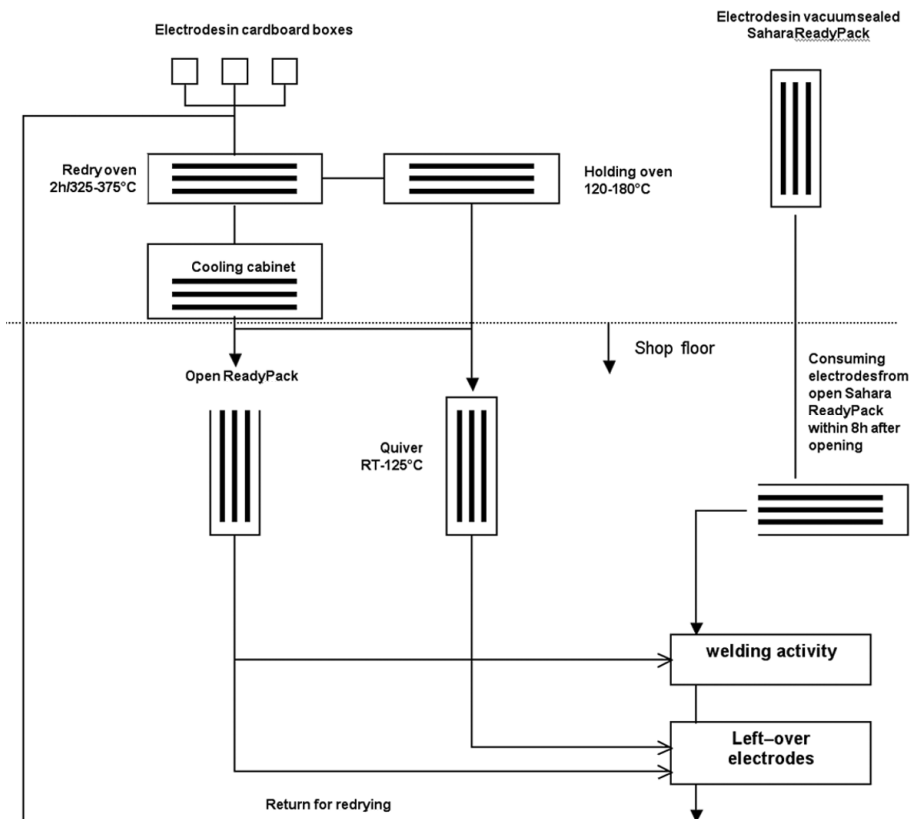
## COVERED ELECTRODE SELECTION TABLE FOR NICKEL BASE ALLOYS

Electrode product groups	Re-drying Time (h)*	Temp (°C)	Holding
Mild steel: - rutile E6013 - rutile E6012, E7024	0.5-1h 1-2h	70-80 100-120	Cabinet 10-20°C above ambient temperature
- basic low hydrogen ( $H_{DM} < 8 \text{ ml/100g}$ ) - basic very low hydrogen**	2-6h 2-6h	250-375 325-375	a. holding oven unlimited time at 120-180°C
Low alloyed: - basic very low hydrogen**	2-6h	325-375	b. quiver max. 10h at RT-125°C (see illustration fig. 1)
Hardfacing (Wearshield) electrodes			c. plastic (PE) box (RepTec and Wearshield electrodes) max. 2 weeks workshop conditions
Maintenance & Repair (RepTec) electrodes			
Stainless steel: - non EMR-SAHARA electrodes - EMR-SAHARA range	1-6h 1-6h	200-300 125-300	Holding oven unlimited time at 75-125°C quiver max. 10h at RT-125°C
Ni-base	1-6h	200-300	Holding oven unlimited time at 75-125°C quiver max. 10h at RT-125°C

\* Redrying can be repeated twice within the indicated max. time of 6h. Redrying of electrodes should be carried out by taking them out of the packaging and place the electrodes in approx. 3 cm thick layers in a temperature controlled air-circulation oven.

\*\* If these EMR-SAHARA electrodes are redried a maximum hydrogen content  $H_{DM}$  of max. 5ml/100g is valid.

Figure 1: Recommended handling procedure of EMR-SAHARA electrodes after removal either from a regular cardboard box or vacuum sealed Sahara ReadyPacks



## 1. General

Tubular cored wires with the following trade names are supplied in various spooling and packaging:

Product family	Packaging
Outershield	spool in plastic bag in cardboard box spool in A1/PE vacuum packaging in cardboard outerbox or spool in plastic protection on pallet
Innershield Lincore	spool in cardboard box or plastic bucket or hermetically sealed cans
Cor-A-Rosta	spool in aluminium (vacuum) bag in cardboard box

## 2. Storage

Exposure to a humid environment with only a relative thin plastic foil shall be prevented.

Tubular wire, packed in the original foil and cardboard box require controlled warehouse conditions such as:

- temperature 17-27°C, relative humidity: max. 60%
- temperature 27-37°C, relative humidity: max. 50%

Innershield wire in plastic buckets or in hermetically sealed cans and Outershield as well as Cor-A-Rosta in Al/PE bags under vacuum, if applicable, do not require measures against moisture pick-up. Damage of the packaging shall be prevented.

## 3. Handling

3a. Outershield, Innershield xxx-H types and Cor-A-Rosta

Spools outside the protective packaging allow exposure to normal workshop conditions during max. 72 hours;

3b. Innershield, non xxx-H types:

Spools outside the protective packaging allow 2 weeks exposure to normal workshop conditions.

In all cases the products require protection against contamination with moisture, dirt and oil products. During interruption of the production process for more than 8 hours, wire spools shall be stored in their plastic bag in the above-mentioned storage conditions.

## 4. Deteriorated product

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

1. General

Welding fluxes are supplied in plastic bags and metal drums

2. Storage

The following storage conditions are recommended:

Welding fluxes, packed in plastic bags, require controlled warehouse conditions such as: temperature 15-35°C, relative humidity: max. 70%

Product in metal drums does not require special storage conditions but rust and damage of the packaging shall be prevented.

3. Handling

Product characteristics as specified for the original condition, are retained if the product is treated in accordance with the following recommendations:

Packaging	storage conditions	
	0-6 months, temperature < 35°C rel. humidity < 70%	> 6 months or temperature > 35°C or relative humidity 70-90%*
Plastic bags	use as is**	redry 1-2h / 300-375°C
Metal drums	use as is	use as is

\* if storage conditions include a relative humidity over 90% the flux may have been deteriorated so that redrying becomes ineffective.

\*\* if a severe application is considered (HAZ or weld metal hardness HV10 > 350, heavy restraint, etc.) redrying 1-2h / 300-375°C is recommended.

Redrying is carried out with the product removed from the original packaging and treated in an oven with an even temperature. It is recommended to have either an oven atmosphere circulation over a maximum flux height of 3 cm or to have the flux moving.

The redrying operation can be repeated to a maximum of 4 times.

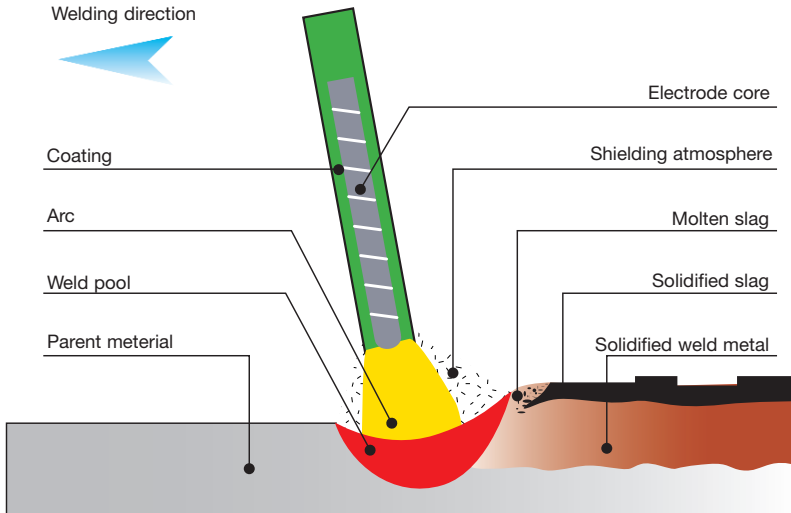
Redried flux and flux handled in the welding operation, shall be kept dry, preferably at a temperature of 50-120°C above ambient temperature, time unlimited.

4. Recycling

Non consumed flux, collected from the weld, shall be cleaned from slag, metal and/or other contaminations. Damage of the flux by heavy impingements in the transport system shall be prevented. Prevent separation of the different grain fraction in cyclones or in "dead" corners. Add new flux in the hopper in a circulation system before a level of 25% of the full hopper is reached.

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## Shielded Metal Arc Welding / Stick (M.M.A.) Welding



*In this welding process, an electric arc is created between a coated consumable electrode and the work piece to be welded, causing the parent material to be fused together and the electrode to melt. The electrode is of similar material as the parent material, and by melting provides the weld (or joint) with a reinforcing filler material. The electrode may be coated with basic, rutile or cellulose material, and as the coating burns it protects the arc and weld pool from the atmosphere with a gaseous shroud, the slag which solidifies over the newly deposited weld also protects it from the atmosphere.*

## Cellulosic electrode

### Classification

AWS A5.1-91 : E6010  
EN 499-94 : E 42 2 C 25

### General description

Cellulosic coated electrode for pipe and general welding  
Gives high ductility root welds  
Very deep penetration ensures sound root pass  
Easy striking, easy slag release  
High volume of generated gas eliminates porosity  
Reduces problems from dirt and oil on surface

### Welding positions



ISO/ASME PF/5G up PG/5G down

### Current type

DC electr. +

### Approvals

LR	TÜV
3	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.15	0.44	0.2

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-20°C	-29°C
Required: AWS A5.1-91		min. 331	min. 414	min. 22		27
EN 499-94		min. 420	500-640	min. 20	47	
Typical values	AW	440	520	26	60	50

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit: metal can	Pieces / unit (nominal)	490	305	215	135
	Net weight/unit (kg)	7.5	7.7	8.3	8.2

### Identification

Imprint: 6010-FW5P

Tip colour: none

Fleetweld® 5P: rev. EN 15



## Materials to be welded

Steel	Code	Type
Pipe material	EN 10208-1	L 210, L 240
	EN 10208-2	L 240 , L 290, L 360
	EN 10216-1 / 10217-1	P 235, P 275, P 355
	API 5LX	X42, X46, X52
	Gaz de France	X42, X46, X52

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	40-70	DC+				15.3		
3.2x350	65-130	DC+				25.2		
4.0x350	90-175	DC+				38.6		
5.0x350	140-225	DC+				60.7		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PF/5G up Current (A)	PG/5G down
2.5	55	65
3.2	90	110
4.0	130	150
5.0	150	165

## Application advice

Preheating pipe material L360 (X52) required (acc. EN 1011-1).

Pipeclamps to be removed after finishing root pass, start welding hot pass (within 5 min) after root pass

Use electrodes directly from metal cans

## Cellulosic electrode

### Classification

AWS A5.1-91 : E6010  
EN 499-94 : E 42 3 C 25

### General description

Cellulosic coated electrode for pipe and general welding.  
Gives high ductility root welds.  
Very deep penetration ensures sound pass root.  
Easy striking, easy slag release.  
High volume of generated gas eliminates porosity.  
Reduced problems from dirt and oil on surface.

### Welding positions



ISO/ASME PF/5G up PG/5G down

### Current type

DC electr. +

### Approvals

LR	TÜV
3	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.15	0.50	0.25

### Mechanical properties, all weld metal

Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
				-20°C	-29°C	-30°C
Required: AWS A5.1-91	min. 331	min. 414	min. 22		27	
EN 499-94	min. 420	500-640	min. 20			47
Typical values	AW 440	520	26	70	65	

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit: metal can	Pieces / unit (nominal)	480	275	205	135
	Net weight/unit (kg)	7.6	7.2	8.2	8.3

### Identification

Imprint: 6010-FW5P+

Tip colour: none

Fleetweld® 5P+: rev. EN 15

## Materials to be welded

Steel	Code	Type
Pipe material	EN 10208-1	L 210, L 240
	EN 10208-2	L 240 , L 290, L 360
	EN 10216-1 / 10217-1	P 235, P 275, P 355
	API 5LX	X42, X46, X52
	Gaz de France	X42, X46, X52

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	40-70	DC+				15.8		
3.2x350	65-130	DC+				26.2		
4.0x350	90-175	DC+				40.0		
5.0x350	140-225	DC+				61.5		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PF/5G up Current (A)	PG/5G down
2.5	55	65
3.2	90	110
4.0	130	150
5.0	150	165

## Application advice

Preheating pipe material L360 (X52) required (acc. EN 1011-1).

Pipeclamps to be removed after finishing root pass, start welding the hot pass immediately (within 5 min.) after root pass

Use electrode directly from metal cans

Use Fleetweld 5P for lower hardness in the root pass, when necessary

## Rutile electrode

### Classification

AWS A5.1-91 : E6012  
EN 499-94 : E 38 2 RA 13

### General description

Rutile coated electrode with brittle slag that releases easily  
Specially for narrow gaps, fillet welds and rusty materials  
Good X-ray soundness  
Excellent mechanical properties  
Class 3 approvals

### Welding positions



ISO/ASME PA/1G PB/2F

### Current type

AC / DC electr. -

### Approvals

ABS	BV	CTL	DB	DNV	LR	TÜV
3	3	+	+	3	3	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.09	0.6	0.3

### Mechanical properties, all weld metal

Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required: AWS A5.1-91	min. 331	min. 414	min. 17	not required
EN 499-94	min. 380	470-600	min. 20	min. 47
Typical values AW	420	530	25	65

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	450	450	450
Unit: box	Pieces / unit (nominal)	130	90	60
	Net weight/unit (kg)	5.9	5.9	6.2

### Identification

Imprint: 6012/Resistens 100

Tip colour: orange

Resistens® 100: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S255, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360.
	API 5LX	X42, X46, X52
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	100 - 150	AC	68	286	1.4	45.6	38	1.72
4.0 x 450	160 - 180	AC	80	446	1.8	66.3	25	1.67
5.0 x 450	230 - 240	AC	78	658	2.8	104.8	16	1.69

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F
3.2	140	140
4.0	190	190
5.0	250	260

## Application advice

For high yield strength steels such as S355, L360, P355 preheat according EN 1011-1

# Rutile electrode

## Classification

AWS A5.1-91 : E6012  
EN 499-94 : E 38 0 RC 11

## General description

All position rutile electrode with excellent vertical down welding properties

Shipbuilding repairs

Excellent on painted or rustcovered steel

Recommended for bridging wide gaps

Weldable in all positions with one current setting

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PG/3G down PE/4G

## Current type

AC / DC electr. -

## Approvals

ABS	BV	CTL	DB	DNV	FORCE	GL	LR	RMRS	TÜV
2	2	+	+	2	+	2	2	2	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.12	0.5	0.6

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 331	min. 414	min. 17	not required
EN 499-94		min. 380	470-600	min. 20	min. 47
Typical values	AW	470	550	23	56

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit:box	Pieces / unit (nominal)	155	180	120	80
	Net weight/unit (kg)	2.8	5.0	5.0	5.2

## Identification

Imprint: 6012/Supra

Tip colour: brown

Supra®: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275
Ship plates	ASTM A 131	Grade A, B, D
Fine grained steel	EN 10113-2	S275
	EN 10113-3	S275

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	70 - 90	AC	47	109	0.84	17.5	90	1.58
3.2 x 350	95 - 130	AC	64	175	1.1	27.6	53	1.45
4.0 x 350	130 - 170	AC	66	330	1.4	41.1	39	1.61
5.0 x 350	170 - 250	AC	77	534	1.8	63.6	26	1.63

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G
2.5	85	80	80	80	80	80
3.2	115	115	120	120	120	120
4.0	155	170	155	160	180	155
5.0	190	220			240	190

## Application advice

Weldable in all positions with one current setting

# Rutile electrode

## Classification

AWS A5.1-91 : E6013  
EN 499-94 : E 42 0 RC 11

## General description

Rutile general purpose, all position electrode, including vertical down  
Vertical down only applicable for "clean" structural steel  
Also weldable with low Open Circuit Voltage transformers (min. OCV 42V)

## Welding positions



## Current type

AC / DC electr. -

## Approvals

ABS	BV	CTL	DB	DNV	FORCE	GL	LR	TÜV
2	2	+	+	2	+	2	2	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.07	0.5	0.5

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 331	min. 414	min. 17	not required
EN 499-94		min. 420	500-640	min. 20	min. 47
Typical values	AW	520	550	26	60

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: box	Pieces / unit (nominal)	145	155	120
	Net weight/unit (kg)	2.8	4.8	5.4

## Identification

Imprint: 6013/Panta

Tip colour: yellow

Panta®: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275
Ship plates	ASTM A 131	Grade A, B, D
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290
	EN 10208-2	L240, L290
	API 5LX	X42, X46
	EN 10216-1/ EN 10217-1	P235, P275
	EN 10028-2	P235, P265, P295
Boiler & pressure vessel steel	EN 10113-2	S275
Fine grained steel	EN 10113-3	S275

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	70 - 90	AC	47	109	0.84	17.5	90	1.58
3.2 x 350	110 - 130	AC	59	198	1.1	29.5	54	1.58
4.0 x 350	130 - 160	AC	59	301	1.7	42.4	37	1.57

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G
2.5	80	75	75	75	75	75
3.2	120	115	125	115	125	115
4.0	175	165	160	160	170	160

## Application advice

Vertical down only applicable for "clean" structural steel

## Rutile electrode

### Classification

AWS A5.1-91 : E6013  
EN 499-94 : E 38 0 RC 11

### General description

Rutile general purpose, all position electrode, including vertical down  
Soft arc therefore suitable for relative thin plates and bridging wide gaps  
Excellent in pipe welding and construction  
Good start and restart behaviour  
Also weldable with low Open Circuit Voltage transformers (min. OCV 42V)  
Good X-ray soundness

### Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3G up PG/3G down PE/4G PF/5G up PG/5G down

### Current type

AC / DC electr. -

### Approvals

DB TÜV  
+ +

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.09	0.4	0.3

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required:	AWS A5.1-91	min. 331	min. 414	min. 17	not required
	EN 499-94	min. 380	470-600	min. 20	min. 47
Typical values	AW	500	540	24	60

### Packaging, available sizes and identification

Diameter (mm)		2.0	2.5	3.2	4.0	4.0	5.0
Length (mm)		300	350	350	350	450	450
Unit: box	Pieces / unit (nominal)	235	180	155	120		70
	Net weight/unit (kg)	2.4	3.2	4.8	5.4		6.4

Identification Imprint: 6013/Pantafix Tip colour: green

Pantafix: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275
Ship plates	ASTM A 131	Grade A, B, D
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290
	EN 10208-2	L240, L290
	API 5LX	X42, X46
	EN 10216-1/ EN 10217-1	P235, P275
	EN 10028-2	P235, P265, P295
Boiler & pressure vessel steel	EN 10113-2	S275
Fine grained steel	EN 10113-3	S275

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	40 - 75	AC	41	58	0.5	10.4	178	1.98
2.5 x 350	50 - 90	AC	60	130	0.68	17.8	88	1.57
3.2 x 350	70 - 130	AC	66	206	1.0	29.5	53	1.58
4.0 x 350	130 - 175	AC	72	333	1.3	43.6	37	1.61
4.0 x 450	130 - 175							
5.0 x 450	185 - 230							

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G
2.5	80	75	75	75	75	75
3.2	120	115	125	115	125	115

## Application advice

Vertical down only applicable for "clean" structural steel

# Rutile electrode

## Classification

AWS A5.1-91 : E6013  
EN 499-94 : E 42 0 RC 11

## General description

Rutile general purpose, all position electrode, including vertical down  
Applicable for "clean" structural steel  
Smaller diameters excellent for hobby market  
Very suitable for low Open Circuit Voltage transformers (min. OCV 42V)

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PG/3G down PE/4G

## Current type

AC / DC elektr. -

## Approvals

ABS	BV	CTL	DNV	GL	LR	RMRS
2	2	+	2	2	2	2

## Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.07	0.5	0.5

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 331	min. 414	min. 17	not required
EN 499-94		min. 420	500-640	min. 20	min. 47
Typical values	AW	520	550	26	60

## Packaging, available sizes and identification

	Diameter (mm)	1.8	2.5	3.2	4.0	5.0
	Length (mm)	300	350	350	350	450
Unit: box	Pieces / unit (nominal)	270	155	155	120	70
	Net weight/unit (kg)	2.3	2.9	4.8	5.4	6.4

## Identification

Imprint: 6013/Omnia

Tip colour: dark blue

Omnia®: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275
Ship plates	ASTM A 131	Grade A, B, D
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290
	EN 10208-2	L240, L290
	API 5LX	X42, X46
	EN 10216-1/ EN 10217-1	P235, P275
	EN 10028-2	P235, P265, P295
Boiler & pressure vessel steel		
Fine grained steel	EN 10113-2	S275
	EN 10113-3	S275

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
1.8 x 300	40 - 60	AC	40	38	0.43	8.4	210	1.75
2.5 x 350	65 - 90	AC	52	108	0.81	18.5	85	1.59
3.2 x 350	95 - 130	AC	65	229	1.0	31.1	53	1.67
4.0 x 350	130 - 160	AC	72	333	1.3	43.6	37	1.61
5.0 x 450	170 - 240	AC	106	740	2.1	92.2	16	1.47

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G
1.8					45	
2.5	80	75	75	75	75	75
3.2	120	115	125	115	125	115
4.0	175	165	160	160	170	160
5.0	240	240			250	

## Application advice

Vertical down only applicable for "clean" structural steel

## Rutile electrode

### Classification

AWS A5.1 : E6013  
EN 499 : E 38 0 R 11

### General description

Rutile general purpose, all positions electrode.  
Applicable for "clean" structural steel.  
Smaller diameters excelent for hobby market.  
Very suitable for low open circuit voltage transformers.

### Welding positions



### Current type

AC / DC electr. -

### Approvals

ABS	BV	DNV	GL	LR	TÜV
2	2	2	2	2	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.06	0.5	0.45

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required	AWS A5.1-91	min. 331	min. 414	min. 17	not required
	EN 499-94	min. 380	470-600	min. 20	min. 47
Typical values	AW	430	480	26	60

### Packaging, available sizes and identification

	Diameter (mm)	2.0	2.5	3.2	3.2	4.0	4.0	5.0
	Length (mm)	300	350	350	450	350	450	450
Unit: box	Pieces / unit (nominal)	370	250	175	150	110	95	55
	Net weight/unit (kg)	4.2	4.8	5.3	6.2	5.0	5.9	5.8

### Identification

Imprint: 6013-Omnia 46

Tip colour: Yellow

Omnia® 46 : rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275
Ship plates	ASTM A 131	Grade A, B, D
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290
	EN 10208-2	L240, L290
	API 5LX	X42, X46
	EN 10216-1/	P235, P275
	EN 10217-1	
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295
Fine grained steel	EN 10113-2	S275
	EN 10113-3	S275

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0x300	50-60	AC	43	57	0.5	11.4	154	1.68
2.5x350	70-90	AC	68	134	0.6	19.2	84	1.6
3.2x350	90-125	AC	80	220	0.9	30.3	50	1.51
3.2x450	100-135	AC	102	303	0.9	41.3	38	1.56
4.0x350	140-190	AC	74	323	1.5	45.5	33	1.49
4.0x450	150-200	AC	95	456	1.5	62.1	26	1.58
5.0x450	180-240	AC	115	662	1.8	105.5	17	1.75

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G	PF/5G up	PG/5G down
2.0	55	55	55	50	55		50	55
2.5	80	85	85	80	85	85	80	85
3.2	110	115	115	110	115	110	110	115
4.0	170	175	175	175	180	175	175	180
5.0	220	230		230				

# Rutile electrode

## Classification

AWS A5.1-91 : E6013  
EN 499-94 : E 38 0 R 12

## General description

Rutile, all position electrode (except vertical down)  
Excellent for pipe welding and construction work  
Smooth side wall wetting  
Good X-ray soundness

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. -

## Approvals

ABS	BV	CTL	DNV	GL	LR	TÜV
2	2	+	2	2	2,2Y	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.1	0.5	0.4

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 331	min. 414	min. 17	not required
EN 499-94		min. 380	470-600	min. 20	min. 47
Typical values	AW	500	540	25	55

## Packaging, available sizes and identification

	Diameter (mm)	2.0	2.5	3.2	4.0
	Length (mm)	300	350	350	350
Unit: box	Pieces / unit (nominal)	230	150	175	115
	Net weight/unit (kg)	2.3	2.9	5.2	5.3

## Identification

Imprint: 6013/Cumulo

Tip colour: white

Cumulo®: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275
Ship plates	ASTM A 131	Grade A, B, D
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290
	EN 10208-2	L240, L290
	API 5LX	X42, X46
	EN 10216-1/ EN 10217-1	P235, P275
	EN 10028-2	P235, P295
Boiler & pressure vessel steel		
Fine grained steel	EN 10113-2	S275
	EN 10113-3	S275

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	40 - 65	AC	51	69	0.4	10.0	164	1.64
2.5 x 350	65 - 90	AC	52	120	0.8	18.7	86	1.61
3.2 x 350	85 - 130	AC	66	181	1.1	29.7	51	1.53
4.0 x 350	130 - 180	AC	62	345	1.6	46.5	36	1.69

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.0	55					
2.5	95	85	85	75	75	75
3.2	135	135	120	120	120	120
4.0	160	160	155	140	140	

## Rutile electrode

### Classification

AWS A5.1-91 : E6013  
EN 499-94 : E 42 0 RR 12

### General description

Rutile electrode, especially for down hand welding in structural steel  
Smaller sizes most versatile for thin plate material  
Very smooth appearance  
Self releasing slag

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PE/4G

### Current type

AC / DC electr. -

### Approvals

ABS	BV	CTL	DB	DNV	FORCE	GL	LR	TÜV
2	2	+	+	2	+	2	2	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.1	0.95	0.4

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 331	min. 414	min. 17	not required
EN 499-94		min. 420	500-640	min. 20	min. 47
Typical values	AW	480	560	26	50

### Packaging, available sizes and identification

	Diameter (mm)	1.8	2.0	2.5	3.2	3.2	4.0	4.0	5.0
	Length (mm)	300	300	350	350	450	350	450	450
Unit: box	Pieces / unit (nominal)	270	200	130	140	125	80	80	55
	Net weight/unit (kg)	2.3	2.4	2.8	4.8	5.8	4.5	5.9	6.1

### Identification

Imprint: 6013/Universalis

Tip colour: red

Universalis®: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360.
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235, P275
	EN 10217-1	P355
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295, P355
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
1.8 x 300	40 - 60	AC	50	63	0.3	8.3	227	1.89
2.0 x 300	40 - 65	AC	41	58	0.5	11.4	178	2.00
2.5 x 350	70 - 100	AC	51	134	0.8	21.1	93	1.96
3.2 x 350	100 - 140	AC	57	281	1.3	39.3	47	1.85
3.2 x 450	100 - 140	AC	69	341	1.5	49.6	36	1.79
4.0 x 350	150 - 200	AC	55	399	2.0	56.3	33	1.85
4.0 x 450	150 - 200	AC	69	483	2.1	66.9	25	1.67
5.0 x 450	180 - 250	AC	83	882	2.9	112.0	15	1.69

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PE/4G
1.8	50			
2.0	50			
2.5	100	95	85	85
3.2	130	120	115	105
4.0	185	185	160	130
5.0	260	260		

## Remarks

Best choice for welding thin plates.

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## High recovery rutile electrode

### Classification

AWS A5.1-91 : E7024-1  
EN 499-94 : E 42 2 RA 73

### General description

Rutile coated electrode with brittle slag, for fillet welds and horizontal V- and X-welds

160% recovery, high welding speed

Good X-ray soundness

Even in narrow gaps and rusty materials easy slag release

Class 3 approved

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G

### Current type

AC / DC electr. + / -

### Approvals

ABS	DNV	GL	LR	TÜV
3,3Y	3	3	3,3Y	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.07	0.95	0.3

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-10°C	-18°C	-20°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22		min.27	
EN 499-94		min. 420	500-640	min. 20			min. 47
Typical values	AW	475	520	26	70		67

### Packaging, available sizes and identification

		3.2	4.0	4.0	4.5	5.0	5.0	5.6	6.0	6.0
		450	450	600	600	450	600	600	450	600
Unit: box	Pieces / unit (nominal)	99	60	65	50	41	40	28	28	xx
	Net weight/unit (kg)	6.1	5.6	8.1	8.2	6.0	7.7	6.0	6.0	xx

### Identification

Imprint: 7024-1/Ferrod 165A

Tip colour: dark blue

Ferrod 165A: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360.
	API 5LX	X42, X46, X52
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	125 - 155	AC	75	326	1.9	62.9	25	1.39
4.0 x 450	140 - 235	AC	65	527	3.6	96.5	15	1.39
4.0 x 600	140 - 235							
4.5 x 600	190 - 250							
5.0 x 450	210 - 330	AC	68	853	5.3	144.9	10	1.39
5.0 x 600	210 - 330							
5.6 x 600	200 - 270							
6.0 x 450	280 - 430	AC	73	1271	7.0	209.8	7	1.35
6.0 x 600	280 - 430							

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameters (mm)	PA/1G Current (A)	PB/2F	PC/2G
3.2	160	150	150
4.0	220	200	195
5.0	310	290	
6.0	390	360	

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## High recovery rutile electrode

### Classification

AWS A5.1-91 : E7024  
EN 499-94 : E 38 0 RR 33

### General description

Rutile coated electrode for downhand fillets and horizontal V- and X-grooves  
High current can be used with low spatter  
Adjustable run-out length to optimize fillet size  
Excellent side wall wetting  
Selfreleasing, closed slag

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G

### Current type

AC / DC electr. -

### Approvals

ABS	BV	CTL	DNV	GL	LR	TÜV
1	1	+	1	1	1	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.06	0.60	0.50

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					0°C	-18°C
Required: AWS A5.1-91		min. 399	min. 482	min. 17	not required	
EN 499-94		min. 380	470-600	min. 20	47	
Typical values	AW	480	560	24	65	

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	450	450	450
Unit: box	Pieces / unit (nominal)	100	80	55
	Net weight/unit (kg)	5.7	6.2	6.4

Identification Imprint: 7024/Ferrod 120T Tip colour: brown

Ferrod 120T: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	G P 240R
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295, P355
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	130 - 150	AC	76	319	1.6	55.8	31	1.67
4.0 x 450	170 - 190	AC	89	457	1.9	76.3	22	1.67
5.0 x 450	250 - 280	AC	90	706	2.9	114.1	14	1.67

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameters (mm)	PA/1G Current (A)	PB/2F	PC/2G
3.2	150	150	150
4.0	190	180	180
5.0	270	260	

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## High recovery rutile electrode

### Classification

AWS A5.1-91 : E7024  
EN 499-94 : E 38 0 RR 53

### General description

Rutile electrode for fillet welds and horizontal V- and X-welds  
High welding speed  
Smooth weld appearance  
Self releasing slag  
High recovery (140%)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G

### Current type

AC / DC electr. -

### Approvals

ABS	BV	CTL	DNV	FORCE	GL	LR	RMRS	TÜV
2	2,2Y	+	2	+	2Y	2,2Y	2Y	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.08	0.5	0.35

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 399	min. 482	min. 17	not required
EN 499-94		min. 380	470 – 600	min. 20	47
Typical values	AW	460	530	25	54

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	4.5	5.0	6.3
	Length (mm)	350	450	450	450	450	450
Unit: box	Pieces / unit (nominal)	100	90	65	60	45	30
	Net weight/unit (kg)	2.8	5.5	5.7	6.1	5.9	5.8

### Identification

Imprint: 7024/Ferrod 135T

Tip colour: gold

Ferrod 135T: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	G P 240R
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295, P355
Fine grained steel	EN 10113-2	S275, S355
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	80 - 100	AC	63	164	1.0	28.7	56	1.67
3.2 x 450	130 - 150	AC	85	344	1.6	61.3	27	1.67
4.0 x 450	180 - 200	AC	92	515	2.2	87.7	18	1.67
4.5 x 450	200 - 225	AC	110	619	2.2	102.9	15	1.56
5.0 x 450	275 - 300	AC	86	735	3.7	129.9	11	1.43

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameters (mm)	PA/1G Current (A)	PB/2F	PC/2G
2.5	90	90	90
3.2	150	140	140
4.0	200	190	190
4.5	210	210	200
5.0	290	280	

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## High recovery rutile electrode

### Classification

AWS A5.1-91 : E7024  
EN 499-94 : E 42 0 RR 74

### General description

Rutile electrode for fillet welds and horizontal V- and X-welds

Very high welding speed

Smooth weld appearance

Self releasing slag

High recovery (160%)

### Welding positions



ISO/ASME PA/1G PB/2F

### Current type

AC / DC electr. -

### Approvals

ABS	BV	CTL	DNV	FORCE	GL	LR	TÜV
2	2,2Y	+	2	+	2Y	2,2Y	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.07	0.9	0.6

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 399	min. 482	min. 17	not required
EN 499-94		min. 420	500-640	min. 20	min. 47
Typical values	AW	450	570	26	70

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	450	450	450
Unit: box	Pieces / unit (nominal)	95	65	40
	Net weight/unit (kg)	6.4	6.3	6.1

### Identification

Imprint: 7024/Ferrod 160T

Tip colour: green

Ferrod 160T: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295, P355
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	130 - 160							
4.0 x 450	180 - 220	AC	90	554	2.6	92.7	15	1.43
5.0 x 450	260 - 300	AC	90	864	4.2	154.9	10	1.43

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position	PA/1G	PB/2F
Diameter (mm)	Current (A)	
4.0	210	200
5.0	300	270

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## High recovery rutile electrode

### Classification

AWS A5.1-91 : E7024  
EN 499-94 : E 42 0 RR 73

### General description

Rutile electrode for fillet welds and horizontal V- and X-welds

170% recovery

Very high welding speed

Smooth weld appearance

Self releasing slag

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G

### Current type

AC / DC electr. + / -

### Approvals

ABS	GL
2	2Y

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.07	1.1	0.5

### Mechanical properties, all weld metal

Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91	min. 399	min. 482	min. 17	not required
EN 499-94	min. 420	500-640	min. 20	min. 47
Typical values AW	480	560	26	66

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	450	450
Unit: Box	Pieces / unit (nominal)	93	66	40
	Net weight/unit (kg)	4.7	6.5	6.1

**Identification** Imprint: 7024/Ferrod 170 Tip colour: none

Ferrod 170: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295, P355
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	125 - 160	AC	65	270	1.9	49.2	30	1.46
4.0 x 450	175 - 210	AC	84	494	2.9	100.1	15	1.03
5.0 x 450	260 - 320	AC	84	963	4.5	107.3	10	1.49

\*stub end 35 mm

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## High recovery rutile electrode

### Classification

AWS A5.1-91 : E7024  
EN 499-94 : E 42 0 RR 73

### General description

Rutile electrode for fillet welds and horizontal V- and X-welds

180% recovery

Very high welding speed

Smooth weld appearance

Self releasing slag

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G

### Current type

AC / DC electr. + / -

### Approvals

ABS	BV	DNV	LR	TÜV
2	2	2	2,2Y	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.11	0.9	0.5

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 399	min. 482	min. 17	not required
EN 499-94		min. 420	500 – 640	min. 20	min. 47
Typical values	AW	520	550	23	60

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	4.5	5.0	6.3
	Length (mm)	450	450	450	450	450
Unit: Box	Pieces / unit (nominal)	73	50		34	23
	Net weight/unit (kg)	6.0	5.7		6.0	5.7

### Identification

Imprint: 7024/Ferrod 185T

Tip colour: blue

Ferrod 185T: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295, P355
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	130 - 170	AC	71	338	2.4	71.4	21	1.49
4.0 x 450	200 - 240	AC	69	528	3.9	108.7	14	1.43
4.5 x 450	230 - 290	AC						
5.0 x 450	280 - 300	AC	78	897	5.4	166.7	9	1.43
6.3 x 450	320 - 420	AC	80	1243	7.0	247.83	6	1.43

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G
3.2	150	150	150
4.0	210	200	200
5.0	300	280	
6.3	390	360	

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## High recovery rutile electrode

### Classification

AWS A5.1-91 : E7024  
EN 499-94 : E 42 2 RR 74

### General description

Rutile electrode for fillet welds and filling  
200% recovery  
Very high welding speed, low spatter  
Smooth weld appearance  
Self releasing slag  
Easy start and restart  
Electrode can be used with drag or contact welding technique

### Welding positions



ISO/ASME PA/1G PB/2F

### Current type

AC / DC electr. +

### Approvals

DNV  
3

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.06	1.1	0.5

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required: AWS A5.1-91		min. 399	min. 482	min. 17	not required
EN 499-94		min. 420	500 – 640	min. 20	min. 47
Typical values	AW	520	550	23	60

### Packaging, available sizes and identification

	Diameter (mm)	4.0	4.0	4.5	4.5
	Length (mm)	450	600	450	600
Unit: Box	Pieces / unit (nominal)	55	54	44	44
	Net weight/unit (kg)	6.1	8.0	6.1	8.0

### Identification

Imprint: 7024/Ferrod 200T

Tip colour: yellow

Ferrod 200T: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295, P355
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
4.0 x 450	170 - 210	DC+	73	621	3.7	110.5	14	
4.0 x 600	170 - 210	DC+	114	752	3.3	148	10	
4.5 x 450	240 - 270	DC+	74	808	4.6	145.6	11	
4.5 x 600	240 - 270	DC+	132	1001	3.6	183.9	8	

\*stub end 35 mm

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## High recovery rutile electrode

### Classification

AWS A5.1-91 : E7024-1  
EN 499-94 : E 42 2 RA 73

### General description

Rutile coated electrode with brittle slag, for fillet welds and horizontal V- and X-welds  
160% recovery, high welding speed  
Good X-ray soundness  
Even in narrow gaps and rusty materials easy slag release  
Class 3 approved

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G

### Current type

AC / DC electr. + / -

### Approvals

ABS	BV	CRS	DNV	FORCE	GL	LR	RINA	RMRS	TÜV
3,3Y	3,3Y	3Y	3	+	3Y	3,3Y	3	3,3Y	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.08	1.0	0.3

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-18°C	-20°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22	min. 27	
EN 499-94		min. 420	500-640	min. 20		min. 47
Typical values	AW	460	520	28		47

### Packaging, available sizes and identification

	Diameter (mm)	4.0	5.0
	Length (mm)	450	450
Unit: box	Pieces / unit (nominal)	65	40
	Net weight/unit (kg)	6.3	5.7

### Identification

Imprint: 7024-1/Resistens 160

Tip colour: dark blue

Resistens® 160: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360.
	API 5LX	X42, X46, X52
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
4.0 x 450	140 - 235	AC	65	527	3.6	96.5	15	
5.0 x 450	210 - 330	AC	68	853	5.3	144.9	10	

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position	PA/1G	PB/2F	PC/2G
Diameters (mm)	Current (A)		
4.0	220	200	195
5.0	310	290	

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## High recovery rutile electrode

## Classification

AWS A5.1-91 : E7024  
EN 499-94 : E 42 0 RR 73

## General description

Rutile electrode for fillet welds and horizontal V- and X-welds

180% recovery

Very high welding speed

Smooth weld appearance

Self releasing slag

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G

## Current type

AC / DC electr. +/-

## Approvals

ABS	BV	CRS	DNV	FORCE	GL	LR	RINA	RMRS
2Y	2Y	2Y	2	+	2Y	2Y	2	2Y

## Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.07	1.0	0.35

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 399	min. 482	min. 17	not required
EN 499-94		min. 420	500 – 640	min. 20	min. 47
Typical values	AW	450	525	27	75

## Packaging, available sizes and identification

	Diameter (mm)	4.0	5.0	6.3
	Length (mm)	450	450	450
Unit: Box	Pieces / unit (nominal)	55	45	23
	Net weight/unit (kg)	5.8	5.8	5.7

## Identification

Imprint: 7024/Gonia 180

Tip colour: blue

Gonia® 180: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Boiler & pressure vessel steel	EN 10028-2	P235, P265, P295, P355
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
4.0 x 450	200 - 240	AC	69	528	3.9	108.7	14	1.43
5.0 x 450	280 - 300	AC	78	897	5.4	166.7	9	1.43
6.3 x 450	320 - 420	AC	80	1243	7.0	247.83	6	1.43

\*stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position	PA/1G	PB/2F	PC/2G
Diameter (mm)	Current (A)		
4.0	210	200	200
5.0	300	280	
6.3	390	360	

## Application advice

High yield strength steels such as S355, L360, P355 and X60 preheat according EN 1011-1

## Gravity electrode

## Classification

AWS A5.1-91 : E7024  
EN 499-94 : E 38 0 RR 73

## General description

Rutile electrode, especially for gravity welding  
Applicable on primed plate material  
Fillet throat size a 3.0-5.5mm at 90 cm run out length  
Also suitable for high speed manual arc welding

## Welding positions



ISO/ASME PB/2F

## Current type

AC / DC electr. + / -

## Approvals

RMRS  
2Y

## Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.06	0.6	0.4

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) 0°C
Required: AWS A5.1-91		min. 399	min. 482	min. 17	not required
EN 499-94		min. 380	470-600	min. 20	min. 47
Typical values	AW	430	520	27	80

## Packaging, available sizes and identification

	Diameter (mm)	5.0	5.0	5.0	5.6	6.3	6.3
	Length (mm)	600	600	600	600	600	600
Unit: box	a-size (mm)	3.0	3.5	4.0	4.5	5.0	5.5
	Pieces / unit (nominal)	65	50	40	35	30	25
	Net weight/unit (kg)	9.7	8.8	7.9	8.5	8.5	8.4

## Identification

Imprint: none

Tip colour: lilac

Geofors®: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Fine grained steel	EN 10113-2	S275, S355,
	EN 10113-3	S275, S355

## Calculation data

Sizes Diam. x length (mm)	Throat size a (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
5.0 x 600	3.0	180 - 225	AC	138	932	2.4	145.5	11.0	1.60
5.0 x 600	3.5	210 - 250	AC	153	1052	2.7	178.0	8.8	1.57
5.0 x 600	4.0	220 - 275	AC	127	1083	4.0	207.7	7.0	1.46
5.6 x 600	4.5	250 - 325	AC	131	1426	4.9	253.0	5.6	1.42
6.3 x 600	5.0	310 - 375	AC	127	1646	5.9	292.3	4.8	1.39
6.3 x 600	5.5	350 - 400	AC	116	1879	7.5	342.0	4.1	1.42

\*stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	a*	PB/2F** Current (A)	PB/2F ***
5.0	3.0	190	220
5.0	3.5	220	245
5.0	4.0	230	270
5.6	4.5	260	320
6.3	5.0	320	360
6.3	5.5	360	380

\* run out length approx. 90 cm

\*\* gravity welding

\*\*\* manual arc welding

## Application advice

Adjust Geoski gravity welder to 900 mm welding length

## Basic electrode

### Classification

AWS A5.1-91 : E7018-1 H8  
EN 499-94 : E 46 3 B 32 H10

### General description

Rutile basic coated electrode with excellent start- and restart properties  
Weldable on AC and DC  
Stable arc, also at low amperage  
Popular at welding schools  
Min. 60 Volt is recommended  
Good mechanical and impact properties down to -30°C (47 J)  
All weld metal with low hydrogen content  $H_{DM} < 8$  ml/100 weld metal)

### Welding positions



### Current type

Ø 2.5 AC / DC electr. + / -  
Ø 3.2 AC / DC electr. +  
Ø 4.0 AC / DC electr. +  
Ø 5.0 AC / DC electr. +

### Approvals

ABS	BV	CTL	DNV	LR	TÜV
3YH10	HHH	+	3YH5	3,3YH10	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	H <sub>DM</sub>
0.075	1.4	0.65	7 ml/100 g

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	-20°C	Impact ISO-V(J) -30°C	-46°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22			min. 27
EN 499-94		min. 460	530-680	min. 20		min. 47	
Typical values	AW	590	640	25	90	60	

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	3.2	4.0	4.0	5.0
	Length (mm)	350	350	450	350	450	450
Unit: box	Pieces / unit (nominal)	125	78	78	50	50	50
	Net weight/unit (kg)	2.5	2.6	3.3	2.5	3.4	5.5

**Identification** Imprint: 7018-1/Baso 48SP Tip colour: green

Baso® 48 SP: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH36.
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355, S420
	EN 10113-3	S275, S355, S420, S460

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	50 - 85	AC	48	104	0.9	19.4	82	1.6
3.2 x 450	85 - 135	AC	75	273	1.1	41.0	42	1.72
4.0 x 450	135 - 190	AC	95	487	1.6	64.6	24	1.55

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G
2.5	80	85	85	85	80
3.2	120	115	115	115	110
4.0	170	180	180	180	160

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

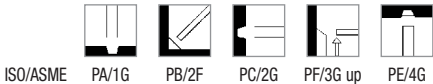
### Classification

AWS A5.1-91 : E7018 H8  
EN 499-94 : E 46 3 B 32 H5

### General description

Basic low hydrogen electrode  
Very good weldability, in all positions  
Almost no spatter, nice wetting and full weld pool control  
Good impact properties down to -30°C  
Excellent X-ray toughness

### Welding positions



### Current type

DC electr. + / -

### Approvals

ABS	BV	DB	DNV	GL	LR	TÜV
Pending	Pending	Pending	Pending	Pending	Pending	Pending

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	H <sub>018</sub>
0.09	1.1	0.6	0.015	0.01	5 ml/100

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)		
					-20 °C	-29 °C	-30 °C
Required: AWS A5.1-91		min. 399	min. 482	min. 22		min. 27	
EN 499-94		min. 460	530 - 680	min. 20			min. 47
Typical values	AW	550	635	25	115		85

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	3.2	4.0	4.0	5.0
	Length (mm)	350	350	450	350	450	450
Unit: box	Pieces / unit (nominal)	xx	xx	xx	xx	xx	xx
	Net weight / unit (kg)	xx	xx	xx	xx	xx	xx

Identification Imprint: 7018/Baso 49 Tip colour: none

Baso<sup>®</sup> 49: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type (s)*	Arc time - per electrode at max. current - E(kJ)	Energy H(kg/h)	Dep.rate - current - (kg)	Weight/ 1000 pcs. B	Electrodes/ kg weldmetal 1/N	kg Electrodes/ kg weldmetal
2.5 x 350	70 - 80	DC+	58	120	0.85	23.1	73	1.7
3.2 x 350	110 - 130	DC+	68	194	1.3	36.8	41	1.5
4.0 x 450			98	429	1.8	69.5	20	1.4
5.0 x 450	160 - 240	DC+	117	619	2.3	107.3	13	1.4

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G
2.5	95	95	90	90	85
3.2	140	130	130	120	120
4.0	180	180	180	160	150
5.0	230	230	230	180	

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

### Classification

AWS A5.1-91 : E7018 H8  
EN 499-94 : E 46 3 B 32 H5

### General description

Basic low hydrogen electrode  
Very good weldability, in all positions  
Excellent for pipe welding  
Stable arc, also at low amperage  
Good mechanical and impact properties down to -30°C

### Welding positions



### Current type

AC / DC electr. + / -

### Approvals

ABS	BV	DB	DNV	GL	LR	TÜV
Pending	Pending	Pending	Pending	Pending	Pending	Pending

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Hom
0.06	1.3	0.5	0.015	0.01	5 ml/100 g

### Mechanical properties, all weld metal

	Condition	Yield Strength (N/mm <sup>2</sup> )	Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)		
					-20 °C	-29 °C	-30 °C
Required: AWS A5.1-91		min. 399	min. 482	min. 22		min. 27	
EN 499-94		min. 460	530 - 680	min. 20			min. 47
Typical values	AW	510	600	27	90		70

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	3.2	4.0	4.0	5.0
	Length (mm)	350	350	450	350	450	450
Unit: box	Pieces / unit (nominal)	xx	xx	xx	xx	xx	xx
	Net weight / unit (kg)	xx	xx	xx	xx	xx	xx

Identification Imprint: 7018/Baso 51P Tip colour: none

Baso® 51P: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420, S460

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type (s)*	Arc time - per electrode at max. current - E(kJ)	Energy H(kg/h)	Dep.rate current - (kg)	Weight/ 1000 pcs. B	Electrodes/ kg weldmetal 1/N	kg Electrodes/ kg weldmetal
2.5 x 350	50 - 85	AC	48	104	0.9	19.4	82	1.6
3.2 x 450	85 - 135	AC	75	273	1.1	41.0	42	1.72
4.0 x 450	135 - 190	AC	95	487	1.6	64.6	24	1.55
5.0 x 450								

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position	PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G	5G
Diameter (mm)	Current (A)					
2.5	95	95	90	90	85	85
3.2	140	130	130	120	120	110
4.0	180	180	180	160	150	160
5.0	230	230	230	180		

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

## Classification

AWS A5.1-91 : E7016 H4R  
EN 499-94 : E 42 3 B 12 H5

## General description

Basic, very low hydrogen electrode  $H_{DM} < 5\text{ml}/100\text{ g}$   
Excellent for general purpose welding  
Will run on low open circuit voltage (min. OCV 55 V)  
Good side wall wetting  
Impact toughness at  $-20^{\circ}\text{C}$   
Popular at welding schools

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

ABS	BV	CTL	DNV	FORCE	GL	LR	TÜV
3H,3Y	3,3YHH	+	3YH5	+	3YH10	3,3YH5	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	$H_{DM}$
0.08	1.0	0.5	4 ml/100 g

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-20°C	-29°C	-30°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22		min. 27	
EN 499-94		min. 420	500-640	min. 20			min. 47
Typical values	AW	555	600	26	120		

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: box	Pieces / unit (nominal)	135	120	90	65
	Net weight/unit (kg)	2.5	4.3	4.8	6.3

## Identification

Imprint: 7016/Baso 100

Tip colour: Light blue

Baso® 100: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH36.
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P274T1, P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel		
Fine grained steel	EN 10113-2	S275, S355, S420,
	EN 10113-3	S275, S355, S420, S460

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	55 - 80	AC	53	116	0.8	19.1	85	1.63
3.2 x 350	75 - 115	AC	62	229	1.2	36.1	50	1.81
4.0 x 350	120 - 160	AC	64	337	1.6	50.1	34	1.72
5.0 x 450	160 - 240	AC	91	578	2.4	96.7	16	1.58
5.0 x 450	160 - 240	DC+	93	591	2.6	96.7	15	1.44

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	5G
2.5	80	80	80	90	85	85
3.2	130	125	140	120	115	120
4.0	165	160	165	150	140	
5.0	230	220	210	200		

Root run lower setting!

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

## Classification

AWS A5.1-91 : E7018 H4R  
EN 499-94 : E 42 3 B 32 H5

## General description

Basic, low hydrogen electrode H<sub>0</sub>M 4ml/100 g)  
Recovery 120%  
Excellent weldability even on AC in all positions  
Good impact toughness at -30°C  
Excellent X-ray soundness

## Welding positions



## Current type

AC / DC electr. + / -

## Approvals

ABS	BV	CTL	DNV	FORCE	GL	LR	TÜV
3H,3Y	3,3YH	+	3YH5	+	3YH	3,3YH5	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	H <sub>0</sub> M
0.08	1.2	0.5	4 ml/100 g

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-20°C	-29°C	-30°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22		min.27	
EN 499-94		min. 420	500-640	min. 20			min. 47
Typical values	AW	540	600	26	150		

## Packaging, available sizes and identification

		2.5	3.2	3.2	4.0	4.0	5.0
		350	350	450	350	450	450
Unit: box	Pieces / unit (nominal)	135	120	120	85	85	55
	Net weight/unit (kg)	2.5	4.6	6.2	4.6	6.0	6.0

## Identification

Imprint: 7018/Baso 120

Tip colour: silver

Baso® 120: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH36.
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 80	AC	55	121	0.8	19.1	85	1.61
3.2 x 350	90 - 140	AC	62	229	1.3	37.1	44	1.64
3.2 x 450	90 - 140	AC	74	275	1.5	50.1	33	1.67
4.0 x 350	120 - 160	AC	63	338	1.8	54.4	32	1.72
4.0 x 450	120 - 160	DC+	85	391	1.9	69.5	22	1.52
5.0 x 450	160 - 240	AC	99	616	2.6	108.8	14	1.54
5.0 x 450	160 - 240	DC+	100	625	2.6	108.8	14	1.52

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position	1 G	PB/2F	PC/2G	PF/3G up	PE/4G
Diameter (mm)	Current (A)				
2.5	80	80	85	85	80
3.2	145	120	140	120	125
4.0	175	155	170	165	145
5.0	235	220	210	195	

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

## Classification

AWS A5.1-91 : E7018-1 H4R  
EN 499-94 : E 42 5 B 32 H5

## General description

Basic all position very low hydrogen electrode

115 - 120% recovery

AC/DC welding in all positions especially pipe

Excellent for site welding applications

Good pipe welding

Good impact values down to -50°C

Also available in vacuum sealed Sahara ReadyPack® (SRP) H<sub>DM</sub> <3 ml/100g

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

ABS	BV	CTL	DB	DNV	GL	LR	RINA	RMRS	TÜV
3H,3Y	3,3YH	+	+	3YH5	3YH10	3,3YH5	4YH5	3-3YH5	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	H <sub>DM</sub>
0.05	1.3	0.4	3 ml/100 g

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)			
					-20°C	-40°C	-46°C	-50°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22			min. 27	
EN 499-94		min. 420	500-640	min. 20				min. 47
Typical values	AW	490	575	28	200	130		100

## Packaging, available sizes and identification

		Diameter (mm)	2	2.5	3.2	3.2	4.0	4.0	5.0
		Length (mm)	300	350	350	450	350	450	450
Unit: box	Pieces / unit (nominal)	180	135	120	120	85	85	55	
	Net weight/unit (kg)	2.1	2.8	4.4	5.8	4.7	5.9	6.0	
Unit: SRP	Pieces / unit	69	50	50	28	28	23		
	Net weight/unit (kg)	1.4	2.0	2.5	1.6	2.0	2.6		

## Identification

Imprint: 7018-1/BasoG

Tip colour: blue

Baso® G: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420,

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	35 - 55	DC+	50	61	0.5	11.7	149	1.75
2.5 x 350	55 - 90	DC+	59	107	0.8	20.3	78	1.59
3.2 x 350	75 - 120	DC+	70	234	1.2	36.5	42	1.54
3.2 x 450	75 - 120	DC+	79	265	1.4	45.4	33	1.47
4.0 x 350	120 - 180	DC+	75	358	1.7	50.9	28	1.45
4.0 x 450	120 - 180	DC+	96	473	1.7	69.3	22	1.52
5.0 x 450	160 - 240	DC+	114	671	2.2	106.2	14	1.54

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	5G
2.0						45
2.5	80	80	85	90	80	80
3.2	145	120	150	120	115	120
4.0	160	145	170	150	145	145
5.0	220	210	215	170		

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

### Classification

AWS A5.1-91 : E 7048 H8  
EN 499-94 : E 42 3 B 15 H10

### General description

Basic coated low hydrogen electrode  
Special developed for vertical down welding on shipyards  
Complete fusion in open root passes  
Good tack weldability  
Good slag removal, smooth bead appearance

### Welding positions



### Current type

AC / DC electr. + / -

### Approvals

ABS	BV	DNV	FORCE	GL	LR	RMRS
3Y	3Y	3YH10	+	3YH10	3,3YH10	3-3YH10

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	H <sub>02</sub>
0.09	1.1	0.7	6 ml/100 g

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-20°C	-29°C	-30°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22		min. 27	
EN 499-94		min. 420	500-640	min. 20			min. 47
Typical values	AW	580	630	26	130		

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0	5.6
	Length (mm)	350	450	450	450
Unit: box	Pieces / unit (nominal)	150	100	70	56
	Net weight/unit (kg)	6.1	6.2	6.7	6.5

### Identification

Imprint: 7048/Baso 26V

Tip colour: dark green

Baso<sup>®</sup> 26V: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH36.
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420,

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	110 - 140	DC+	51	181	1.5	34.0	48	1.62
4.0 x 450	155 - 185	DC+	70	315	2.1	59.7	24	1.44
5.0 x 450	195 - 225	DC+	86	435	2.7	92.9	15	1.43
5.6 x 450	200 - 260							

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position	PA/1G	PG/3G down
Diameter (mm)	Current (A)	
3.2	130	130
4.0	145	175
5.0	220	220

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

## Classification

AWS A5.1-91 : E7018-1 H4R  
EN 499-94 : E 46 4 B 42 H5

## General description

Basic coated, low hydrogen electrode with  $H_{DM}$  5ml/100 g

Recovery 130%

Excellent weldability on DC+ as well as on AC in all positions, especially overhead and vertical up

Excellent impact toughness down to -40°C

Excellent X-ray soundness

## Welding positions



ISO/ASME



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. +

## Approvals

DNV

4YH5

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	$H_{DM}$
0.05	1.3	0.3	4 ml/100 g

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-40°C	-46°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22		min. 27
EN 499-94		min. 460	530-680	min. 20	min. 47	
Typical values	AW	470	570	27	103	

## Packaging, available sizes and identification

	Diameter (mm)	2.0	2.5	3.2	3.2	4.0	4.0	5.0	6.0
	Length (mm)	300	350	350	450	350	450	450	450
Unit: box	Pieces / unit (nominal)	146	110	126	110	95	82	58	46
	Net weight/unit (kg)	1.9	2.5	5	5.7	5.4	6.0	6.3	6.5

## Identification

Imprint: 7018-1/Conarc 48

Tip colour: orange

Conarc® 48: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate - H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	50 - 80	DC+	53		0.6	14.3	123	1.76
2.5 x 350	80 - 110	DC+	64		0.8	23.1	67	1.55
3.2 x 350	95 - 150	DC+	67		1.3	40.0	40	1.60
3.2 x 450	95 - 150	DC+	-		-	-	-	-
4.0 x 350	125 - 210	DC+	83		1.7	57.6	26	1.50
4.0 x 450	125 - 210	DC+	95		1.8	73.4	21	1.54
5.0 x 450	190 - 270							
6.0 x 450	220 - 310							

\* stub end 35 mm

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

### Classification

AWS A5.1-91 : E7018 H4R  
EN 499-94 : E 46 3 B 32 H5

### General description

Most suitable universal basic electrode for shipbuilding and light general construction work

Welding characteristics come very close to the welders ideal electrode

Almost no spatter, nice wetting and full weld pool control

One current setting for all positions possible

Perfect welding and 120% recovery contributes to high productivity

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

### Current type

AC / DC electr. + / -

### Approvals

ABS	BV	CTL	DB	DNV	GL	LR	RINA	RMRS	TÜV
3H,3Y	3,3YHH	+	+	3YH5	3YH10	3,3YH5	3YH5	3-3YH5	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	H <sub>2</sub> O
0.09	1.1	0.6	0.015	0.01	4 ml/100 g

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-20°C	-29°C	-30°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22		min. 27	
EN 499-94		min. 460	530-680	min. 20			min. 47
Typical values	AW	480	560	28	140		

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	4.0	5.0	6.0
	Length (mm)	350	350	350	450	450	450
Unit: box	Pieces / unit (nominal)	118	120	85	85	55	45
	Net weight/unit (kg)	2.7	4.5	4.6	5.9	6.0	6.3

### Identification

Imprint: 7018/Conarc49

Tip colour: green

Conarc® 49: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420,

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	70 - 80	DC+	58	120	0.85	23.1	73	1.7
3.2 x 350	110 - 130	DC+	68	194	1.3	36.8	41	1.5
4.0 x 450			98	429	1.8	69.5	20	1.4
5.0 x 450	160 - 240	DC+	117	619	2.3	107.3	13	1.4
6.0 x 450	250 - 300	DC+	106	976	3.5	136.9	10	1.33

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	95	95	90	90	85	85
3.2	140	130	130	120	120	110
4.0	180	180	180	160	150	160
5.0	230	230	230	180		
6.0	300	290				

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

## Classification

AWS A5.1-91 : E7018-1 H4R  
EN 499-94 : E 46 4 B 32 H5

## General description

Basic extremely low hydrogen electrode  $H_{DM} < 3\text{ ml/100 g}$  (SRP)

Reliable impact toughness at  $-40^{\circ}\text{C}$ , good CTOD-values at  $-10^{\circ}\text{C}$

The off-shore electrode when Ni-alloying is not allowed

100 - 120% recovery

Good pipe welding properties

Excellent X-ray soundness

Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml/100g}$

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

ABS	BV	CTL	DB	DNV	FORCE	GL	LR	RMRS	TÜV
3H,3Y	3YHH	+	+	3YH5	+	3YH10	3,3YH5	3-3YH5	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	$H_{DM}$
0.06	1.4	0.3	0.015	0.01	2 ml/100 g

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-20°C	-40°C	-46°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22			min. 27
EN 499-94		min. 460	530-680	min. 20		min. 47	
Typical values	AW	480	580	28	200	170	

## Packaging, available sizes and identification

		Diameter (mm)	2.5	3.0	3.2	3.2	4.0	4.0	5.0	6.0
		Length (mm)	350	350	350	450	350	450	450	450
Unit: box	Pieces / unit (nominal)		135	80	120	120	85	85	55	45
	Net weight/unit (kg)		2.7	2.4	4.2	5.8	4.5	5.7	5.8	6.3
Unit: SRP	Pieces / unit		70	54	50	50	28	28	23	21
	Net weight/unit (kg)		1.4	1.5	1.9	2.4	1.6	2.0	2.5	2.9

## Identification

Imprint: 7018-1/Conarc49C

Tip colour: grey

Conarc® 49C: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420,

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	55 - 80	DC+	55	99	0.78	19.6	84	1.65
3.0 x 350	70 - 110	DC+	53	193	1.2	30.4	58	1.77
3.2 x 350	80 - 130	DC+	65	217	1.2	37.9	45	1.69
4.0 x 350	120 - 160	DC+	75	348	1.6	54.2	30	1.61
4.0 x 450	120 - 160	DC+	100	444	1.7	70.4	21	1.47
5.0 x 450	180 - 240	DC+	90	632	2.6	105.6	15	1.60
6.0 x 450	250 - 330	DC+	106	976	3.5	136.9	10	1.33

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	80	80	85	80	80
3.0	110	110	115	110	105	110
3.2	140	120	145	120	120	120
4.0	150	140	150	140	135	140
5.0	220	210	210	170		
6.0	300	290				

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

Best choice: 3.0 x 350 mm for rootlayer welding in pipes

Best choice: 3.2 x 350 mm for pipewelding

## Basic electrode

## Classification

AWS A5.1-91 : E7016-1 H4R  
EN 499-94 : E 42 4 B 12 H5

## General description

Basic extremely low hydrogen electrode  $H_{DM} < 3\text{ ml}/100\text{ g}$  (SRP)

Reliable impact toughness at  $-40^\circ\text{C}$

Good CTOD at  $-10^\circ\text{C}$ , meets offshore requirements

Excellent root pass electrode (diam. 2,5 en 3,2 mm)

Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml}/100\text{ g}$

## Welding positions



ISO/ASME PA/1G PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

ABS	BV	CTL	DB	DNV	FORCE	GL	LR	TÜV
3H,3Y	3,3YHH	+	+	3YH5	+	3YH10	3,3YH5	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	$H_{DM}$
0.06	1.4	0.5	0.015	0.01	2 ml/100 g

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-20°C	-40°C	-46°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22			min. 27
EN 499-94		min. 420	500-640	min. 20		min. 47	
Typical values	AW	520	575	28	115		
CTOD-values at $-10^\circ\text{C}$ : $> 0.25\text{ mm}$							

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	3.2	4.0	4.0	5.0
	Length (mm)	350	350	450	350	450	450
Unit: box	Pieces / unit (nominal)	135	150	151	100	96	55
	Net weight/unit (kg)	2.7	4.7	6	4.6	6.0	5.8
Unit: SRP	Pieces / unit	70	56	56	30	30	23
	Net weight/unit (kg)	1.4	1.8	2.3	1.4	1.8	2.4

## Identification

Imprint: 7016-1/Conarc 51

Tip colour: gold

Conarc® 51: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 80	DC+	53	123	0.8	19.6	86	1.68
3.2 x 350	70 - 120	DC+	62	178	1.0	30.8	57	1.74
3.2 x 450	70 - 120							
4.0 x 350	100 - 160	DC+	71	306	1.4	48.0	37	1.78
4.0 x 450	100 - 160							
5.0 x 450	180 - 240	DC+	104	702	2.6	103.0	13	1.36

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	75	70	75	70	75
3.2	100	110	100	100	100
4.0	150	140	130	125	125
5.0	220	220	180		

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic electrode

### Classification

AWS A5.1 : E7018-1  
EN 499 : E 42 4 B 22 H5

### General description

Basic, very low hydrogen electrode.  
Excellent for general purpose welding.  
Good impact toughness at -46°C.

### Welding positions



### Current type

DC electr. +/-

### Approvals

ABS	BV	DB	DNV	GL	LR	RINA	TÜV
4Y40H5	4Y40HHH	+	4Y40H5	+	4Y40H5	4Y40H5	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si
0.05	1.0	0.3

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)		
					-20 °C	-29 °C	-30 °C
Required: AWS A5.1-91 EN 499-94		min. 399 min.420	min. 482 500-640	min. 22 min. 20		min 27	min. 47
Typical values	AW	436	533	29	100	90	85

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	3.2	4.0	4.0	5.0
	Length (mm)	350	350	450	350	450	450
Unit: box	Pieces / unit (nominal)	175	115	115	80	80	55
	Net weight / unit (kg)	3.9	4.0	5.2	4.1	5.3	5.6

### Identification

Imprint: LINCOLN 7018-1

Tip colour:

LINCOLN® 7018-1 : rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	70-90	DC+	591	32	0.86	22.3	71	1.59
3.2x350	100-130	DC+	65	221	1.16	34.8	48	1.66
3.2x450	100-135	DC+	75	272	1.35	45.2	36	1.61
4.0x350	130-180	DC+	64	313	1.90	51.3	29	1.51
4.0x450	130-190	DC+	77	410	2.19	66.3	21	1.41
5.0x450	220-260	DC+	84	657	3.03	101.8	14	1.43

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G
2.5	80	85	85	85	80
3.2	120	115	115	115	110
4.0	170	180	180	180	160
5.0	240	250	250	250	230

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Basic high recovery electrode

### Classification

AWS A5.1-91 : E7028 H4R  
EN 499-94 : E 42 2 B 53 H5

### General description

Basic, low hydrogen electrode  
150% recovery  
Easy slag release  
Fillet welds and horizontal V- and X-welds  
Excellent weldability on AC and DC  
Transformers with OCV > 70V recommended  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G

### Current type

AC / DC electr. + / -

### Approvals

ABS	BV	CTL	DB	DNV	FORCE	GL	LR	TÜV
3H,3Y	3,3YH	+	+	3YH5	+	3YH10	3,3YH15	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	H <sub>DM</sub>
0.07	0.95	0.4	4 ml/100 g

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -18°C -20°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22	min. 27
EN 499-94		min. 420	500-640	min. 20	min. 47
Typical values	AW	540	580	27	75

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0	6.0
	Length (mm)	450	450	450	450
Unit box	Pieces / unit (nominal)	90	55	35	25
	Net weight/unit (kg)	5.9	5.3	5.2	5.3
Unit: SRP	Pieces/unit	28	23	18	
	Net weight/unit (kg)	1.9	1.6	2.7	

### Identification

Imprint: 7028/Conarc L150

Tip colour: yellow

Conarc® L150: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	140 - 160	AC/DC+	84	375	1.7	64.8	26	1.67
4.0 x 450	175 - 220	AC/DC+	80	555	2.6	97.8	17	1.69
5.0 x 450	275 - 325	AC/DC+	75	838	4.4	155.7	11	1.72
6.0 x 450	325 - 350	AC/DC+	85	1260	5.4	209.4	8	1.64

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position	PA/1G	PB/2F	PC/2G
Diameter (mm)	Current (A)		
3.2	150	150	140
4.0	210	200	190
5.0	310	280	
6.0	360	300	

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

Transformers with OCV > 70 V recommended

## Basic high recovery electrode

## Classification

AWS A5.1-91 : E7028 H4R  
EN 499-94 : E 42 4 B 73 H5

## General description

Basic, extremely low hydrogen electrode  $H_{DM} < 3 \text{ ml/100 g}$  (SRP)

175% recovery and easy slag release

Fillet welds and horizontal V- and X-welds

Reliable impact toughness  $-40^\circ\text{C}$ , good CTOD at  $-10^\circ\text{C}$

Excellent X-ray quality

Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3 \text{ ml/100g}$

## Welding positions



PA/1G



PB/2F



PC/2G

ISO/ASME

## Current type

AC / DC electr. + / -

## Approvals

ABS	BV	CTL	DNV	GL	LR	RINA	RMRS
3YH5	3,3YHH	+	3YH5	3YH10	3,3YH5	3YH5	3-3YH5

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	$H_{DM}$
0.08	1.2	0.3	2 ml/100g

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-18°C	-20°C	-40°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22	min. 27		
EN 499-94		min. 420	500-640	min. 20			min. 47
Typical values	AW	440	510	30		130	

## Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0	6.3
	Length (mm)	450	450	450	450
Unit: box	Pieces / unit (nominal)		60	40	23
	Net weight/unit (kg)		6.0	6.1	5.4
Unit: SRP	Pieces / unit	27	23	19	8
	Net weight/unit (kg)	2.0	2.4	2.8	1.9

## Identification

Imprint: 7028/Conarc V180

Tip colour: white

Conarc® V180: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate - H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	130 - 160	AC	73	337	2.3	68.9	21	1.47
4.0 x 450	170 - 240	AC	70	538	3.6	101.0	14	1.45
5.0 x 450	275 - 330	AC	75	780	4.9	149.7	10	1.45
6.3 x 450	280 - 425	AC	83	1171	7.0	230.4	6	1.43

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position	PA/1G	PB/2F	PC/2G
Diameter (mm)	Current (A)		
3.2	160	140	140
4.0	230	190	190
5.0	300	230	230
6.3	390	280	

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

Transformers with OCV &gt; 70 V recommended

## Basic high recovery electrode

### Classification

AWS A5.1-91 : E7028 H4R  
EN 499-94 : E 42 4 B 73 H5

### General description

Basic low hydrogen electrode  $H_{DM} < 5\text{ml}/100\text{ g}$   
245% recovery and easy slag release  
Fillet welds and horizontal V- and X-welds  
Reliable impact toughness  $-40^{\circ}\text{C}$   
Excellent X-ray soundness  
Deposition rate is comparable with submerged arc welding

### Welding positions



ISO/ASME PA/1G PB/2F\*

\*PB/2F position only 4 and 5 mm.

### Current type

AC / DC electr. + / -

### Approvals

ABS	BV	DNV	GL	LR	RINA	RMRS	TÜV
4Y400H5	3,3YHH	4Y40H5	4Y40H5	4Y40H5	4YH5	3-3YH5	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	H <sub>DM</sub>
0.08	1.3	0.45	4 ml/100 g

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-18°C	-40°C
Required: AWS A5.1-91		min. 399	min. 482	min. 22	min. 27	
EN 499-94		min. 420	500-640	min. 20		min. 47
Typical values	AW	460	550	29		80

### Packaging, available sizes and identification

	Diameter (mm)	4.0	5.0	5.0	6.0	6.0
	Length (mm)	450	450	600	450	600
Unit: box	Pieces / unit (nominal)	42	26	26	19	
	Net weight/unit (kg)	5.9	5.8	7.8	5.8	

### Identification

Imprint: 7028/Conarc V250

Tip colour: red

Conarc® V250: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415, L445
	API 5LX	X42, X46, X52
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
4.0 x 450	190 - 240	AC	70	621	4.8	141	10	1.40
5.0 x 450	260 - 360	AC	73	1017	7.1	217	7	1.39
6.0 x 450	300 - 470	AC	72	1324	10.1	300	4	1.37

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F
4.0	230	200
5.0	300	260
6.0	390	

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

Transformers with OCV > 70 V recommended

## Basic low strength electrode

## Classification

AWS A5.1 : E6018 (according classification 1966)  
 EN 499-94 : E 35 4 B 32 H5

## General description

Basic extremely low hydrogen electrode  $H_{DM} < 3 \text{ ml/100 g}$  (SRP)  
 Repairs and tie-ins in oil and gas transport pipe lines  
 Low yield and ultimate tensile strength, high impact toughness  
 Buffer layer electrode for internally clad stainless steel  
 Only available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3 \text{ ml/100g}$

## Welding positions



ISO/ASME



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

CTL

+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	$H_{DM}$
0.03	0.4	0.25	3 ml/100 g

## Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-18°C	-20°C	-40°C
Required: AWS A5.1-91		min. 331	min. 414	min. 22	min. 27		
EN 499-94		min. 355	440-570	min. 22			min. 47
Typical values	AW	390	450	28		>200	

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: SRP	Pieces / unit	23	17	28
	Net weight/unit (kg)	0.5	0.7	1.5

## Identification

Imprint: 6018/Kardo

Tip colour: black

Kardo®: rev. EN 15

**Materials to be welded**

Pipe line and low alloyed steel, clad with CrNi- and CrNiMo-stainless steel to weld the buffer layer on stainless one side welded root run.

High strength fine grained steel as StE 460 for NH3 storage tanks, to weld very soft, ferritic cap layers

Pipe line steel grades, to weld low yield strength fillet welds in split-T-joints (system Nederlandse Gasunie)

**Calculation Data**

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 80	DC+	81	173	0.5	19.7	81	1.60
3.2 x 350	90 - 120	DC+	84	252	1.0	36.5	43	1.58
4.0 x 350	120 - 160	DC+	79	448	1.6	53.0	29	1.56

\* stub end 35 mm

**Welding parameters, optimum fill passes**

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	80	80	85	80	80
3.2	140	120	145	120	120	120
4.0	150	140	150	140	135	140

**Application Advice**

Use electrodes directly from Sahara ReadyPack.

Restrict dilution on stainless steel root runs.

## High strength cellulosic electrode

### Classification

AWS A5.5-96 : E7010-G  
EN 499-94 : E 42 2 Mo C 25

### General description

Cellulosic coated electrode for vertical down pipe welding  
Suitable for pipe with strengths X52 through X65  
Popular with welders  
Easy operability  
Low susceptibility to wagon tracks, windows and pinholes

### Welding positions



ISO/ASME PG/5Gdown

### Current type

DC electr. +

### Approvals

LR	TÜV
3,3Y	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Mo	V
0.12	0.35	0.12	0.35	0.02

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-20°C	-30°C
Required: AWS A5.5-96		min. 390	min. 480	min. 22	not required	
EN 499-94		min. 420	500-640	min. 20		min. 47
Typical values	AW	430	520	26	75	50

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit: Metal can	Pieces / unit (nominal)	440	325	195	130
	Net weight/unit (kg)	6.9	8.4	7.8	8.1

### Identification

Imprint: 7010-G SAHYP

Tip colour: none

Shield Arc® HYP: rev. EN 15



## Materials to be welded

Steel	Code	Type
Pipe material	EN 10208-2	L 360, L 415
	EN 10216-1 / 10217-1	P 355
	API 5LX	X52, X 56, X60, X65
	Gaz de France	X52, X63

## Calculation Data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	40-70	DC+				15.7		
3.2x350	75-130	DC+				26.0		
4.0x350	90-185	DC+				40.0		
5.0x350	140-225	DC+				62.3		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position:	PG/5G down
Diameter (mm)	Current (A)
2.5	65
3.2	110
4.0	150
5.0	165

## Application Advice

Preheating pipe material L360 and L415 (X56 t/m X65) required (acc. EN 1011-1).

Pipeclamps to be removed after finishing root pass, start welding "hot pass" immediately (within 5 min.) after root pass.

Use electrode directly from metal cans.

Use Fleetweld® 5P for lower hardness in the root pass

## High strength cellulosic electrode

### Classification

AWS A5.5-96 : E8010-G  
EN 499-94 : E 46 4 1Ni C 25

### General description

Cellulosic coated electrode for vertical down pipe welding  
Suitable for pipe with strengths in the range of X56 - X70  
Can be used for root, fill and capping passes  
Low susceptibility to wagon tracks, windows and pinholes  
Good impact properties  
Can be used for silicon-killed steels

### Welding positions



ISO/ASME PG/5Gdown

### Current type

DC electr. +

### Approvals

TÜV  
+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cr	V	P	S
0.12	0.90	0.20	0.85	0.10	0.03	0.012	0.013

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-20°C	-40°C
Required: AWS A5.5-96		min. 460	min. 550	min. 19	not required	
EN 499-94		min. 460	530-680	min. 20	min. 47	
Typical values	AW	510	570	24	75	

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	350
Unit: Metal can	Pieces / unit (nominal)	325	205	130
	Net weight/unit (kg)	8.4	8.1	8.1

### Identification

Imprint: 8010-G SA70+

Tip colour: none

Shield Arc® 70+: rev. EN 15

## Materials to be welded

Steel	Code	Type
Pipe material	EN 10208-2	L 360, L 415, L 445, L 480
	EN 10216-1 / 10217-1	P 355
	API 5LX	X 56, X60, X65, X70
	Gaz de France	X52, X63

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	75 - 130	DC+				25.8		
4.0 x 350	90 - 185	DC+				39.5		
5.0 x 350	140 - 225	DC+				62.3		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position:	PG/5G down
Diameter (mm)	Current (A)
3.2	110
4.0	150
5.0	165

## Application Advice

Preheating pipe material L360 t/m L480 (X56 t/m X70) required (acc. EN 1011-1).

Pipeclamps to be removed after finishing root pass, start welding "hot pass" immediately (within 5 min.) after root pass.

Use electrode directly from metal cans.

Use Fleetweld® 5P for lower hardness in the root pass

## High strength cellulosic electrode

### Classification

AWS A5.5-96 : E7010-A1  
EN 499-94 : E 42 2 Mo C 25

### General description

Cellulosic coated electrode for vertical down pipe welding  
Suitable for pipe strengths in range X52-X56, as well as for 0.5%Mo pipe steels  
Can be used for root, fill and capping passes  
Low susceptibility to wagon tracks, windows and pinholes

### Welding positions



ISO/ASME PG/5Gdown

### Current type

DC electr. +

### Approvals

TÜV  
+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Mo
0.11	0.50	0.25	0.50

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required: AWS A5.5-96		min. 390	min. 480	min. 22	not required
EN 499-94		min. 420	540-640	min. 20	min. 47
Typical values	SR:1h/620°C	450	570	26	80

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	350
Unit: Metal can	Pieces / unit (nominal)	320	210	145
	Net weight/unit (kg)	8.3	8.5	9.0

### Identification

Imprint: E7010-A1 SA85

Tip colour: none

Shield Arc® 85: rev. EN 15

## Materials to be welded

Steel	Code	Type
Pipe material	EN 10208-2	L 360
	EN 10216-1 / 10217-1	P 355
	API 5LX	X46, X52
	Gaz de France	X46, X52

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	80-140	DC+				25.6		
4.0 x 350	100-200	DC+				40.3		
5.0 x 350	140-210	DC+				61.4		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position:	PG/5G down
Diameter (mm)	Current (A)
3.2	120
4.0	170
5.0	180

## Application Advice

Preheating pipe material L360 required (acc. EN 1011-1).

Pipeclamps to be removed after finishing root pass, start welding "hot pass" immediately (within 5 min.) after root pass.

Use electrode directly from metal cans.

## High strength cellulosic electrode

### Classification

AWS A5.5-96 : E 9010-G  
EN 499-94 : E 50 4 1NiMo C 25

### General description

Cellulosic electrode, 0.5% Mo and Ni-alloyed, for vertical down welding in pipes  
Suitable for pipe material API 5LX-70 and X-80, EN 10208-2, or L480 and L550  
Applicable for root, filling- and capping pass  
Not sensitive for wagon tracks, windows and pinholes

### Welding positions



ISO/ASME PG/5Gdown

### Current type

DC electr. +  
DC electr. - (root)

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Mo	Ni
0.13	0.60	0.15	0.6	0.7

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength	Tensile strength	Elongation	Impact ISO-V(J)	
		(N/mm <sup>2</sup> )	(N/mm <sup>2</sup> )	(%)	-40°C	-46°C
Required: AWS A5.5-96		min. 530	min. 620	min. 17	not required	
EN 499-94		min. 550	560-720	min. 18	min. 47	
Typical values	AW	550	640	22	50	45

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	450
Unit: Metal can	Pieces / unit (nominal)	340	210	145
	Net weight/unit (kg)	8.7	8.5	9.0

### Identification

Imprint: 9010-G

Tip colour: none

Shield Arc® 90: rev. EN 15

## Materials to be welded

Steel	Code	Type
Pipe material	EN 10208-2 API 5LX	L 480 , L 550 X70, X80

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	75-130	DC+				26.3		
4.0 x 350	80-185	DC+				40.8		
5.0 x 450	140-225	DC+				63.6		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position:	PG/5G down
Diameter (mm)	Current (A)
3.2	120
4.0	170
5.0	180

## Application Advice

Preheating pipe material required (acc. EN 1011-1)

Rootlayer preferable to weld with lower yield electrodes (Fleetweld® 5P/5P+ or Shield Arc 70+.)

Pipeclamps to be removed after finishing root pass, start welding "hot pass" immediately (within 5 min.) after root pass.

Use electrode directly from metal cans.

## High strength basic electrode

## Classification

AWS A5.5-96 : E8018-W2 HR4\*  
 EN 499-95 : E 46 5 Mn1Ni B 32 H5\*

\* Deviation: see remarks

## General description

Basic all position electrode for welding weather resistant steel

Very suitable for off- and on-shore constructions, high resistance to corrosion caused by seawater or combinations of oil, gas and seawater

Excellent mechanical properties (impact at -50°C)

Extremely low hydrogen  $H_{DM} < 3\text{ml}/100\text{g}$  (SRP)

Only available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml}/100\text{g}$

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

LR  
 4Y42H5

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Cu	$H_{DM}$
0.05	1.5	0.4	0.010	0.015	0.9	0.4	2ml/100g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)			
					-18°C	-20°C	-40°C	-50°C
Required: AWS A5.5-96		min. 460	min. 550	min. 19	min. 27			
EN 499-95		min. 460	min. 530	min. 20				
Typical values	AW	540	610	25		115	100	min. 47 60

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: SRP	Pieces / unit (nominal)	70	50	28	23
	Net weight/unit (kg)	1.4	1.9	1.6	2.5

## Identification

Imprint: 8018-W2/Conarc 55CT

Tip colour: black

Conarc® 55 CT: rev. EN 15



## Materials to be welded

Steel	Code	Type
Weather resisting steel	EN 10155	S235 J0W S235 J2W S355 J0W S355 J2W S355 K2G1W

Weather resistant steels like: Cor-Ten®, Patinax®-F, Patinax®-37 and similar Ni- and Cu-alloyed steels

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	55 - 85	DC+	53	81	0.77	19.7	88	1.74
3.2 x 350	80 - 145	DC+	70	223	1.2	36.9	43	1.60
4.0 x 350	120 - 185	DC+	77	355	1.6	54.1	29	1.59
5.0 x 450	180 - 270	DC+	104	784	2.4	105.2	15	1.53

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	110	110	115	110	105	110
3.2	140	120	145	120	120	120
4.0	150	140	150	140	135	140
5.0	220	210	210	170		

## Remarks

Deviations: chemical composition:

Mn = 1.4 - 1.9%

Si = 0.15 - 0.60%

Cr = 0.1%

Ni = 0.7 - 1.0%

Cu = 0.3 - 0.5%

AWS: Mn = 0.50 - 1.30%

AWS: Si = 0.35 - 0.80%

AWS: Cr = 0.45 - 0.75%

AWS: Ni = 0.40 - 0.80%

EN: Cu max. 0.3%

EN: Cr = 0.2%

## High strength basic electrode

## Classification

AWS A5.5-96 : E9018M H4  
EN 757-97 : E 55 4 Z B 32 H5

## General description

Basic all position extremely low hydrogen electrode  $H_{DM} < 3\text{ ml}/100\text{g}$  (SRP)

For welding high strength steel grades (UTS 540-640 N/mm<sup>2</sup>)

Good impact toughness at -51°C

DC preferred

115-120% recovery

Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml}/100\text{g}$

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

ABS	BV	CTL	DNV	GL	LR	TÜV
3Y	4Y50	+	4Y50H5	4YH10	+	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Mo	$H_{DM}$
0.06	1.0	0.4	0.015	0.010	1.6	0.3	2 ml/100g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-20°C	-40°C	-51°C
Required: AWSA5.5-96		540-620*	min. 620	min. 24			min. 27
EN 757-97		min. 550	610-780	min. 18		min. 47	
Typical values	AW	600	670	25		98	
	SR: 1h/620°C	550	640	24	90		40

\* max. Yield strength 655 N/mm<sup>2</sup> for diam. 2.5 mm

## Packaging, available sizes and identification

		Diameter (mm)	2.5	3.2	4.0	5.0
		Length (mm)	350	350	350	450
Unit: Box	Pieces / unit (nominal)	110	120	85	55	
	Net weight/unit (kg)	2.5	4.6	4.6	5.8	
Unit: SRP	Pieces / unit	65	50	28	23	
	Net weight/unit (kg)	1.4	2.0	1.5	2.6	

## Identification

Imprint: 9018M/Conarc 60G

Tip colour: red

Conarc® 60G: rev. EN 15

### Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S355
Pipe material	EN 10208-2	L360, L415, L445, L480
	API 5 LX	X52, X56, X60, X65, X70
Creep resisting steel	EN 10028-2	16 Mo 3
Fine grained steel	EN 10113-3	S420 M (L), S460 M (L), S420 N (L), S460 N (L)
	EN 10137-2	S460, S500
Weather resisting steel	EN 10155	S235 J0W
		S235 J2W
		S355 J0W
		S355 J2W
		S 355 K2G1W

### Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 100	DC+	63	114	0.7	23.5	77	1.80
3.2 x 350	80 - 130	DC+	69	231	1.3	38.3	40	1.52
4.0 x 350	120 - 180	DC+	72	324	1.7	55.8	30	1.66
5.0 x 450	160 - 240	DC+	119	760	2.2	105.2	14	1.43

\* stub end 35mm

### Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	75	80	85	75	75
3.2	130	120	135	120	115	120
4.0	155	145	160	145	140	140
5.0	225	220	210			

### Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## High strength basic electrode

## Classification

AWS A5.5-96 : E9018-G H4  
EN 757-97 : E 55 4 1NiMo B 32 H5

## General description

Basic all position extremely low hydrogen electrode  $H_{DM} < 3\text{ml}/100\text{g}$  (SRP)  
For high strength steel grades (UTS 640-735 N/mm<sup>2</sup>), root passes in HY 100 steel  
Good impact at -40°C  
DC welding preferred  
115-120% recovery  
Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml}/100\text{g}$

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

CTL	DNV	TÜV
+	4Y50H5	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Mo	$H_{DM}$
0.06	1.2	0.4	0.014	0.009	1.0	0.4	2 ml/100g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-20°C	-40°C	-46°C
Required: AWS A5.5-96		min. 530	min. 620	min. 17	not required		
EN 757-97		min. 550	610-780	min. 18		min. 47	
Typical values	AW	600	655	24		90	60
	SR: 15h/580°C	550	640	24	90		50

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: SRP	Pieces / unit	64	50	28	23
	Net weight/unit (kg)	1.5	2.0	1.5	2.4
Unit: Box	Pieces/unit (normal)		120	85	55
	Net weight/unit (kg)		4.6	4.6	5.8

## Identification

Imprint: 9018-G/Conarc 70G

Tip colour: light green

Conarc® 70G: rev. EN 15

## Materials to be welded

Steel	Code	Type
Boiler & pressure vessel steel (Reactor steels) (incl. Q & T steels)	DIN	20MnMoNi55, 22NiMoCr37, 51NiCuMoNb5-S1 GS-18NiMoCr37
	ASTM	A508CL2, A508CL3, A533CL.1Gr.B / C, A533CL.2Gr.B / C 15NiCuMoN65 (WB36), 17MnMoV64(WB35)
Creep resisting steel		
Pipe material	API 5LX	X65, X70
	EN 10208-2	L480, L550
Fine grained steel	EN 10137-2	S460, S500, S550
		Root runs and fillet welds in S620 and S690

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 100	DC+	67	121	0.7	19.5	75	1.47
3.2 x 350	80 - 130	DC+	70	234	1.3	37.5	41	1.56
4.0 x 350	120 - 180	DC+	74	343	1.7	55.4	29	1.59
5.0 x 450	160 - 240	DC+	106	573	2.5	106.4	14	1.43

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	75	80	85	75	75
3.2	130	120	135	120	115	120
4.0	155	145	160	145	140	140
5.0	225	220	210			

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## High strength basic electrode

## Classification

AWS A5.5-96 : E11018M H4  
EN 757-97 : E 69 5 Z B 32 H5

## General description

Basic all position extremely low hydrogen electrode  $H_{DM} < 3$  ml/100g (SRP)

Weldable on AC and DC

110-115% recovery

Good impact values at -51°C

Meets the requirements of military specifications

Suitable for welding submarines high strength steels (UTS up to 800 N/mm<sup>2</sup>)

Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3$  ml/100g

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

ABS	CTL	DB	LR
+	+	+	4Y69H5

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Mo	H <sub>DM</sub>
0.06	1.5	0.4	0.015	0.01	2.2	0.4	2 ml/100g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-40°C	-50°C	-51°C
Required: AWSA5.5-96		680-760*	min. 760	min. 20			min. 27
EN 757-97		min. 690	760-960	min. 17		min. 47	
Typical values	AW	750	785	22	100	80	

\* Diam. 2.5 max. 795 N/mm<sup>2</sup>

## Packaging, available sizes and identification

		Diameter (mm)			
		2.5	3.2	4.0	5.0
		Length (mm)			
		350	350	350	450
Unit: SRP	Pieces / unit (nominal)	70	50	28	23
	Net weight/unit (kg)	1.4	1.9	1.5	2.5
Unit: Box	Pieces / unit	225	125	90	60
	Net weight/unit (kg)	4.4	4.5	5.0	6.3

## Identification

Imprint: 11018-M/Conarc80

Tip colour: gold

Conarc® 80: rev. EN 15

## Materials to be welded

Steel	Code	Type
Pipe material	API-5LX	X70, X75
Fine grained steel	EN 10137-2	S620, S690
		root runs and fillet welds in S890

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 80	DC+	55	99	0.8	19.5	82	1.61
3.2 x 350	80 - 130	DC+	78	261	1.1	36.5	43	1.55
4.0 x 350	120 - 180	DC+	75	356	1.6	53.2	30	1.59
5.0 x 450	160 - 240	DC+	116	627	2.3	105.1	14	1.45

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	75	75	75	80	75	80
3.2	130	120	135	120	115	120
4.0	145	145	155	140	140	140
5.0	225	230	210			

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## High strength basic electrode

## Classification

AWS A5.5-96	: E12018-G H4
EN 757-97	: E 69 5 Mn2NiCrMo B 32 H5

## General description

Basic all position extremely low hydrogen electrode  $H_{DM} < 3\text{ ml/100g}$

For steels with a tensile strength UTS of max.  $835\text{ N/mm}^2$

For high strength steels such as T1, HY 100, Naxtra 70, HRS 650, Dillimax. 690

Good impact toughness down to  $-50^\circ\text{C}$

Only available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml/100g}$

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

ABS	CTL	DNV
+	+	4Y69H5

## Chemical composition (w%), typical, all weld metal

C	Mn	Mn	Si	P	S	Cr	Ni	Mo	$H_{DM}$
0.06	Ø3.2 1.3	≥ Ø4.0 1.6	0.3	0.01	0.01	0.4	2.0	0.4	2 ml/100g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-40°C	-50°C
Required: AWS A5.5-96		min. 740	min. 830	min. 14	not required	
EN 757-97		min. 690	760-960	min. 17		min. 47
Typical values	AW	840	890	21	80	60
	SR: 1h/620°C	790	850	20	70	60

## Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	450
Unit: SRP	Pieces / unit	50	28	23
	Net weight/unit (kg)	1.9	1.5	2.5

## Identification

Imprint: 12018-G/Conarc 85

Tip colour: light blue

Conarc® 85: rev. EN 15



## Materials to be welded

Steel	Code	Type
Pipe material	API-5LX	X70, X75, X80
Fine grained steel	EN 10137-2	S690
		root runs and fillet welds in S890

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	80 - 130	DC+	69	219	1.0	37.5	50	1.89
4.0 x 350	120 - 180	DC+	68	321	1.5	53.2	35	1.87
5.0 x 450	160 - 240	DC+	106	632	2.0	106.7	17	1.81

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
3.2	135	130	140	120	120	120
4.0	155	145	155	140	140	140
5.0	225	220	215			

## High strength basic electrode

## Classification

AWS A5.5-96 : E12018-G H4  
EN 757-97 : E 69 5 Mn2NiMo B 53 H5\*

\* Nearest classification

## General description

Basic high recovery (150%) low hydrogen electrode  $H_{0M} < 5\text{ml}/100\text{g}$

For steels with a tensile strength UTS of max. 835 N/mm<sup>2</sup>

For high strength steels such as T1, HY 100, Naxtra 70, HRS 650, Dillimax. 690

Good impact toughness down to -60°C

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G

## Current type

AC / DC elektr. + / -

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Mo
0.06	1.5	0.4	0.02	0.01	2.5	1.0

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-40°C	-50°C	-60°C
Required: AWS A5.5-96		min. 740	min. 830	min. 14	not required		
EN 757-97		min. 690	760-960	min. 17		min. 47	
Typical values	AW	790	850	17	70		55

## Packaging, available sizes and identification

Diameter (mm)	4.0	5.0
Length (mm)	450	450
on request		

## Identification

Imprint: 12018-G/Conarc 85-150

Tip colour: Yellow

Conarc® 85-150: rev. EN 15

## Materials to be welded

Steel	Code	Type
Pipe material	API-5LX	X70, X75, X80
Fine grained steel	EN 10137-2	S690
root runs and fillet welds in S890		

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
4.0 x 450	150 - 210	DC+						
5.0 x 450	180 - 290	DC+						

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	1F	PB/2F
4.0	175	210	190
5.0	225	255	235

## Remarks

Deviations: chemical composition:

Mo = 0.7 - 1.1%

EN: Mo = 0.3 - 0.6%

## Low temperature basic electrode

## Classification

AWS A5.5-96 : E7018-G H4R (meet also AWS A5.5-96: E 8018-G H4R)  
 EN 499-94 : E 50 6 Mn1Ni B 32 H5

## General description

The basic all position offshore electrode with max. 1% Ni  
 Excellent mechanical properties (impact at -60°C)  
 Good CTOD at -10°C  
 Extremely low hydrogen  $H_{DM} < 3\text{ ml}/100\text{g}$  (SRP)  
 110-120% recovery  
 Weldable on AC and DC  
 Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml}/100\text{g}$

## Welding positions



ISO/ASME



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

ABS	BV	CTL	DB	DNV	GL	LR	RINA	RMRS	TÜV
3Y	UP	+	+	5Y46H5	6Y46H10	5Y40H5	4YH5	3-3YH5	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	$H_{DM}$
0.05	1.5	0.4	0.01	0.01	0.9	2 ml/100g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-20°C	-40°C	-60°C
Required: AWS5.5-96		min. 390	min. 480	min. 25	not required		
EN 499-94		min. 500	560-720	min. 18			min. 47
Typical values	AW	550	640	24	150		90

CTOD-value at -10°C &gt; 0.25 mm

## Packaging, available sizes and identification

		Diameter (mm)						
		2.5	3.0	3.2	3.2	4.0	4.0	5.0
		Length (mm)						
		350	350	350	450	350	450	450
Unit: Box	Pieces / unit (nominal)	135	90	120	120	85	85	55
	Net weight/unit (kg)	2.7	2.8	4.7	5.8	4.4	5.9	5.7
Unit: SRP	Pieces / unit	70	54	50	50	28	28	23
	Net weight/unit (kg)	1.4	1.5	1.9	2.4	1.5	2.0	2.5

## Identification

Imprint: 7018-G/Kryo1

Tip colour: purple

Kryo® 1: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP 240R
Pipe material	EN 10208-1	L290 GA, L360 GA
	EN 10208-2	L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60, X65
	EN 10216-1	P275 T1
	EN 10217-1	P275 T2, P355 N
Fine grained steel	EN 10113-2	S275, S355, S420, S460
	EN 10113-3	S275, S355, S420, S460
	EN 10137-2	S460

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	55 - 80	DC+	59	85	0.72	19.3	86	1.65
3.0 x 350	70 - 110	DC+	74	256	0.93	30.2	52	1.58
3.2 x 350	80 - 140	DC+	66	220	1.2	37.7	48	1.79
3.2 x 450	80 - 140	DC+	78	259	1.3	48.7	35	1.72
4.0 x 350	120 - 170	DC+	77	355	1.6	54.1	29	1.59
4.0 x 450	120 - 170	DC+	90	450	1.8	68.4	23	1.56
5.0 x 450	180 - 240	DC+	104	784	2.4	105.2	15	1.53

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	80	80	80	80	80
3.0	110	110	115	110	105	110
3.2	140	120	145	120	120	120
4.0	150	140	150	140	135	140
5.0	220	210	210	170		

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Low temperature basic electrode

## Classification

AWS A5.5-96 : E8016-G H4R  
EN 499-94 : E 50 6 Mn1Ni B 12 H5

## General description

Extremely low hydrogen  $H_{DM} < 3\text{ml}/100\text{g}$  (SRP)  
The basic all position offshore electrode with max. 1% Ni  
Thin coated electrode, easy weld pool control  
Excellent mechanical properties (impact at  $-60^\circ\text{C}$ )  
Good CTOD at  $-10^\circ\text{C}$   
Weldable on AC and DC  
Only available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml}/100\text{g}$

## Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	$H_{DM}$
0.07	1.7	0.5	0.02	0.005	0.9	2 ml/100 g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					$-40^\circ\text{C}$	$-60^\circ\text{C}$
Required: AWS A5.5-96		min. 460	min. 550	min. 19	not required	
EN 499-94		min. 500	560-720	min. 18		min. 47
Typical values	AW	570	650	24	95	60
CTOD-value at $-10^\circ\text{C} > 0.25\text{ mm}$						

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	450	450	450
Unit: SRP	Pieces / unit (nominal)	45	56	30	xx
	Net weight/unit (kg)	0.9	2.3	1.9	xx

## Identification

Imprint: 8016-G/Kryo1N

Tip colour: red

Kryo® 1N: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP 240R
Pipe material	EN 10208-1	L290 GA, L360 GA
	EN 10208-2	L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60, X65
	EN 10216-1	P275 T1
	EN 10217-1	P275 T2, P355 N
Fine grained steel	EN 10113-2	S275, S355, S420, S460
	EN 10113-3	S275, S355, S420, S460
	EN 10137-2	S460

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 95	DC+	50	106	0.82	19.2	90	1.71
3.2 x 450	80 - 145	DC+	68	256	1.2	40.1	43	1.73
4.0 x 450	120 - 190	DC+	82	436	1.7	63.6	26	1.65
5.0 x 450	175 - 230							

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	75	70	75	70	75	80
3.0	100	110	100	100	100	110
4.0	150	140	130	125	125	120

## Low temperature basic electrode

## Classification

AWS A5.5-96 : E 8018-G H4R  
EN 499-94 : E 50 6 Mn1Ni B 32 H5

## General description

The basic all position offshore electrode with max. 1% Ni  
Excellent mechanical properties (impact at -60°C)  
Good CTOD at -10°C  
Extremely low hydrogen  $H_{DM} < 3\text{ ml}/100\text{g}$  (SRP)  
110-120% recovery  
Weldable on AC and DC  
Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml}/100\text{g}$

## Welding positions



ISO/ASME



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	$H_{DM}$
0.05	1.5	0.5	0.010	0.005	0.95	2 ml/100g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-40°C	-60°C
Required: AWSA5.5-96		min. 460	min. 550	min. 19	not required	
EN 499-94		min. 500	560-720	min. 20		min. 47
Typical values	AW	550	640	24	140	80

CTOD-value at -10°C &gt; 0.25mm

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	3.2	4.0	4.0	5.0
	Length (mm)	350	350	450	350	450	450
Unit: Box	Pieces / unit (nominal)	135	120	120	85	85	55
	Net weight/unit (kg)	2.7	4.7	5.8	4.4	5.9	5.7
Unit: SRP	Pieces / unit	70	50	50	28	28	23
	Net weight/unit (kg)	1.4	1.9	2.0	1.5	2.0	2.5

## Identification

Imprint: 8018-G /Kryo1P

Tip colour: purple

Kryo® 1P: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S275, S355
Ship plates	ASTM A131	Grade A, B, D, E, AH 32 to EH 40
Cast steel	EN 10213-2	GP 240R
Pipe material	EN 10208-1	L290 GA, L360 GA
	EN 10208-2	L290, L360, L415, L445
	API 5LX	X42, X46, X52, X60, X65
	EN 10216-1	P275 T1
	EN 10217-1	P275 T2, P355 N
Fine grained steel	EN 10113-2	S275, S355, S420, S460
	EN 10113-3	S275, S355, S420, S460
	EN 10137-2	S460

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	55 - 85	DC+	59	85	0.72	19.3	86	1.65
3.2 x 350	80 - 145	DC+	66	220	1.2	37.7	48	1.79
3.2 x 450	80 - 145	DC+	78	259	1.3	48.7	35	1.72
4.0 x 350	120 - 185	DC+	77	355	1.6	54.1	29	1.59
4.0 x 450	120 - 185	DC+	90	450	1.8	68.4	23	1.56
5.0 x 450	180 - 270	DC+	104	784	2.4	105.2	15	1.53

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	80	80	80	80	80
3.2	140	120	145	120	120	120
4.0	150	140	150	140	135	140
5.0	220	210	210	170		

## Low temperature basic electrode

## Classification

AWS A5.5-96 : E 8018-G H4R  
EN 499-94 : E 50 5 1Ni B 72 H5

## General description

Basic electrode with max. 1%Ni

Extremely low hydrogen content  $H_{DM} < 3\text{ml}/100\text{g}$  (SRP)

Approx. 175% recovery, easy slag release, weldable on AC and DC

Filling horizontal V- and X-grooves

4 mm diam. also suitable for fillet welds

Reliable impact toughness at -60°C

Excellent X-ray quality

Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM} < 3\text{ ml}/100\text{g}$

## Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G

## Current type

AC / DC electr. + / -

## Approvals

CTL	DB	DNV	LR
+	+	4Y46H5	4YH5

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	$H_{DM}$
0.07	1.2	0.3	0.02	0.01	0.9	2 ml/100g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-40°C	-50°C
Required: AWSA5.5-96		min. 460	min. 550	min. 19	not required	
EN 499-94		min. 500	560-720	min. 22		min. 47
Typical values	AW	550	640	26	90	60

## Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0	6.3
	Length (mm)	450	450	450	450
Unit: SRP	Pieces / unit (nominal)	27	23	19	10
	Net weight/unit (kg)	2.0	2.4	2.8	1.9
Unit: Box	Pieces / unit		60	40	23
	Net weight/unit (kg)		6.0	6.1	5.4

## Identification

Imprint: 8018-G/Kryo1-180

Tip colour: pink

Kryo® 1-180: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	GP 240R
Pipe material	EN 10208-1	L290 GA, L360 GA
	EN 10208-2	L290, L360, L415, L445
	API 5 LX	X42, X46, X52, X60, X65
	EN 10216-1	P275 T1
	EN 10217-1	P275 T2, P355 N
Fine grained steel	EN 10113-2	S275, S355, S420, S460
	EN 10113-3	S275, S355, S420, S460
	EN 10137-2	S460

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	130 - 160							
4.0 x 450	170 - 240	AC	73	537	3.5	102.0	14	1.43
5.0 x 450	250 - 300	AC	78	772	5.0	156.7	9	1.45
6.3 x 450	280 - 390	AC	84	1171	6.9	234.6	6	1.45

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G
4.0	230	190	190
5.0	300	230	230
6.3	390	280	

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Low temperature basic electrode

## Classification

AWS A5.5-96 : E9018-G H4R  
EN 757-97 : E 55 6 Z B 32 H5

## General description

Basic all position offshore electrode for high strength steels (YS 420 - 500 N/mm<sup>2</sup>)

110 - 120% recovery

Extremely low hydrogen H<sub>DM</sub> < 3ml/100g (SRP)

Excellent impact toughness at -60°C

Good CTOD at -10°C

Also available in vacuum sealed Sahara ReadyPack® (SRP) H<sub>DM</sub> < 3 ml/100g

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	H <sub>DM</sub>
0.05	1.6	0.3	0.015	0.01	1.5	2 ml/100 g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-40°C	-50°C	-60°C
Required: AWS A5.5-96		min. 530	min. 620	min. 17	not required		
EN 757-97		min. 550	610-780	min. 18			min. 47
Typical values	AW	570	650	22	140	110	60

CTOD-value at -15°C > 0.30mm

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	450	450	450
Unit: Box	Pieces / unit (nominal)	135	120	85	55
	Net weight/unit (kg)	2.7	5.8	5.9	5.7
Unit: SRP	Pieces/unit	70	50	28	23
	Net weight/unit (kg)	1.4	2.4	2.0	2.5

## Identification

Imprint: 9018-G/Kryo 2

Tip colour: green

Kryo® 2: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S355
Cast steel	EN 10213-2	GP 240R
Pipe material	EN 10208-1	L290 GA, L360 GA
	EN 10208-2	L290, L360, L415, L445, L480
	API 5 LX	X42, X46, X52, X60, X65, X70
	EN 10216-1	P275 T1
	EN 10217-1	P275 T2, P355 N
Fine grained steel	EN 10113-2	S275, S355, S420, S460
	EN 10113-3	S275, S355, S420, S460
	EN 10137-2	S460, S500
Low temperature steel	EN 10028-4	11 MnNi 5-3, 13 MnNi 6-3, 15 NiMn 6
	EN 10222-3	13 MnNi 6-3, 15 NiMn 6

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	55 - 85	DC+	59	85	0.72	19.4	86	1.65
3.2 x 450	80 - 140	DC+	80	268	1.2	46.8	36	1.70
4.0 x 450	120 - 170	DC+	89	445	1.8	70.0	22	1.52
5.0 x 450	180 - 240	DC+	96	598	2.6	103.8	14	1.51

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	80	80	85	80	80
3.2	140	120	145	120	120	120
4.0	150	140	150	140	135	140
5.0	220	210	210	170		

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Low temperature basic electrode

## Classification

AWS A5.5-96 : E8018-C1 H4  
EN 449-94 : E 46 8 3Ni B 32 H5\*

\* Deviation: see remarks

## General description

The basic all position offshore electrode with approx. 2.5% Ni

115-120% recovery

Excellent impact toughness at -80°C

Good CTOD at -10°C

Extremely low hydrogen  $H_{DM}$  <3ml/100g (SRP)

Also available in vacuum sealed Sahara ReadyPack® (SRP)  $H_{DM}$  <3 ml/100g

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

ABS	BV	CTL	DNV	GL	LR	RINA	TÜV
+	UP	+	5YH10	6Y42H10	5Y40H	5YH5	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	$H_{DM}$
0.05	0.7	0.3	0.015	0.010	2.5	2 ml/100 g

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-59°C	-60°C	-80°C
Required: AWSA5.5-96	SR	min. 460	min. 550	min. 19	min. 27		
EN 499-94		min. 460	530-680	min. 20			min. 47
Typical values	AW	500	600	26		120	60

CTOD value at -10°C > 0.25 mm

Stress relieved SR = 605±14°C/1h

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	3.2	4.0	4.0	5.0
	Length (mm)	350	350	450	350	450	450
Unit: Box	Pieces / unit (nominal)	135	120		85		55
	Net weight/unit (kg)	2.7	4.2		4.4		5.7
Unit: SRP	Pieces / unit	70	50	50	28	28	23
	Net weight/unit (kg)	1.4	1.9	2.4	1.5	2.0	2.5

## Identification

Imprint: 8018-C1/Kryo 3

Tip colour: silver

Kryo® 3: rev. EN 15

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S355
Pipe material	EN 10208-2 API 5 LX	L360, L415, L445 X52, X56, X60, X65
Fine grained steel	EN 10113-2 EN 10113-3	S355, S420 S355, S420
Low temperature steel	EN 10028-4 EN 10222-3	11 MnNi 5-3, 13 MnNi 6-3, 15 NiMn 6 (12 Ni 14 G 1, G 2) 13 MnNi 6-3, 15 NiMn 6

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	55 - 80	DC+	57	103	0.72	19.5	88	1.71
3.2 x 350	80 - 140	DC+	65	218	1.3	37.4	44	1.64
3.2 x 450	80 - 140	DC+	79	263	1.4	48.5	33	1.59
4.0 x 350	120 - 170	DC+	74	344	1.6	52.7	30	1.57
4.0 x 450	120 - 170	DC+	100	463	1.7	69.8	21	1.45
5.0 x 450	180 - 240	DC+	103	723	2.5	104.8	14	1.48

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	80	80	85	80	80
3.2	140	120	145	120	120	120
4.0	150	140	150	140	135	140
5.0	220	210	210	170		

## Remarks

Deviations: chemical composition:

Ni = 2.25 - 2.75%

EN: Ni = 2.6 - 3.8%

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

# Creep resistant basic electrode

## Classification

AWS A5.5-96 : E7018-A1 H4  
EN 1599-97 : E Mo B 32 H5

## General description

Basic, very low hydrogen all position electrode  $H_{DM} < 5\text{ml}/100\text{g}$

For welding creep resisting and fine grained steels

Service temperature from -40 up to 500°C

DC-welding preferred

115 - 120% recovery

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

CTL	DNV	TÜV
+	0,3 Mo	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Mo	$H_{DM}$
0.05	0.8	0.6	0.02	0.01	0.55	2 ml/100g

## Mechanical properties, all weld metal (for creep data see overleaf)

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-20°C
Required: AWS A5.5-96	SR1)	min. 390	min. 480	min. 25	not required	
EN 1599-97	SR2)	min. 355	min. 510	min. 22	min. 47	
Typical values	SR3)	560	620	25	140	30
	AW	550	610	25	160	70

Stress relieved: SR1) = 620±14°C/1h, SR2) = 570-620°C/1h, SR3) = 620°C/1h

## Packaging, available sizes and identification

		Diameter (mm)			
		2.5	3.2	4.0	5.0
Unit: Box	Length (mm)	350	350	350	450
	Pieces / unit (nominal)	110	120	85	55
Unit: SRP	Net weight/unit (kg)	2.5	4.5	4.7	6.0
	Pieces / unit	67	50	28	23
	Net weight/unit (kg)	1.4	2.0	1.5	2.6

## Identification

Imprint: 7018-A1/SL12G

Tip colour: blue

SL®12G: rev. EN 15



### Materials to be welded

Steel	Code	Type
Creep resisting steel	EN 10028-2	P295 G H, P355 G H, 16 Mo 3
	EN 10222-2	17 Mo 3, 14 Mo 6
Fine grained steel	EN 10113-2	S275, S355, S420
	EN 10113-3	S275, S355, S420

### Creep Data

Test temperature	°C	400	450	500	550
Yield strength Rp0.2%	N/mm <sup>2</sup>	420	380	330	
Creep strength Rm/1000	N/mm <sup>2</sup>		360	300	200
Creep strength Rm/10.000	N/mm <sup>2</sup>		320	180	80
Creep resistance Rp1%/10.000	N/mm <sup>2</sup>		230	150	65

### Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 90	DC+	65	118	0.7	22.8	84	1.92
3.2 x 350	80 - 130	DC+	69	230	1.3	37.9	42	1.59
4.0 x 350	120 - 180	DC+	81	373	1.6	54.8	28	1.56
5.0 x 450	160 - 240	DC+	106	799	2.4	107.4	14	1.52

\* stub end 35mm

### Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	85	80	85	80	80
3.2	130	120	130	120	120	120
4.0	150	145	140	140	140	140
5.0	225	225	210			

### Remarks

Recommended stress relieving temperature range: 580 - 630°C (time depends on material thickness)

### Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

# Creep resistant basic electrode

## Classification

AWS A5.5-96 : E8018-B2 H4  
EN 1599-97 : E CrMo1 B 32 H5

## General description

Basic very low hydrogen all position electrode  $H_{DM} < 5 \text{ ml/100g}$  (SRP)

For welding creep and hydrogen resistant Cr Mo-steels

maximum service temperature 550°C

DC-welding preferred

115 - 120% recovery

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

BV	CTL	DNV	RINA	TÜV
C1M	+	1Cr0.5Mo	C1M	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Cr	Mo	$H_{DM}$
0.06	0.75	0.6	0.015	0.01	1.1	0.5	3 ml/100g

## Mechanical properties, all weld metal (for creep data see overleaf)

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -20°C
Required: AWS A5.5-96	SR1)	min. 460	min. 550	min. 19	not required
EN 1599-97	SR2)	min. 355	min. 510	min. 20	min. 47
Typical values:	SR3)	570	640	24	180 50

Stress relieved: SR1) = 690±14°C/1h, SR2) = 660-700°C/1h, SR3) = 700°C/1h

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: Box	Pieces / unit (nominal)	110	120	85	55
	Net weight/unit (kg)	2.6	4.6	4.7	6.1
Unit: SRP	Pieces / unit	67	50	28	23
	Net weight/unit (kg)	1.4	2.0	1.5	2.6

## Identification

Imprint: 8018-B2/SL19G

Tip colour: red

SL®19G: rev. EN 15

### Materials to be welded

Steel	Code	Type
Creep resisting steel	EN 10028-2	13 CrMo 4-5
	EN 10083-1	25 CrMo 4
	EN 10222-2	14 CrMo 4-5
Tool steel	DIN 17210	16 MnCr 5

### Creep Data

Test temperature	°C	400	450	500	550	600
Yield strength Rp0.2%	N/mm <sup>2</sup>	460	440	430		
Creep strength Rm/1000	N/mm <sup>2</sup>			300	140	80
Creep strength Rm/10.000	N/mm <sup>2</sup>		350	240	110	50
Creep resistance Rp1%/10.000	N/mm <sup>2</sup>		250	170	80	35

### Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 90	DC+	63	114	0.71	21.0	80	1.67
3.2 x 350	80 - 130	DC+	68	227	1.3	37.9	41	1.56
4.0 x 350	120 - 180	DC+	79	367	1.6	54.9	29	1.59
5.0 x 450	160 - 240	DC+	103	777	2.5	106.9	14	1.52

\* stub end 35mm

### Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	85	80	85	80	80
3.2	130	120	130	120	120	120
4.0	150	145	140	140	140	140
5.0	225	225	210			

### Remarks

Recommended preheat temperature: 200 - 250°C

Recommended stress relieving temperature range 660 - 700°C (time depends on material thickness)

### Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Creep resistant basic electrode

## Classification

AWS A5.5-96 : E8018-B2 H4  
EN 1599-97 : E CrMo1 B 32 H5

## General description

Basic coated electrode for welding of Cr Mo-creep resistant steels  
Extra low hydrogen in the weldmetal  $H_{DM} < 5\text{ml}/100\text{g}$   
Excellent weldability for welding pipe and plate on site  
Reliable X-ray soundness  
Good mechanical properties in the as welded and stress relieved condition  
Applicable for service temperature from -20 to 500°C  
SL19G(STC) meets the actual "step cool" requirements including the Bruscato factor of  $X < 15$   
Only available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



## Current type

AC / DC electr. + / -

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Cr	Mo	Bruscato	$H_{DM}$
0.06	0.7	0.35	0.010	0.010	1.2	0.55	max. 15 ppm	3 ml/100g

## Mechanical properties, all weld metal (for creep data see overleaf)

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -20°C
Required: AWS A5.5-96	SR1)	min. 460	min. 550	min. 19	not required
EN 1599-97	SR2)	min. 355	min. 510	min. 20	min. 47
Typical values:	SR3)	570	640	24	180 150

Stress relieving: SR1) = 690±14°C/1h, SR2) = 660-700°C/1h, SR3) = 700°C/1h

Shifting CVN at 55 J(DeltaT55): +10°C after "STC" (step cool treatment)

## Packaging, available sizes and identification

	Length (mm)	350	350	350
	Diameter (mm)	2.5	3.2	4.0
Unit: SRP	Pieces / unit	69	50	28
	Net weight/unit (kg)	1.4	2.0	1.5

## Identification

Imprint: 8018-B2/SL19G(STC)

Tip colour: red

SL®19G(STC): rev. EN 15

## Materials to be welded

Steel	Code	Type
Creep resisting steel	EN 10028-2	13 CrMo 4-5
	EN 10083-1	25 CrMo 4
	EN 10222-2	14 CrMo 4-5
Tool steel	DIN 17210	16 MnCr 5

## Creep Data

Test temperature	°C	400	450	500	550	600
Yield strength Rp0.2%	N/mm <sup>2</sup>	460	440	430		
Creep strength Rm/1000	N/mm <sup>2</sup>			300	140	80
Creep strength Rm/10.000	N/mm <sup>2</sup>		350	240	110	50
Creep resistance Rp1%/10.000	N/mm <sup>2</sup>		250	170	80	35

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 90							
3.2 x 350	80 - 145	DC+	68	227	1.3	37.9	41	1.56
4.0 x 350	120 - 185	DC+	79	367	1.6	54.9	29	1.59

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
3.2	130	120	130	120	120	120
4.0	150	145	140	140	140	140

## Remarks

Recommended preheat temperature: 200 - 250 °C

Recommended stress relieving temperature range: 660 - 700°C (time depends on material thickness)

Stepcooling requirements: Bruscato factor  $X = (10 P + 5 Sb + 4 Sn + As)/100 \leq 15$  ppm and Mn + Si < 1.1

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Creep resistant basic electrode

## Classification

AWS A5.5-96 : E9018-B3 H4  
EN 1599-97 : E CrMo2 B 32 H5

## General description

Basic, very low hydrogen all position electrode  $H_{DM} < 5\text{ml}/100\text{g}$  (SRP)

For welding creep and hydrogen resistant CrMo-steels

maximum service temperature 600°C

DC-welding preferred

115-120% recovery

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

CTL	RINA	TÜV
+	C2M1	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Cr	Mo	$H_{DM}$
0.06	0.8	0.6	0.015	0.01	2.3	1.0	3 ml/100 g

## Mechanical properties, all weld metal (for creep data see overleaf)

		Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
						+20°C	-10°C
Required:	AWS A5.5-96	SR1)	min. 530	min. 620	min. 17	not required	
	EN 1599-97	SR2)	min. 400	min. 500	min. 18	min. 47	
Typical values :		SR3)	530	650	22	150	90

Stress relieving: SR1) = 690±14°C/1h, SR2) = 690-750°C/1h, SR3) = 695°C/1h

## Packaging, available sizes and identification

		Diameter (mm)	2.5	3.2	4.0	5.0
		Length (mm)	350	350	350	450
Unit: Box	Pieces / unit (nominal)		110	120	85	55
	Net weight/unit (kg)		2.6	4.7	4.8	6.2
Unit: SRP	Pieces / unit		67	50	28	23
	Net weight/unit (kg)		1.4	2.0	1.5	2.6

## Identification

Imprint: 9018-B3/SL20G

Tip colour: white

SL®20G: rev. EN 15

## Materials to be welded

Steel	Code	Type
Creep and hydrogen resistant steel	EN 10028-2	10 CrMo 9-10
	EN 10222-2	12 CrMo 9-10

## Creep Data

Test temperature	°C	400	450	500	550	600
Yield strength Rp0.2%	N/mm <sup>2</sup>	480	460	430		
Creep strength Rm/1000	N/mm <sup>2</sup>			240	160	100
Creep strength Rm/10.000	N/mm <sup>2</sup>			210	110	60
Creep resistance Rp1%/10.000	N/mm <sup>2</sup>			160	85	45

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 90	DC+	63	114	0.72	21.0	79	1.67
3.2 x 350	80 - 130	DC+	70	233	1.3	37.6	40	1.49
4.0 x 350	120 - 180	DC+	75	348	1.7	56.7	28	1.56
5.0 x 450	160 - 240	DC+	100	754	2.6	107.6	14	1.47

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	85	80	85	80	80
3.2	130	120	130	120	120	120
4.0	150	145	140	140	140	140
5.0	225	225	210			

## Remarks

Recommended preheat temperature: 200 - 300°C

Recommended stress relieving range: 690 - 750°C (time depends on material thickness)

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Creep resistant basic electrode

## Classification

AWS A5.5-96 : E9018-B3 H4  
EN 1599-97 : E CrMo2 B 32 H 5

## General description

Basic coated electrode for welding 2.25% Cr 1% Mo-creep and hydrogen resistant steels

Extra low hydrogen in the weld metal  $H_{DM} < 5 \text{ ml/100g}$  (SRP)

Excellent weldability for pipe and site welding

Reliable X-ray properties

Good mechanical properties in the as welded and stress relieved condition

Applicable for service temperature from -20 to 600°C

SL 20G (STC) meets the actual "step cool" requirements including the Bruscato factor  $X < 15$

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Cr	Mo	Bruscato	$H_{DM}$
0.10	0.6	0.35	0.01	0.01	2.3	1.0	max. 15 ppm	3 ml/100g

## Mechanical properties, all weld metal (for creep data see overleaf)

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-20°C
Required: AWS A5.5-96	SR1)	min. 530	min. 620	min. 17	not required	
	EN 1599-97 SR2)	min. 400	min. 500	min. 18	min. 47	
Typical values:	SR3)	540	640	20	160	80

Stress relieving: SR1) = 690±14°C/1h, SR2) = 690-750°C/1h, SR3) = 695°C/1h

Shifting CVN at 55 J(DeltaT55): +10°C after "STC" (step cool treatment)

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: SRP	Pieces / unit (nominal)	67	51	28	23
	Net weight/unit (kg)	1.4	2.0	1.5	1.6
Unit: box	Pieces / unit	110	120	85	xx
	Net weight/unit (kg)	2.6	4.7	4.8	xx

## Identification

Imprint: 9018-B3/SL20G (STC)

Tip colour: White

SL®20G(STC): rev. EN 15



## Materials to be welded

Steel	Code	Type
Creep and hydrogen	EN 10028-2	10 CrMo 9-10
resisting steel	EN 10222-2	12 CrMo 9-10

## Creep Data

Test temperature	°C	400	450	500	550	600
Yield strength Rp0.2%	N/mm <sup>2</sup>	480	460	430		
Creep strength Rm/1000	N/mm <sup>2</sup>			240	160	100
Creep strength Rm/10.000	N/mm <sup>2</sup>			210	110	60
Creep resistance Rp1%/10.000	N/mm <sup>2</sup>			160	85	45

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 95	DC+	63	114	0.72	21.0	79	1.67
3.2 x 350	80 - 145	DC+	70	233	1.3	37.6	40	1.49
4.0 x 350	120 - 185	DC+	75	348	1.7	56.7	28	1.56
5.0 x 450	160 - 260	DC+	100	754	2.6	107.6	14	1.47

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter(mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	85	80	85	80	80
3.2	130	120	130	120	120	120
4.0	150	145	140	140	140	140
5.0	225	225	210			

## Remarks

Recommended preheat temperature: 200 - 300°C

Recommended stress relieving temperature range: 680 - 750°C (time depends on material thickness)

Stepcooling requirements: Bruscato factor  $X = (10 P + 5 Sb + 4 Sn + As)/100 \leq 15$  ppm and Mn + Si < 1.1

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Creep resistant basic electrode

## Classification

AWS A5.5-96 : E8018-B1 H4  
EN 1599-97 : E Z B 32 H5

## General description

Basic, very low hydrogen all position electrode  $H_{DM} < 5\text{ ml/100g}$  (SRP)

For welding creep resistant CrMoV-steels

maximum service temperature 550°C

DC-welding preferred

115 - 120% recovery

Only available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

CTL TÜV  
+ +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Cr	Mo	V	$H_{DM}$
0.06	0.8	0.6	0.02	0.01	0.5	0.5	0.3	3 ml/100 g

## Mechanical properties, all weld metal (for creep data see overleaf)

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-10°C
Required: AWS A5.5-96	SR1)	min. 460	min. 550	min. 19	not required	
Typical values	SR2)	570	640	24	180	110

Stress relieve: SR1) = 690±14°C/1h, SR2) = 730°C/1h

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: SRP	Pieces / unit (nominal)	67	50	28	23
	Net weight/unit (kg)	1.4	2.0	1.5	2.6

## Identification

Imprint: 8018-B1/SL22G

Tip colour: orange

SL®22G: rev. EN 15

## Materials to be welded

Steel	Code	Type
Creep resistant steels	DIN	14MoV63 17MnMoV64 10CrSiMoV7

## Creep Data

Test temperature	°C	400	450	500	550	575
Yield strength Rp-0,2%	N/mm <sup>2</sup>	480	470	450		
Creep strength Rm/1000	N/mm <sup>2</sup>			270	170	150
Creep strength Rm/10.000	N/mm <sup>2</sup>			250	150	130
Creep resisteces Rp1%/10.000	N/mm <sup>2</sup>			210	130	110

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 90	DC+	64	115	0.70	21.0	82	1.69
3.2 x 350	80 - 130	DC+	71	238	1.2	37.5	41	1.54
4.0 x 350	120 - 180	DC+	76	353	1.6	55.8	30	1.64
5.0 x 450	160 - 220	DC+	101	762	2.6	106.6	14	1.49

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position	PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
Diameter (mm)	Current (A)					
2.5	80	85	80	85	80	80
3.2	130	120	130	120	120	120
4.0	150	145	140	140	140	140
5.0	225	225	210			

## Remarks

Recommended preheat temperature: 200 - 250°C

Recommended stress relieving temperature range: 690 - 740°C (time depends on material thickness)

## Application Advice

Electrodes after removal from cardboard boxes redry 2-4h 350 ± 25°C

## Creep resistant basic electrode

## Classification

AWS A5.5-96 : E8018-B6 H4  
EN 1599-97 : E CrMo5 B 32 H5

## General description

Basic, very low hydrogen all position electrode  $H_{DM} < 5\text{ ml/100g}$  (SRP)

For welding creep and hydrogen resistant 5% Cr-0.5% Mo-steels  
maximum service temperature 550°C

Developed for the petrochemical industry

Only available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

TÜV

+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Cr	Mo	$H_{DM}$
0.07	0.8	0.6	0.020	0.010	5.3	0.6	3 ml/100g

## Mechanical properties, all weld metal (for creep data see overleaf)

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.5-96	SR1)	min. 460	min. 550	min. 19	not required
EN 1599-97	SR2)	min. 400	min. 590	min. 17	min. 47
Typical values	SR3)	580	680	22	110

Stress relieve: SR1) = 740 ±14°C/1h, SR2) = 730-760°C/1h, SR3) = 750°C/2h

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: SRP	Pieces / unit (nominal)	70	52	29
	Net weight/unit (kg)	1.4	1.9	1.6

## Identification

Imprint: 8018-B6/SL502

Tip colour: brown

SL®502: rev. EN 15

## Materials to be welded

Steel	Code	Type
Creep and hydrogen resistant steel	DIN	12CrMo19.5 and equivalent grades
	ASTM	A182 F5 A213 T5 A335 P5 A336 F5 A369 FP5 A387 Grade 5

## Creep Data

Test temperature	°C	400	450	500	550	600
Yield strength Rp-0.2%	N/mm <sup>2</sup>	480	440	380		
Creep strength Rm/1000	N/mm <sup>2</sup>			160	140	80
Creep strength Rm/10.000	N/mm <sup>2</sup>			130	90	60
Creep resistance Rp1%/10.000	N/mm <sup>2</sup>			100	50	30

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 90	DC+	55	95	0.82	20.8	80	1.67
3.2 x 350	85 - 130	DC+	66	237	1.1	35.4	50	1.79
4.0 x 350	130 - 180	DC+	76	331	1.5	51.8	32	1.64

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	80	75	70	70	70
3.2	130	130	125	120	120	120
4.0	140	140	135	135	135	135

## Remarks

Formerly not classified but produced to the E502 composition ranges in A5.4-81: E502

Recommended preheat and interpasstemperature 200 - 300°C

Postweld heattreatment 730 - 760°C (time depends on material thickness)

## Creep resistant basic electrode

## Classification

AWS A5.5-96 : E9016-B9 H4  
EN 1599-97 : E CrMo91 B 32 H5

## General description

Basic, very low hydrogen all position electrode  $H_{DM} < 5\text{ ml/100g}$   
For welding creep and hydrogen resistant 9% Cr-1% Mo steels  
maximum service temperature 650°C  
Developed for power plants and the petrochemical industry  
Only available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



## Current type

AC / DC electr. + / -

## Approvals

TÜV  
+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Cr	Ni	Mo	Nb	V	N	$H_{DM}$
0.09	0.6	0.2	0.010	0.010	9.0	0.6	1.0	0.04	0.2	0.04	3 ml/100 g

## Mechanical properties, all weld metal (for creep data see overleaf)

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.5-96	SR1)	min. 530	min. 620	min. 17	not required
EN 1599-97	SR2)	min. 415	min. 585	min. 17	min. 47
Typical values	SR3)	650	800	20	50

Stress relieve: SR1) = 740±14°C/1h, SR2) = 750-770°C/2h, SR3) = 750-754°C/2h

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: SRP	Pieces / unit (nominal)	69	50	28	
	Net weight/unit (kg)	1.4	1.8	1.5	

## Identification

Imprint: 9016-B9/SL9Cr(P91)

Tip colour: dark green

SL®9Cr(P91): rev. EN 15

## Materials to be welded

Steel	Code	Type	Code	Type
Creep and hydrogen resistant steels	EN 10222-2 ASTM	X10CrMoV 9-1 A199 Grade T91 A200 Grade T91 A213 Grade T91 A335 Grade P91 A336 Grade F91	ASME	SA 182-F91  SA 213-T91 SA 335-P91 SA 336-F91 SA 369-FP91 SA 387-Grade 91

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 90	DC+	57	88	0.7	19.3	92	1.78
3.2 x 350	85 - 140	DC+	65	172	1.0	34.8	59	2.04
4.0 x 350	130 - 175	DC+	66	263	1.5	50.8	36	1.81

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	80	75	70	70	70
3.2	130	130	125	120	120	120
4.0	140	140	135	135	135	135

## Remarks

Recommended preheat and interpass temperature: 250 - 300°C

Recommended stress relieve temperature range: 750 - 780°C (time depends on material thickness)

## Stainless steel electrode

### Classification

AWS A5.4-92 : E308L-16  
EN 1600-97 : E 19 9 L R 12

### Temperature Range

pressure parts: -196...+350°C  
oxidation resistance: to 800°C

### General description

Rutile basic all position stainless steel electrode for 304L or equivalent steels  
Excellent corrosion resistance in oxidizing environments such as nitric acid  
High resistance to intergranular corrosion  
Smooth bead appearance  
Easy slag release  
Strong electrode coating  
Weldable on AC and DC  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

### Current type

AC / DC electr. + / -

### Approvals

BV	CTL	DB	TÜV
304L	+	+	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	FN
0.020	0.80	0.80	19.5	9.7	4-10

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J)		
					+20°C	-20°C	-196°C
Required: AWS A5.4-92		not required	min. 520	min. 35	not required		
EN 1600-97		min. 320	min. 510	min. 30	not required		
Typical values	AW	440	580	43	70	60	35

### Packaging, available sizes and identification

	Diameter (mm)	1.5	2.0	2.5	3.2	4.0	5.0
	Length (mm)	250	300	350	350	350	350
Unit: Box	Pieces / unit (nominal)	125	225	135	150	100	65
	Net weight/unit (kg)	0.7	2.3	2.6	4.8	4.9	4.8
Unit: SRP	Pieces / unit			69	56	29	
	Net weight/unit (kg)			1.4	1.9	1.5	

### Identification

Imprint: 308L-16/Arosta 304L

Tip colour: light blue

Arosta® 304L: rev. EN 15



## Materials to be welded

Steel grades	EN 10088-1/-2	EN 10213-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNi 19 11		1.4306	(TP)304L CF-3	S30403 J92500
X2 CrNiN 18 10			1.4311	(TP)304LN 302.304	S30453 S30400
Medium carbon C >0.03%	X4 CrNi 18 10		1.4301	(TP)304	S30409
		GX5 CrNi 19 10	1.4308	CF 8	J92600
Ti-, Nb stabilized	X6 CrNiTi 18 10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6 CrNiNb 18 10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ) - per electrode at max. current -	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
1.5 x 250	20 - 40	DC+	25	19	0.44	5.5	330	1.82
2.0 x 300	30 - 50	DC+	43	45	0.55	10.4	154	1.59
2.5 x 350	40 - 75	DC+	51	88	0.86	19.2	82	1.59
3.2 x 350	60 - 110	DC+	57	158	1.3	32.2	49	1.59
4.0 x 350	80 - 150	DC+	65	245	1.7	47.3	32	1.52
5.0 x 350	140 - 220	DC+	66	390	2.7	76.7	20	1.56

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
1.5		35	35			
2.0		45	45	40	40	40
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		
5.0	180	180	180			

For root passes DC- is recommended.

## Stainless steel electrode

## Classification

AWS A5.4-92 : E308L-16\*  
EN 1600-97 : E 19 9 L R 12

\* Deviation: see remarks

## Temperature Range

pressure parts: -196...+350°C  
oxidation resistance: to 800°C

## General description

A rutile-basic all position stainless steel electrode for 304L or equivalent steels

Mirror like bead appearance

Self releasing slag

Excellent side wall wetting, no undercut

Highly resistant to porosity

Weldable on AC and DC

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

CTL	DB	DNV	GL	LR	RMRS	TÜV
+	+	308LH10	4550	304L	304L	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	FN
0.025	0.75	0.95	19.0	9.7	4-10

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-20°C
Required: AWS A5.4-92		not required	min. 520	min. 35	not required	
EN 1600-97		min. 320	min. 510	min. 30	not required	
Typical values	AW	440	600	45	75	60

## Packaging, available sizes and identification

		Diameter (mm)				
		2.0	2.5	3.2	4.0	5.0
Unit: Box	Length (mm)	300	350	350	450	450
	Pieces / unit (nominal)	200	125	135	85	55
Unit: SRP	Net weight/unit (kg)	2.3	2.7	4.7	5.8	5.8
	Pieces / unit	60	65	52	28	22
	Net weight/unit (kg)	0.6	1.4	1.8	2.0	2.4

## Identification

Imprint: 308L-16/Limarosta 304L

Tip colour: light blue

Limarosta® 304L: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNi 19 11		1.4306	(TP)304L CF-3	S30403 J92500
X2 CrNiN 18 10			1.4311	(TP)304LN 302.304	S30453 S30400
Medium carbon C >0.03%	X4 CrNi 18 10		1.4301	(TP)304 CF 8	S30409 J92600
		GX5 CrNi 19 10	1.4308		
Ti-, Nb stabilized	X6 CrNiTi 18 10		1.4541	(TP)321 (TP)321H	S32100 S32109
X6 CrNiNb 18 10			1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy - per electrode at max. current - E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	35 - 50	DC+	40	51	0.59	11.6	151	1.75
2.5 x 350	45 - 80	DC+	51	103	0.88	21.7	81	1.75
3.2 x 350	80 - 115	DC+	57	177	1.3	34.3	48	1.64
4.0 x 450	100 - 155	DC+	83	373	1.8	68.0	24	1.64
5.0 x 450	150 - 220	DC+	85	577	2.7	106.2	16	1.67

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.0		45	45	40	40	40
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140			
5.0	180	180				

For root passes DC- is recommended.

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Stainless steel electrode

## Classification

AWS A5.4-92 : E308L-15  
EN 1600-97 : E 19 9 L R 21

## Temperature Range

pressure parts: -196...+350°C  
oxidation resistance: to 800°C

## General description

A rutile-basic stainless steel electrode for welding 304L or equivalent steels  
Specially developed for vertical down welding on DC  
Root passes in grooves with root opening  
High corrosion resistance in oxidizing environments

## Welding positions



ISO/ASME PG/3G down

## Current type

DC electr. +

## Approvals

DB	TÜV
+	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	FN
0.020	0.8	0.7	20.0	9.8	4-10

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-20°C
Required: AWS A5.4-92		not required	min. 520	min. 35	not required	
EN 1600-97		min. 320	min. 510	min. 30	not required	
Typical values	AW	440	600	40	70	50

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2
	Length (mm)	300	300
Unit: Box	Pieces / unit (nominal)	190	130
	Net weight/unit (kg)	2.9	3.1

## Identification

Imprint: 308L-15/Vertarosta 304L

Tip colour: grey

Vertarosta® 304L: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNi 19 11		1.4306	(TP)304L CF-3	S30403 J92500
	X2 CrNiN 18 10		1.4311	(TP)304LN 302.304	S30453 S30400
Medium carbon C >0.03%	X4 CrNi 18 10		1.4301	(TP)304	S30409
		GX5 CrNi 19 10	1.4308	CF 8	J92600
Ti-, Nb- stabilized	X6 CrNiTi 18 10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6 CrNiNb 18 10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	60 - 70	DC+	44	65	0.81	15.0	101	1.52
3.2 x 300	80 - 110	DC+	51	117	1.2	23.5	59	1.39

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions	3G down
Diameter (mm)	Current (A)
2.5	70
3.2	100

## Stainless steel electrode

### Classification

AWS A5.4-92 : E308L-15  
EN 1600-97 : E 19 9 L B 22

### Temperature Range

pressure parts: -196...+350°C  
oxidation resistance: n.a.

### General description

Basic coated electrode for low temperature applications  
Low carbon content, good impact properties down to -196°C  
Good weldability and smooth bead appearance  
High resistance against oxidation up to 800°C  
Welding on DC electrode + is recommended

### Welding positions



### Current type

DC electr. +

### Approvals

TÜV  
+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	FN
0.025	1.8	0.4	19.0	10.0	4-10

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-196°C
Required: AWS A5.4-92		not required	min. 520	min. 35	not required	
EN 1600-97		min. 320	min. 510	min. 30	not required	
Typical values	AW	450	600	40	80	40

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	120	150	100
	Net weight/unit (kg)	2.4	4.8	4.8

### Identification

Imprint: 308L-15/Jungo 304L

Tip colour: dark blue

Jungo® 304L: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 10213-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNi 19 11		1.4306	(TP)304L CF-3	S30403 J92500
	X6 CrNiNb 18 10		1.4311	(TP)304LN 302.304	S30453 S30400
Medium carbon C >0.03%	X4 CrNi 18 10		1.4301	(TP)304	S30409
		GX5 CrNi 19 10	1.4308	CF 8	J92600
Ti-, Nb- stabilized	X6 CrNiTi 18 10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6 CrNiNb 18 10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	55 - 65	DC+	50	86	0.82	19.1	88	1.89
3.2 x 350	70 - 90	DC+	51	135	1.3	31.6	53	1.72
4.0 x 350	90 - 120	DC+	66	206	1.7	47.0	32	1.56

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	60	60	60	60	60
3.2	95	90	90	75	75	75
4.0	125	110	125	100	100	100

## Stainless steel electrode

## Classification

AWS A5.4-92 : E308L-16\*  
EN 1600-97 : E 19 9 L R 53

\* Deviation: see remarks

## Temperature Range

pressure parts: -120...+350°C  
oxidation resistance: to 800°C

## General description

A rutile-basic stainless steel electrode for 304L or equivalent steels  
High recovery (130%) providing high welding speed  
Good side wall wetting, no undercut, self releasing slag  
Only for down hand position  
Excellent for fillet welds and filling V- and X-grooves  
Weldable on AC and DC+ polarity  
Only available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F

## Current type

AC / DC electr. +

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	FN
0.020	0.6	0.9	19.0	10.0	4-10

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-20°C
Required: AWS A5.4-92		not required	min. 520	min. 35	not required	
EN 1600-97		min. 320	min. 510	min. 30	not required	
Typical values	AW	440	600	40	70	50

## Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	450	450	450
Unit: SRP	Pieces / unit (nominal)	31	23	19
	Net weight/unit (kg)	1.6	2.0	2.3

## Identification

Imprint: 308L-16/Limarosta 304L-130

Tip colour: light blue

Limarosta® 304L 130: rev. EN 15



## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNi 19 11		1.4306	(TP)304L CF-3	S30403 J92500
	X2 CrNiN 18 10		1.4311	(TP)304LN 302.304	S30453 S30400
Medium carbon C >0.03%	X4 CrNi 18 10		1.4301	(TP)304	S30409
		GX5 CrNi 19 10	1.4308	CF 8	J92600
Ti-, Nb stabilized	X6 CrNiTi 18 10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6 CrNiNb 18 10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	90 - 120	DC+	69	241	1.8	59.0	28	1.67
4.0 x 450	120 - 160	DC+	76	378	2.5	87.4	19	1.64
5.0 x 450	160 - 230	DC+	84	616	3.6	135.0	12	1.64

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F
3.2	110	105
4.0	155	150
5.0	175	175

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Stainless steel electrode

## Classification

AWS A5.4-92 : E347-16  
EN 1600-97 : E 19 9 Nb R 12

## Temperature Range

pressure parts: -120...+400°C  
oxidation resistance: to 800°C

## General description

Rutile-basic all position stainless steel electrode  
For Ti or Nb stabilized 304 or equivalent steels  
Excellent resistance in oxidizing environments such as nitric acid  
High resistance to intergranular corrosion  
Easy slag release and smooth bead appearance  
Strong electrode coating  
Weldable on AC and DC  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



## Current type

AC / DC electr. + / -

## Approvals

CTL	DB	TÜV
+	+	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Nb	FN
0.030	0.8	0.8	19.5	9.8	0.35	6-12

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					+20°C	-20°C	-60°C
Required: AWS A5.4-92		not required	min. 550	min. 25	not required		
EN 1600-97		min. 350	min. 550	min. 25	not required		
Typical values	AW	500	630	35	70	50	35

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	120	130	90
	Net weight/unit (kg)	2.6	4.7	4.9
Unit: SRP	Pieces / unit (nominal)	69	52	28
	Net weight/unit (kg)	1.4	1.8	1.4

## Identification

Imprint: 347-16/Arosta 347

Tip colour: gold

Arosta® 347: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Ti-, Nb stabilized	X6CrNiTi 18-10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6CrNiNb 18-10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5CrNiNb 19-10	1.4552	CF-8C 302	J92710
				(TP)304	S30400
Non stabilized	X4CrNi 18-10		1.4301	(TP)304L	S30403
	X2CrNi 19-11		1.4306	CF-8	J92600
		GX5CrNi 19-10	1.4308 1.4312		
				(TP)304H	S30409

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. (s)*	Energy - per electrode at max. current - E(kJ)	Dep.rate - H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 75	DC+	52	78	0.87	20.7	80	1.66
3.2 x 350	60 - 110	DC+	54	119	1.4	34.9	48	1.67
4.0 x 350	80 - 150	DC+	64	210	1.7	49.0	33	1.61

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		

For root passes DC- is recommended.

## Stainless steel electrode

### Classification

AWS A5.4-92 : E347-15  
EN 1600-97 : E 19 9 Nb B 22

### Temperature Range

pressure parts: -120...+400°C  
oxidation resistance: to 800°C

### General description

Basic coated all position stainless steel electrode  
For Ti or Nb stabilized 304 or equivalent steels  
Excellent resistance in oxidizing environments such as nitric acid  
High resistance to intergranular corrosion  
Easy slag release and smooth bead appearance  
Strong electrode coating

### Welding positions



### Current type

DC electr. +

### Approvals

TÜV  
+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Nb	FN
0.020	1.6	0.5	20.0	10.0	0.40	6-12

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					+20°C	-20°C	-120°C
Required: AWS A5.4-92		not required	min. 520	min. 30	not required		
EN 1600-97		min. 350	min. 550	min. 25	not required		
Typical values	AW	500	630	35	80	50	40

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	450
Unit: Box	Pieces / unit (nominal)	150	100	75
	Net weight/unit (kg)	4.8	4.4	6.8

### Identification

Imprint: 347-15/Jungo 347

Tip colour: brown

Jungo® 347: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Ti-, Nb stabilized	X6 CrNiTi 18-10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6 CrNiNb 18-10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5CrNiNb19-10	1.4552	CF-8C 302	J92710
				(TP)304	S30400
Non stabilized	X4 CrNi 18-10		1.4301	(TP)304L	S30403
	X2 CrNi 19-11		1.4306	CF-8	J92600
		GX5 CrNi 19-10	1.4308		
			1.4312		
				(TP)304H	S30409

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	80 - 100	DC+	51	135	1.3	32.4	53	1.72
4.0 x 350	100 - 130	DC+	66	206	1.7	44.4	32	1.56
5.0 x 450	130 - 160	DC+	69	378	2.3	90.9	23	1.92

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
3.2	95	90	90	75	75	75
4.0	125	110	125	100	100	100
5.0	150	150				

## Stainless steel electrode

### Classification

AWS A5.4-92 : E316L-16  
EN 1600-97 : E 19 12 3 L R 12

### Temperature Range

pressure parts: -120.....+350°C  
oxidation resistance: n.a.

### General description

Rutile-basic all position stainless steel electrode for 316L or equivalent steels

Molybdenum level min. 2.7%

High resistance to general and intergranular corrosion

Smooth weld appearance

Easy slag release

Strong electrode coating

Weldable on AC and DC

Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



### Current type

AC / DC electr. + / -

### Approvals

ABS	BV	CTL	DB	DNV	GL	LR	RINA	RMRS	TÜV
+	316L	+	+	316L	4571	316L	316L	316L	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	FN
0.020	0.8	0.8	18.0	11.5	2.85	4-10

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J)	
					-20°C	-120°C
Required: AWS A5.4-92		not required	min. 490	min. 30	not required	
EN 1600-97		min. 320	min. 510	min. 25	not required	
Typical values	AW	450	580	39	60	40

### Packaging, available sizes and identification

	Diameter (mm)	1.5	2.0	2.5	3.2	4.0	5.0
	Length (mm)	250	300	350	350	350	350
Unit: Box	Pieces / unit (nominal)	160	225	135	150	90	65
	Net weight/unit (kg)	0.8	2.4	2.7	4.9	4.8	5.0
Unit: SRP	Pieces/unit (nominal)		84	69	56	29	
	Net weight/unit (kg)		0.9	1.4	1.8	1.5	

### Identification

Imprint: 316L-16/Arosta 316L

Tip colour: pink

Arosta® 316L: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon C >0.03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
Ti-, Nb stabilized	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
1.5 x 250	20 - 40	DC+	25	19	0.44	5.8	330	1.92
2.0 x 300	30 - 50	DC+	42	44	0.58	10.7	150	1.61
2.5 x 350	40 - 75	DC+	50	86	0.88	19.9	82	1.61
3.2 x 350	60 - 110	DC+	57	157	1.3	32.9	49	1.61
4.0 x 350	80 - 150	DC+	64	240	1.7	49.2	32	1.59
5.0 x 350	140 - 220	DC+	67	396	2.6	77.1	20	1.59

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
1.5		35	35			
2.0		45	45	40	40	40
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		
5.0	180	180	180			

For root passes DC- is recommended.

## Stainless steel electrode

## Classification

AWS A5.4-92 : E316L-16  
EN 1600-97 : E 19 12 3 L R 12

## Temperature Range

pressure parts: -120.....+350°C  
oxidation resistance: n.a.

## General description

Rutile-basic all position stainless steel electrode for 316L or equivalent steels

Specially for welding stainless steel pipes with diameters of over 50 mm with wall thickness of about 2 mm

Welding on site in the pulp and paper industry

Easy welding in all positions, easy weld pool control, full penetration, good slag release

Molybdenum level min. 2.7 %

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PG/3G down



PG/5G down

## Current type

AC / DC electr. + / -

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	FN
0.02	0.7	0.85	18.1	11.5	2.85	4-10

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required: AWS A5.4-92		not required	min. 490	min. 30	not required
EN 1600-97		min. 320	min. 510	min. 25	not required
Typical values	AW	450	580	39	60

## Packaging, available sizes and identification

	Diameter (mm)	2.0	2.5
	Length (mm)	250	250
Unit: Box	Pieces / unit (nominal)	215	150
	Net weight/unit (kg)	1.9	2.0

## Identification

Imprint: 316L-16/Arosta 316LP

Tip colour: yellow

Arosta® 316LP: rev. EN 15



## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon C >0.03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
Ti-, Nb stabilized	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 250	30 - 60	DC+						
2.5 x 250	30 - 70	DC+						

\* stub end 35mm

## Stainless steel electrode

## Classification

AWS A5.4-92 : E316L-16\*  
EN 1600-97 : E 19 12 3 L R 12

\* Deviation: see remarks

## Temperature Range

pressure parts: -120...+350°C  
oxidation resistance: n.a.

## General description

A rutile-basic all position stainless steel electrode for 316L or equivalent steels

Molybdenum level min. 2.7%

Mirror like bead appearance

Self releasing slag

Good side wall fusion, no undercut

High resistance to porosity

Weldable on AC and DC

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

CTL	DB	DNV	LR	RMRS	TÜV
+	+	316LH10	316L	316L	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	FN
0.020	0.8	1.0	18.0	11.5	2.8	4-10

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J)		
					+20°C	-20°C	-105°C
Required: AWS A5.4-92		not required	min. 490	min. 30	not required		
EN 1600-97		min. 320	min. 510	min. 25	not required		
Typical values	AW	450	580	40	70	60	40

## Packaging, available sizes and identification

	Diameter (mm)	1.5	2.0	2.5	3.2	4.0	5.0
	Length (mm)	250	300	350	350	450	450
Unit: Box	Pieces / unit (nominal)	125	200	125	135	85	55
	Net weight/unit (kg)	0.8	2.3	2.7	4.8	5.9	5.9
Unit: SRP	Pieces / unit		57	65	52	28	22
	Net weight/unit (kg)		0.6	1.5	1.8	2.0	2.4

## Identification

Imprint: 316L-16/Limarosta 316L

Tip colour: pink

Limarosta® 316L: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
Medium carbon C >0.03%	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
			1.4571	316Ti	S31635
Ti-, Nb stabilized	X6 CrNiMoTi 17-12-2		1.4580	316Cb	S31640
	X6 CrNiMoNb 17-12-2		1.4550	(TP)347	S34700
	X6 CrNiNb 18-10		1.4552	CF-8C	J92710
		GX5 CrNiNb 19-10			

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
1.5 x 250	20 - 40							
2.0 x 300	35 - 50	DC+	39	49	0.59	11.4	155	1.79
2.5 x 350	45 - 80	DC+	46	92	0.95	21.5	83	1.79
3.2 x 350	80 - 115	DC+	51	157	1.5	35.3	48	1.69
4.0 x 450	100 - 155	DC+	75	339	1.9	69.2	24	1.69
5.0 x 450	150 - 220	DC+	85	577	2.7	107.8	16	1.69

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.0		45	45	40	40	40
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140			
5.0	180	180				

For root passes DC- is recommended.

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Stainless steel electrode

## Classification

AWS A5.4-92 : E316L-15  
EN 1600-97 : E 19 12 3 L R 21

## Temperature Range

pressure parts: -60...+400°C  
oxidation resistance: n.a.

## General description

A rutile-basic stainless steel electrode for welding 316L or equivalent steels  
Molybdenum level min. 2.7%  
Specially developed for vertical down welding on DC  
Root passes in grooves with root opening  
High general corrosion resistance

## Welding positions



ISO/ASME PG/3G down

## Current type

AC / DC electr. +

## Approvals

ABS	BV	CTL	DNV	GL	LR	TÜV
+	316L	+	316L	4429	316L	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	FN
0.020	0.7	0.85	18.0	11.5	2.8	4-10

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					+20°C	-20°C	-60°C
Required: AWS A5.4-92		not required	min. 490	min. 30	not required		
EN 1600-97		min. 320	min. 510	min. 25	not required		
Typical values	AW	500	620	35	50	45	35

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2
	Length (mm)	300	300
Unit: Box	Pieces / unit (nominal)	190	130
	Net weight/unit (kg)	2.9	3.1

## Identification

Imprint: 316L-15/Vertarosta 316L

Tip colour: brown

Vertarosta® 316L: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon C >0.03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
Ti-, Nb stabilized	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	60 - 70	DC+	44	71	0.83	14.9	98	1.47
3.2 x 300	80 - 110	DC+	47	118	1.3	23.9	59	1.41

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions	3G ( down)
Diameter (mm)	Current (A)
2.5	70
3.2	100

## Stainless steel electrode

### Classification

AWS A5.4-92 : E316L-15  
EN 1600-97 : E 19 12 3 L B 22

### Temperature Range

pressure parts: -120...+350°C  
oxidation resistance: n.a.

### General description

Basic coated electrode for low temperature applications  
Good impact properties down to -196°C  
Good weldability and smooth bead appearance  
Low carbon content  
Service temperature up to 400°C  
High resistance against general and intercrystalline corrosion

### Welding positions



### Current type

DC electr. +

### Approvals

BV  
316LBT

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	FN
0.025	1.6	0.4	18.5	11.0	2.7	4-10

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-196°C
Required: AWS A5.4-92		not required	min. 490	min. 30	not required	
EN 1600-97		min. 320	min. 510	min. 25	not required	
Typical values	AW	450	650	35	100	35

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	135	150	100
	Net weight/unit (kg)	2.7	4.8	4.8

### Identification

Imprint: 316L-15/Jungo 316L

Tip colour: red

Jungo® 316L: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMo 17-13-3		1.4429		
	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
Medium carbon C >0.03%	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
			1.4571	316Ti	S31635
Ti-, Nb stabilized	X6 CrNiMoTi 17-12-2		1.4580	316Cb	S31640
	X6 CrNiMoNb 17-12-2		1.4550	(TP)347	S34700
	X6 CrNiNb 18-10		1.4552	CF-8C	J92710
		GX5 CrNiNb 19-10			

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	50 - 70	DC+	50	86	0.82	19.2	88	1.89
3.2 x 350	60 - 90	DC+	51	135	1.3	31.3	53	1.72
4.0 x 350	80 - 120	DC+	66	206	1.7	47.6	32	1.56

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	60	60	60	60	60
3.2	95	90	90	75	75	75
4.0	125	110	125	100	100	100

## Stainless steel electrode

## Classification

AWS A5.4-92 : E316L-16\*  
EN 1600-97 : E 19 12 3 L R 53

\* Deviation: see remarks

## Temperature Range

pressure parts: -120...+350°C  
oxidation resistance: n.a.

## General description

A rutile-basic stainless steel electrode for welding 316L or equivalent steels

Molybdenum level min. 2.7%

High recovery (130%) providing high welding speed

Excellent side wall fusion, no undercut

Only for down hand welding

Excellent for fillet welds and filling of V- and X-grooves

Weldable on AC and DC+ polarity

Only available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F

## Current type

AC / DC electr. +

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	FN
0.020	0.65	1.0	18.0	11.5	2.8	4-10

## Mechanical properties, all weld metal

Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
				+20°C	-20°C	-105°C
Required: AWS A5.4-92 EN 1600-97	not required min. 320	min. 490 min. 510	min. 30 min. 25	not required not required		
Typical values	AW 450	580	40	70	60	40

## Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	450	450	450
Unit: SRP	Pieces / unit (nominal)	29	23	19
	Net weight/unit (kg)	1.7	2.0	2.3

## Identification

Imprint: 316L-16/Limarosta 316L 130 Tip colour: pink

Limarosta® 316L 130: rev. EN 15



## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon C >0.03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
Ti-, Nb stabilized	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	90 - 120	DC+	68	227	1.9	60.4	28	1.67
4.0 x 450	120 - 160	DC+	78	376	2.5	91.0	18	1.67
5.0 x 450	160 - 200	DC+	81	577	3.7	143.7	12	1.72

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F
3.2	110	105
4.0	155	150
5.0	175	175

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Stainless steel electrode

### Classification

AWS A5.4-92 : E318-16  
EN 1600-97 : E 19 12 3 Nb R 12

### Temperature Range

pressure parts: -60...+400°C  
oxidation resistance: n.a.

### General description

Rutile basic all position stainless steel electrodes for welding  
Ti or Nb stabilized 316 or equivalent steels  
High resistance to general and intergranular corrosion  
Smooth bead appearance  
Easy slag release  
Strong electrode coating  
Weldable on AC and DC  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



### Current type

AC / DC elektr. + / -

### Approvals

CTL	TÜV
+	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	Nb	FN
0.030	0.8	0.85	18.0	11.5	2.7	0.35	6-12

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					+20°C	-20°C	-60°C
Required: AWS A5.4-92		not required	min. 550	min. 25	not required		
EN 1600-97		min. 350	min. 550	min. 25	not required		
Typical values	AW	500	630	38	60	50	35

### Packaging, available sizes and identification

	Diameter (mm)	2.0	2.5	3.2	4.0	5.0
	Length (mm)	300	350	350	350	450
Unit: Box	Pieces / unit (nominal)	225	135	140	90	65
	Net weight/unit (kg)	2.4	2.8	5.0	4.8	6.7

### Identification

Imprint: 318-16 /Arosta 318

Tip colour: white

Arosta® 318: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon C >0.03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
Ti-, Nb stabilized	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	30 - 60	DC+	36	36	0.65	10.7	152	1.64
2.5 x 350	40 - 90	DC+	46	82	0.98	20.3	80	1.64
3.2 x 350	70 - 110	DC+	52	137	1.4	32.1	48	1.54
4.0 x 350	90 - 140	DC+	61	212	1.9	48.6	31	1.49

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.0		45	45	40	40	40
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		

For root passes DC- is recommended.

## Stainless steel electrode

### Classification

AWS A5.4-92 : E318-15\*  
EN 1600-97 : E 19 12 3 Nb B 22

\* Deviation: see remarks

### Temperature Range

### General description

Basic coated electrode for stabilized CrNiMo-steels

Service temperatures up to 400°C

Good bridging properties

Specially developed for highly restrained structures

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

### Current type

DC electr. + / -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	Nb	FN
0.025	1.5	0.4	18.0	11.0	2.7	0.5	6-12

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.4-92		not required	min. 550	min. 25	not required
EN 1600-97		min. 350	min. 550	min. 25	not required
Typical values	AW	430	650	30	90

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	135	150	100
	Net weight/unit (kg)	2.6	4.8	4.6

### Identification

Imprint: 318-15/Jungo 318

Tip colour: red

Jungo® 318: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon C >0.03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
Ti-, Nb stabilized	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	50 - 70	DC+	50	86	0.82	17.6	88	1.89
3.2 x 350	80 - 100	DC+	51	135	1.3	28.5	53	1.72
4.0 x 350	100 - 130	DC+	66	206	1.7	43.8	32	1.56

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	60	60	60	60	60
3.2	95	90	90	75	75	75
4.0	125	110	125	100	100	100

## Remarks

Deviations: chemical composition:

Ni = 10.0 - 13.0%

AWS: Ni = 11.0 - 14.0%

## Stainless steel electrode

### Classification

EN 1600-97 : E 18 16 5 N L R 32

### Temperature Range

pressure parts: -120...+400°C  
oxidation resistance: n.a.

### General description

Rutile-basic fully austenitic 4.5% Mo-containing stainless steel electrode

Electrode for welding AISI 317LN or equivalent stainless steels

High resistance to:

- pitting corrosion
- intergranular corrosion
- stress corrosion

Good impact toughness at low temperature

Easy slag release and good weld appearance

### Welding positions



### Current type

AC / DC electr. + / -

### Approvals

BV	CTL	DNV	GL	TÜV
UP	+	+	4439	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	N	FN
0.020	1.3	0.8	18.0	17.0	4.6	0.18	<0.3

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					+20°C	-20°C	-196°C
Required: EN 1600-97		min. 300	min. 480	min. 25	not required		
Typical values	AW	460	650	40	70	70	50

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	140	140	100
	Net weight/unit (kg)	2.8	4.7	5.1

### Identification

Imprint: Arosta 4439

Tip colour: red

Arosta® 4439: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI	UNS
Fully austenitic	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
CrNiMo-	X2 CrNiMoN 17-13-3		1.4429	(TP)316LN	S31653
corrosion	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
resistant steel	X2 CrNiMo 18-15-4		1.4438	317L	S31725
	X2 CrNiMoN 17-13-5		1.4439	317LN	S31726
	G-X2 CrNiMoN 17-13-4	GX2 CrNiMo 17-13-4	1.4446		
	G-X6 CrNiMo 17-13	GX6 CrNiMo 17-13	1.4448		

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 75	DC+	78	153	0.58	19.8	79	1.56
3.2 x 350	60 - 110	DC+	55	152	1.3	33.8	49	1.67
4.0 x 350	90 - 145	DC+	67	291	1.8	51.6	29	1.47

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	90	100	65	65	65
4.0	130	125	130	80		

For root passes DC- is recommended.

## Stainless steel electrode

### Classification

EN 1600-97 : E 20 16 3 Mn N L B 22

### Temperature Range

pressure parts: -269 ... +350°C  
oxidation resistance: n.a.

### General description

Basic coated electrode for fully austenitic CrNiMo-steels

Service temperature from -269°C to 350°C

Cryogenic austenitic stainless steels

Cryogenic nickel steels and their joining

Non magnetic stainless steels

### Welding positions



PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

ISO/ASME

### Current type

DC electr. +

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	N
0.030	7.3	0.4	20.0	16.0	3.0	0.16

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-196°C
Required: EN 1600-97		min. 320	min. 510	min. 25	not required	
Typical values	AW	460	650	35	80	50

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: Box	Pieces / unit (nominal)	135	150	100	70
	Net weight/unit (kg)	2.7	4.7	4.8	6.5

### Identification

Imprint: Jungo 4455

Tip colour: purple

Jungo® 4455: rev. EN 15



## Materials to be welded

Steel grades	Code	Type	W.Nr.	ASTM/ACI	UNS
Austenitic	EN 10088-1/-2	X2 CrNiN 18-10	1.4311	(TP)304LN	S30453
nitrogen alloyed		X2 CrNiMoN 17-11-2	1.4406	(TP)316LN	S31653
CrNi-and		X2 CrNiMoN 17-13-3	1.4429		
CrNiMo-steel		X2 CrNiMoN 17-13-5	1.4439	317LN	S31726
Austenitic	SEW 390	X2 CrNiMoN 22-15	1.3951		
A-magnetic		X2 CrNiMoN 18-14-3	1.3952		
steel		X2 CrNiMo 18-15	1.3953		
		X8 CrMnNi 18-8	1.3965		
Steel for	SEW 685	GX6 CrNi 18-10	1.6902		
low temperature		GX5 CrNiNb 18-10	1.6905		
		12 Ni 14	1.5637		
		X12 Ni 5	1.5680		

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. (s)*	Energy - E(kJ)	Dep.rate - H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	45 - 70	DC+	44	71	0.96	19.0	85	1.52
3.2 x 350	70 - 105	DC+	53	132	1.4	31.0	48	1.39
4.0 x 350	100 - 130	DC+	86	264	1.7	47.6	25	1.41
5.0 x 450	120 - 155	DC+	82	388	2.7	92.8	16	1.39

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	60	60	60	60	60
3.2	90	90	90	70		
4.0	140	115	130	95		
5.0	160	165				

## Stainless steel electrode

## Classification

AWS A5.4-92 : E310Mo-15\*  
EN 1600-97 : E 25 22 2 N L B 22\*

\* Deviation: see remarks

## Temperature Range

pressure parts: -40 ... +400°C  
oxidation resistance: n.a.

## General description

A basic high CrNiMo-alloyed fully austenitic all position electrode  
Excellent corrosion resistance in strong oxidizing and slightly reducing media  
Especially developed for urea and nitric acid plants  
High resistance to intergranular corrosion  
Excellent performance in the Huey-test  
Weldable on DC+ polarity

## Welding positions



## Current type

DC electr. +

## Approvals

TÜV

+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	N	FN
0.03	4.5	0.4	25.0	22.0	2.2	0.13	0.6

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-196°C
Required: AWS A5.4-92		not required	min. 550	min. 30	not required	
EN 1600-97		min. 320	min. 510	min. 25	not required	
Typical values	AW	400	620	35	90	50

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	135	150	100
	Net weight/unit (kg)	2.8	4.8	4.9

## Identification

Imprint: 310Mo-15/Jungo 4465

Tip colour: yellow

Jungo® 4465: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	W.Nr.	ASTM / ACI A240/A312/A351	UNS
Fully austenitic	X1 CrNiMoN 25-25-2	1.4465		
corrosion resistant	X3 CrNiMoTi 25-25	1.4577		
	X2 CrNi 19-11	1.4306	(TP)304L CF-3	S30403 J92500
CrNiMo-steel	X2 CrNiN 18-10	1.4311	(TP)304LN 310S	S30453 S31008

Also very well applicable for build-up welding on low alloyed steel, such as pipe plates

Bufferlayers for applications from -196°C to +350°C

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	50 - 75	DC+	50	86	0.82	21.5	88	1.89
3.2 x 350	70 - 105	DC+	51	135	1.3	32.5	53	1.72
4.0 x 350	100 - 135	DC+	66	206	1.7	48.5	32	1.56

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	60	60	60	60	60
3.2	95	90	90	75	75	75
4.0	125	110	125	100	100	100

## Remarks

Deviations: chemical composition:

Cr = 24.5 - 26.0%

Ni = 21.5 - 22.5%

Mn = 4.5 - 5.3%

AWS: Cr = 25.0 - 28.0%

AWS: Ni = 20.0 - 22.0%

AWS: Mn = 1.0 - 2.5%

EN: Mn = 1.0 - 5.0%

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Stainless steel electrode

### Classification

AWS A5.4-92 : E385-16\*  
EN 1600-97 : E 20 25 5 Cu N L R 12

\* Deviation: see remarks

### Temperature Range

pressure parts: -10 ... +400°C  
oxidation resistance: n.a.

### General description

A rutile-basic fully austenitic all position electrode

Smooth bead appearance

Easy slag release

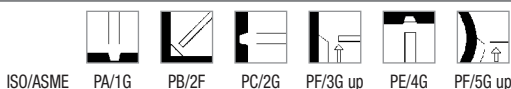
Especially developed for applications in:

- phosphoric acid and sulphuric acid
- paper mill equipment

World wide reputation for reliability

Weldable on DC+ polarity

### Welding positions



### Current type

DC electr. +

### Approvals

TÜV

+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	Cu
0.02	1.2	0.9	20.0	25.0	5.0	1.5

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-10°C
Required: AWS A5.4-92		not required	min. 520	min. 30	not required	
EN 1600-97		min. 320	min. 510	min. 25	not required	
Typical values	AW	410	620	40	80	100

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	145	185	125
	Net weight/unit (kg)	2.9	5.7	5.9

### Identification

Imprint:

Tip colour:

Jungo® 4500: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.
Fully austenitic NiCrMoCu- and CrNiMoCu-steel	X5 NiCrMoCuTi 20-18	GX7 NiCrMoCuNb 25-20	1.4500
			1.4506
		GX2 NiCrMoCuN 20-18	1.4531
	X1 NiCrMoCu 25-20-5	GX2 NiCrMoCuN 25-20	1.4536
			1.4539
	X5 NiCrMoCuNb 22-18	GX7 CrNiMoCuNb 18-18	1.4585
			1.4586

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 75	DC+	43	72	0.96	19.9	79	1.59
3.2 x 350	60 - 105	DC+	53	133	1.3	32.1	52	1.69
4.0 x 350	80 - 145	DC+	61	220	1.8	48.0	32	1.56

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		

## Remarks

Deviations: chemical composition:

Si = max. 1.0%

AWS: Si = max. 0.75%

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Stainless steel electrode

## Classification

AWS A5.4-92 : E2209-16\*  
EN 1600-97 : E 22 9 3 N L R 32

\* Deviation: see remarks

## Temperature Range

pressure parts: -40 ... +250°C  
oxidation resistance: n.a.

## General description

A rutile-basic all position electrode for duplex stainless steel welding  
Excellent weldability for filling as well as for root runs  
Applicable up to a service temperature of 250°C  
High resistance to general corrosion, pitting and stress corrosion (PRE<sub>N</sub> ~35)  
High yield strength > 500 N/mm<sup>2</sup>  
Weldable on AC and DC  
EMR-Sahara product  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

BV	CTL	DNV	GL	RINA	TÜV
2209	+	+	4462	2209	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	N	FN
0.020	0.8	1.0	22.5	9.5	3.2	0.16	30-55

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					+20°C	-30°C	-40°C
Required: AWS A5.4-92		not required	min. 690	min. 20	not required		
EN 1600-97		min. 450	min. 550	min. 20	not required		
Typical values	AW	650	800	27	60	50	40

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit: SRP	Pieces / unit (nominal)	69	52	29	24
	Net weight / unit (kg)	1.5	1.8	1.6	2.0
Unit: Box	Pieces / unit (nominal)	120	152	80	55
	Net weight / unit	2.6	5.0	4.8	4.6

## Identification

Imprint: 2209-16 / Arosta 4462

Tip colour: white

Arosta® 4462: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	W.Nr.	ASTM / ACI A240	UNS
Duplex- stainless steel	X2 CrNiMoN 22 -5-3	1.4462		S31803
		1.4417		S31500
	X3 CrNiMoN 27-5-2	1.4460		S31200
		1.4362		S32304

Dissimilar joints such as un- and low alloyed steel to duplex stainless steel

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 75	DC+	61	127	0.73	20.6	81	1.67
3.2 x 350	80 - 110	DC+	56	184	1.4	34.3	46	1.59
4.0 x 350	80 - 150	DC+	59	205	2.0	51.5	30	1.52
5.0 x 350	140 - 220	DC+	65	357	2.8	77.4	20	1.61

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		
5.0	180	180	180			

For root passes DC- is recommended.

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Application advice

Welding with heat input max. 2.5 kJ/mm

Interpass temperature max. 150°C

## Stainless steel electrode

### Classification

AWS A5.4-92 : E2209-15  
EN 1600-97 : E 22 9 3 N L B 22

### Temperature Range

pressure parts: -40 ... +250°C  
oxidation resistance: n.a.

### General description

A basic electrode for 22% Cr duplex stainless steel welding  
Excellent weldability for filling as well as for root runs  
Applicable up to a service temperature of 250°C  
High resistance to general corrosion, pitting and stress corrosion conditions  
High yield strength > 500 N/mm<sup>2</sup>  
Weldable on DC+ polarity  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

### Current type

DC electr. +

### Approvals

CTL	DNV
+	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	N	FN
0.025	1.6	0.5	23.5	9.0	3.0	0.15	30-60

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)			
					+20°C	-20°C	-40°C	-50°C
Required: AWS A5.4-92 EN 1600-97		not required min. 450	min. 690 min. 550	min. 20 min. 20	not required not required			
Typical values	AW	650	800	28	80	75	70	45

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	250	350	350
Unit: SRP	Pieces / unit (nominal)	69	55	30
	Net weight/unit (kg)	1.4	1.8	1.5
Unit: Box	Pieces / unit (nominal)	112	152	103
	Net weight/unit (kg)	2.3	5.0	5.0

### Identification

Imprint: 2209-15/Jungo 4462

Tip colour: red

Jungo® 4462: rev. EN 15



## Materials to be welded

Steel grades	EN 10088-1/-2	W.Nr.	ASTM / ACI A240	UNS
Duplex- stainless steel	X2 CrNiMoN 22 -5-3	1.4462		S31803
		1.4417		S31500
	X3 CrNiMoN 27-5-2	1.4460		S31200
		1.4362		S32304

Dissimilar joints such as un- and low alloyed steel to duplex stainless steel

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	50 - 80	DC+	74	101	0.62	21	78	1.64
3.2 x 350	70 - 110	DC+	84	219	0.88	33.8	49	1.64
4.0 x 350	100 - 140	DC+	80	304	1.4	50.8	32	1.61

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions	PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
Diameter (mm)	Current (A)					
2.5	60	60	60	60	60	60
3.2	85	80	90	80	80	80
4.0	120					

## Remarks

- interpass temperature depends on construction

## Stainless steel electrode

### Classification

AWS A5.4-92 : E2209-16\*  
EN 1600-97 : E 22 9 3 N L R 53

\* Deviation: see remarks

### Temperature Range

pressure parts: -40...+250°C  
oxidation resistance: n.a.

### General description

Rutile basic electrode for 22% duplex stainless steel welding with 145% recovery  
Suitable for X and V fillet welds in horizontal position  
Service temperature up to 250°C  
High resistance against general corrosion, pitting and stress corrosion (PRE<sub>N</sub> ~ 35)  
Yield point Rp 0.2 > 500 N/mm<sup>2</sup>  
Only available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



ISO/ASME PA/1G PB/2F

### Current type

AC / DC electr. +

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	N	FN
0.025	0.7	1.0	22.5	9.5	3.0	0.16	30-55

### Mechanical properties, all weld metal

Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	+20°C	Impact ISO-V(J) -20°C	-40°C
Required: AWS A5.4-92 EN 1600-97	not required min. 450	min. 690 min. 550	min. 20 min. 20	not required not required		
Typical values AW	650	800	27	60	50	35

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0
	Length (mm)	450	450
Unit: SRP	Pieces / unit (nominal)	31	12
	Net weight/unit (kg)	1.6	1.1

**Identification** Imprint: 2209-16 /Arosta 4462-145 Tip colour: white

Arosta® 4462-145: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	W.Nr.	ASTM / ACI A240	UNS
Duplex- stainless steel	X2 CrNiMoN 22-5-3	1.4462		S31803
		1.447		S31500
	X3 CrNiMoN 27-5-2	1.4460		S31200
		1.4362		S32304

Dissimilar joints such as on- and low alloyed steel to duplex stainless steel

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	90 - 110	DC+	82	305	1.6	57	28	1.65
4.0 x 450	120 - 150	DC+	86	426	2.3	91	18	1.64

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions	PA/1G	PB/2F
Diameter (mm)	Current (A)	
3.2	105	105
4.0	145	145

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Stainless steel electrode

### Classification

AWS A 5.4-92 : E2553-15\*  
EN 1600-97 : E 25 9 4 N L B 42

\* Deviation: see remarks

### Temperature Range

pressure parts: -20 ... +250°C  
oxidation resistance: n.a.

### General description

A fully basic all position "super duplex" electrode  
For welding "super duplex" 25% Cr stainless steel grades  
High resistance to pitting and crevice corrosion, e.g. in seawater; PREN > 40  
High strength and reliable impact toughness  
Good weldability on DC+ polarity  
Only available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

### Current type

DC electr. + / -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	N	FN
0.025	1.7	0.6	25.0	9.0	3.4	0.2	30-60

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -40°C
Required: AWS A5.4-92		not required	min. 760	min. 15	not required
EN 1600-97		min. 550	min. 620	min. 18	not required
Typical values	AW	750	870	25	45

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: SRP	Pieces / unit (nominal)	69	55	30
	Net weight/unit (kg)	1.4	1.8	1.5

### Identification

Imprint: 2553-16 / Jungo SD 2509

Tip colour: white

Jungo® SD 2509: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	E 102 13-4	W.Nr.	ASTM / ACI A276/A351/A473	UNS
Regular and Super duplex stainless steel	X2CrNiMoN 25-7-4		1.4410 1.4460 1.4462 1.4463	2205  CD-4MCu Zeron 100™	S31803  S32550 S32760
	X4 CrNiMoN 27-5-2				
	X2 CrNiMoN 22-5-3				
		GX6 CrNiMo 24-8-2			

Super duplex stainless steel grades: chemical composition approximately:  
24-27% Cr, 6-9% Ni, 3-4% Mo, 0.10-0.25% N alloyed also with Cu and/or W (Zeron 100™)

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	45 - 70	DC+	74	101	0.62	21.0	78	1.64
3.2 x 350	70 - 100	DC+	84	219	0.88	33.8	49	1.64
4.0 x 350	100 - 130	DC+	80	304	1.4	50.8	32	1.61

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	60	60	60	60	60
3.2	85	80	90	80	80	80
4.0	120	120	120	100	100	100

## Remarks

Deviations: chemical composition:

Mn = 0.5 - 2.0%

AWS: Mn = 0.5 - 1.5%

Ni = 8.0 - 10.5%

AWS: Ni = 6.5 - 8.5%

N = 0.20 - 0.30%

AWS: N = 0.10 - 0.25%

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Stainless steel electrode

## Classification

AWS A 5.4-92 : E2553-15\*  
EN 1600-97 : E 25 9 4 N L B 42

\* Deviation: see remarks

## Temperature Range

pressure parts: -20 ... +250°C  
oxidation resistance: n.a.

## General description

A fully basic all position "super duplex" electrode  
For welding Zeron 100 and other "super duplex" stainless steel grades  
Fully cored wire alloyed electrode (including W+Cu)  
High resistance to pitting and crevice corrosion, e.g. in seawater; PREN > 40  
High strength and reliable impact toughness  
Good weldability on DC+ polarity  
Only available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

DC electr. + / -

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	Cu	W	N	FN
0.03	0.8	0.3	25.0	9.5	3.6	0.8	0.7	0.2	30-60

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-20°C	-46°C
Required: AWS A5.4-92		not required	min. 760	min. 15	not required	
EN 1600-97		min. 550	min. 620	min. 18	not required	
Typical values	AW	740	920	24	50	45

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: SRP	Pieces / unit (nominal)	69	52	15
	Net weight/unit (kg)	1.4	1.8	0.8

## Identification

Imprint: Jungo Zeron 100X

Tip colour: purple

Jungo® Zeron 100X: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	E 102 13-4	W.Nr.	ASTM / ACI A276/A351/A473	UNS
Regular and Super duplex stainless steel	X2CrNiMoN 25-7-4		1.4410 1.4460 1.4462 1.4463	2205  CD-4MCu Zeron 100	S31803  S32550 S32760
	X4 CrNiMoN 27-5-2				
	X2 CrNiMoN 22-5-3				
		GX6 CrNiMo 24-8-2			

Super duplex stainless steel grades: chemical composition approximately:

24-27% Cr, 6-9% Ni, 3-4% Mo, 0.10-0.25% N alloyed also with Cu and/or W (Zeron 100™)

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	45 - 70	DC+	74	101	0.62	21.0	78	1.64
3.2 x 350	70 - 100	DC+	84	219	0.88	33.8	49	1.64
4.0 x 350	100 - 130	DC+	80	304	1.4	50.8	32	1.61

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	60	60	60	60	60
3.2	85	80	90	80	80	80
4.0	120	120	120	100	100	100

## Remarks

Deviations: chemical composition:

Ni = 8.0 - 10.5%

AWS: Ni = 6.5 - 8.5%

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Stainless steel electrode

### Classification

AWS A5.4-92 : E309L-16  
EN 1600-97 : E 23 12 L R 32

### Temperature Range

pressurized parts: -120...+350°C  
scaling resistance: n.a.

### General description

A rutile-basic high CrNi alloyed buffer electrode  
For welding stainless steel to mild steel and root passes in clad steel  
Applicable for root passes in N alloyed AISI 304LN steels  
Excellent weldability and slag release  
High resistance to embrittlement  
Weldable on AC and DC+ polarity  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



### Current type

AC / DC electr. +

### Approvals

ABS	BV	CTL	RMRS	TÜV
+	309L	+	SS/CMn	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	FN
0.02	0.8	0.8	23.5	12.5	12-20

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)	Impact ISO-V(J)		
					+20°C	-20°C	-120°C
Required: AWS A5.4-92 EN 1600-97		not required min. 320	min. 520 min. 510	min. 30 min. 25	not required not required		
Typical values	AW	480	560	40	60	50	40

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit: Box	Pieces / unit (nominal)	135	150	100	65
	Net weight/unit (kg)	2.8	5.0	5.0	5.0
Unit: SRP	Pack Pieces / unit	69	56	31	
	Net weight/unit (kg)	1.4	1.9	1.5	

### Identification

Imprint: 309L-16/Arosta 309S

Tip colour: sea green

Arosta® 309S: rev. EN 15



## Materials to be welded

Steel grades	EN 10088-1/-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resisting and cladsteel	X2 CrNiN 18-10	1.4311	(TP)304LN	S30453
	X2 CrNi 19-11	1.4306	(TP)304L	S30403
			CF-3	J92500
	X4 CrNi 18-10	1.4301	(TP)304	S30400

- Dissimilar metals (mild and low alloyed steel to CrNi or CrNiMo stainless steel)
- Build-up welding on mild and low alloyed steel
- Butterlayer CrNi cladsteel

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 75	DC+	50	88	0.93	21.0	77	1.61
3.2 x 350	60 - 110	DC+	58	160	1.3	32.5	46	1.49
4.0 x 350	80 - 150	DC+	64	241	1.8	48.3	31	1.49
5.0 x 350	140 - 220	DC+	68	372	2.8	78.0	19	1.49

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		
5.0	180	180	180			

## Stainless steel electrode

## Classification

AWS A5.4-92 : E309L-16\*  
EN 1600-97 : E 23 12 L R 32

\* Deviation: see remarks

## Temperature Range

pressurized parts: -120 ... +350°C  
scaling resistance: n.a.

## General description

A rutile-basic all position CrNi over-alloyed buffer electrode  
Developed for welding stainless steel to mild steel and for clad steel  
Self releasing slag  
Excellent side wall wetting, no undercut, mirror like bead appearance  
High resistance to porosity  
Weldable on AC and DC+ polarity  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. +

## Approvals

CTL	DB	DNV	GL	LR	RMRS	TÜV
+	+	309L	4432	SS/CMn	SS/CMn	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	FN
0.020	0.8	1.0	23.0	12.5	10-20

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-20°C
Required: AWS A5.4-92		not required	min. 520	min. 30	not required	
EN 1600-97		min. 320	min. 510	min. 25	not required	
Typical values	AW	480	560	40	55	50

## Packaging, available sizes and identification

		Diameter (mm)				
		2.0	2.5	3.2	4.0	5.0
Unit: Box	Length (mm)	300	350	350	450	450
	Pieces / unit (nominal)	200	125	135	85	55
Unit: SRP	Net weight/unit (kg)	2.3	2.8	4.9	5.9	6.0
	Pack Pieces / unit	60	65	50	28	22
	Net weight/unit (kg)	0.6	1.5	1.8	2.0	2.4

## Identification

Imprint: 309L-16 / Limarosta 309S

Tip colour: sea green

Limarosta® 309S: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resisting	X2 CrNiN 18-10	1.4311	(TP)304LN	S30453
Cladsteel	X2 CrNi 19-11	1.4306	(TP)304L	S30403
			CF-3	J92500
	X4 CrNi 18-10	1.4301	(TP)304	S30400

- Dissimilar joints (mild and low alloyed steel to CrNi or CrNiMo stainless steel)

- Build-up welding on mild and low alloyed steel

- Bufferlayer CrNi-cladsteel

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	35 - 55	DC+	38	49	0.66	11.3	142	1.59
2.5 x 350	45 - 80	DC+	48	95	0.99	22.1	77	1.69
3.2 x 350	80 - 115	DC+	56	160	1.4	35.1	46	1.59
4.0 x 450	100 - 155	DC+	76	317	2.0	69.9	23	1.64
5.0 x 450	150 - 220	DC+	84	575	2.9	108.0	15	1.59

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.0		45	45	40	40	40
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140			
5.0	180	180				

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Stainless steel electrode

### Classification

AWS A5.4-92 : E309Cb-16\*  
EN 1600-97 : E 23 12 Nb R 32

\* Deviation: see remarks

### Temperature Range

pressurized parts: -10 ... +460°C  
scaling resistance: n.a.

### General description

A high CrNiNb-alloyed rutile-basic all position buffer electrode  
Specially developed for buffering mild and low alloyed steels for nuclear applications  
Also to be used as buffer electrode in AISI 321 and AISI 347 claddings  
Weldable on AC and DC+ polarity

### Welding positions



### Current type

AC / DC electr. +

### Approvals

TÜV  
+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Nb	FN
0.02	0.8	0.8	23.0	12.0	0.5	15-25

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-20°C
Required: AWS A5.4-92		not required	min. 550	min. 30	not required	
EN 1600-97		min. 350	min. 550	min. 25	not required	
Typical values	AW	490	660	35	60	50

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0
	Length (mm)	350	350
Unit: Box	Pieces / unit (nominal)	150	100
	Net weight/unit (kg)	5.2	5.0

Identification Imprint: 309Cb-16 /Arosta 309Nb Tip colour: gold

Arosta® 309Nb: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C < 0,03%	X2 CrNi 19-11		1.4306	(TP)304L CF-3	S30403 J92500
	X2 CrNiN 18-10		1.4311	(TP)304LN 302	S30453
Medium carbon C > 0.03%	X4 CrNi 18-10		1.4301	(TP)304	S30400
		GX5 CrNi 19-10	1.4308	CF-8	J92600
Ti-, Nb- stabilized	X6 CrNiTi 18-10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6 CrNiNb 18-10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	60 - 130	DC+	62	171	1.3	34.5	45	1.54
4.0 x 350	80 - 150	DC+	67	273	1.9	49.7	30	1.47

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
3.2	100	100	100	70	70	70
4.0	140	140	140	80		

## Remarks

Deviations: chemical composition:

Nb + Ta = min. 0.40%, max. 1.00%

AWS: Nb + Ta = min. 0.70%, max. 1.00%

## Stainless steel electrode

## Classification

AWS A5.4-92 : E309MoL-16  
EN 1600-97 : E 23 12 2 L R 32

## Temperature Range

pressurized parts: -10 ... +400°C  
scaling resistance: n.a.

## General description

A high CrNiMo alloyed all position rutile-basic electrode

High corrosion resistance

Specially developed for welding stainless steel to mild steel and root runs in cladding

max. plate thickness in butt welds ~ 12mm

Suitable for repair welding in dissimilar joints and steels difficult to weld

Weldable on AC and DC + polarity

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. +

## Approvals

ABS	BV	CTL	DB	DNV	GL	LR	RINA	RMRS	TÜV
+	309Mo	+	+	309Mo	4459	SS/CMn	309Mo	SS/CMn	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	FN
0.02	0.8	0.8	23.0	12.5	2.7	15-25

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					+20°C	-20°C	-60°C
Required: AWS A5.4-92		not required	min. 520	min. 30	not required		
EN 1600-97		min. 350	min. 550	min. 25	not required		
Typical values	AW	580	700	30	57	50	45

## Packaging, available sizes and identification

	Diameter (mm)	2.0	2.5	3.2	4.0	5.0
	Length (mm)	300	350	350	350	450
Unit: Box	Pieces / unit (nominal)	180	110	120	85	55
	Net weight/unit (kg)	2.4	2.6	4.7	4.8	5.4

## Identification

Imprint: 309Mo-16/Arosta 309Mo

Tip colour: light blue

Arosta® 309Mo: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
First layer in CrNiMo- claddings	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X10 CrNiMoTi 17-3		1.4573	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
		GX5 CrNiMo 19-11	1.4408		

- Welding dissimilar metals: mild steel or low alloyed steel to stainless CrNiMo-steel up to max. thickness of 12 mm.

- Build-up welding on mild or low alloyed steel

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	30 - 60	DC+	44	46	0.54	10.8	149	1.61
2.5 x 350	40 - 80	DC+	52	90	0.91	20.4	76	1.54
3.2 x 350	60 - 80	DC+	58	122	1.4	33.2	45	1.49
4.0 x 350	80 - 150	DC+	64	259	1.9	51.6	30	1.54
5.0 x 450	140 - 190	DC+	99	549	2.6	98.7	14	1.38

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.0		45	45	40	40	40
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		
5.0	180	180	180			

## Stainless steel electrode

## Classification

ASW A5.4-92 : E308MoL-16\*  
EN 1600-97 : E 20 10 3 R 32

\* Deviation: see remarks

## Temperature Range

pressurized parts: -20 ... +350°C  
scaling resistance: n.a.

## General description

A rutile-basic all position electrode for welding dissimilar joints  
The general purpose electrode for repair welding  
Suitable for hobby and professional applications  
Excellent bead appearance and slag release  
Also applicable for joining steels difficult to weld  
Weldable on AC and DC+ polarity

## Welding positions



## Current type

AC / DC electr. +

## Approvals

BV	CTL	DB	DNV	GL	TÜV
UP	+	+	308Mo	4431	+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	FN
0.025	0.8	1.0	20.0	9.5	2.3	20

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-20°C
Required: AWS A5.4-92		not required	min. 520	min. 35	not required	
EN 1600-97		min. 400	min. 620	min. 20	not required	
Typical values	AW	500	720	30	70	60

## Packaging, available sizes and identification

	Diameter (mm)	2.0	2.5	3.2	4.0	5.0
	Length (mm)	300	350	350	350	350
Unit: Box	Pieces / unit (nominal)	225	135	150	100	65
	Net weight/unit (kg)	2.5	2.7	4.9	5.0	5.0

## Identification

Imprint: 308MoL-16/Nichroma

Tip colour: mauve

Nichroma: rev. EN 15



## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
First layer in CrNiMo- claddings	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X10 CrNiMoTi 17-3		1.4573	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	GX5 CrNiMo 19-11		1.4408		

- Welding dissimilar metals: mild steel or low alloyed steel to stainless CrNi and CrNiMo-steel

- Build-up welding on mild or low alloyed steel

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	30 - 50	DC+	44	46	0.57	11.0	144	1.59
2.5 x 350	40 - 75	DC+	54	99	0.86	19.8	78	1.54
3.2 x 350	60 - 110	DC+	52	132	1.5	33.4	46	1.54
4.0 x 350	80 - 150	DC+	62	234	1.9	49.6	30	1.49
5.0 x 350	140 - 220	DC+	66	365	2.8	78.4	19	1.52

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.0		45	45	40	40	40
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		
5.0	180	180	180			

## Remarks

Deviations: chemical composition:

Si = 0.4 - 1.2%

AWS: Si = max. 0.90%

## Stainless steel electrode

## Classification

AWS A5.4-92 : E309Mo-26\*  
EN 1600-97 : E 23 12 2 LR 53\*

\* Deviation: see remarks

## Temperature Range

pressurized parts: -20 ... +350°C  
scaling resistance: n.a.

## General description

A rutile-basic synthetic high recovery (160%) electrode for shipbuilding  
For welding carbon steel to stainless steel in the down hand position  
Excellent for fillet welding  
High resistance to porosity on primed plate material  
Higher welding current can be used  
High deposit rate  
Smooth bead appearance and easy slag release  
Weldable on AC and DC+ polarity

## Welding positions



ISO/ASME PA/1G PB/2F

## Current type

AC / DC electr. +

## Approvals

ABS	BV	DNV	GL	RINA	RMRS
+	UP	309Mo	4431	309Mo	SS/CMn

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo	FN
0.05	0.7	1.0	23.7	12.8	2.4	15

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.4-92		not required	min. 550	min. 30	not required
EN 1600-97		min. 350	min. 550	min. 25	not required
Typical values	AW	550	740	28	50

## Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	4.5	5.0
	Length (mm)	450	450	600	450
Unit: Box	Pieces / unit (nominal)	90	55	40	35
	Net weight/unit (kg)	6.1	5.9	7.3	5.8

## Identification

Imprint: 309Mo-16 / Nichroma 160

Tip colour: sea green

Nichroma 160: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
	X2 CrNiMo 17-12-2 CF-3M	J92800	1.4404	(TP)316L	S31603
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X10 CrNiMoTi 17-3		1.4573	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
		GX5 CrNiMo 19-11	1.4408		

- Welding dissimilar metals: mild steel or low alloyed steel to stainless CrNiMo-steel up to max. thickness of 12 mm.
- Build-up welding on mild or low alloyed steel

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 450	140 - 170	DC+	86	409	1.9	68.1	22	1.52
4.0 x 450	180 - 230	DC+	80	644	3.0	105.5	15	1.59
4.5 x 600	200 - 250	DC+						
5.0 x 450	230 - 300	DC+	90	1084	4.1	162.0	10	1.59

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position:	PA/1G	PB/2F
Diameter (mm)	Current (A)	
3.2	175	140
4.0	200	180
5.0	230	230

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

C = max. 0.05%

AWS: Si = max. 0.90%

EN: C = max. 0.04%

## Stainless steel electrode

## Classification

EN 1600-97 : E 25 4 R 12\*

\* Deviation: see remarks

## Temperature Range

pressurized parts: -10 ... +350°C  
 scaling resistance: +1100°C

## General description

A rutile-basic all position stainless steel electrode

Typical applications:

- Buffer electrode, hardfacing on mild steels
- welding Cr-steels
- High corrosion resistance
- high proof stress and Tensile strength

A ferritic/austenitic structure

Good weldability and easy slag release

Weldable on AC and DC + polarity

## Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. +

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.08	0.7	1.2	25.0	4.5

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: EN 1600-97		min. 400	min. 600	min. 15	not required
Typical values	AW	500	700	15	30

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: Box	Pieces / unit (nominal)	135	150	100	65
	Net weight/unit (kg)	2.7	4.8	4.8	6.1

## Identification

Imprint: Arosta 329

Tip colour: orange

Arosta® 329: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI
Base metals		GX30 CrSi 6	1.4710	
for high	X10 CrSi 6		1.4712	502
temperature	X10 CrAl 7		1.4713	502
application				403/405-TP405-CA15
Center of weld	X10 CrAl 13		1.4724	410/414-TP405-CA15
to be weld		GX40 CrSi 17	1.4740	
with Arosta 309S	X10 CrAl 18		1.4742	430B-TP430-CB30
cap layers		GX40 CrSi 23	1.4745	TP433
welded with	X10 CrAl 24		1.4762	TP443
Arosta 329	X20 CrNiSi 25-4		1.4821	TP329
		GX40 CrNi 24-5	1.4822	TP329
		GX40 CrNiSi 27-4	1.4823	TP329HC

- Applications at high temperature when high Ni-content is unacceptable

- Also very well suitable for hard surfacing in sea water corrosion resisting Application

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 70	DC+	59	94	0.73	19.5	85	1.64
3.2 x 350	60 - 110	DC+	58	122	1.2	31.4	50	1.56
4.0 x 350	80 - 140	DC+	72	273	1.5	46.5	34	1.59
5.0 x 450	140 - 190	DC+	98	542	2.2	94.4	17	1.59

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		
5.0	180	180	180			

## Remarks

Deviations: chemical composition:

Si = max. 1.5%

EN: Si = max. 1.2%

## Stainless steel electrode

## Classification

AWS A5.4-92 : E312-16\*  
EN 1600-97 : E 29 9 R 12

\* Deviation: see remarks

## Temperature Range

pressurized parts: -10 ... +350°C  
scaling resistance: n.a.

## General description

A rutile-basic high CrNi-alloyed all position electrode

Excellent for repair welding

Specially developed for welding steels difficult to weld such as:

- armour plate - austenitic Mn-steel - high C-steel

Excellent weldability and self releasing slag

Weldable on AC and DC+ polarity

Also available in vacuum sealed Sahara ReadyPack® (SRP)

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. +

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.11	0.9	1.0	29.0	9.0

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.4-92		not required	min. 660	min. 22	not required
EN 1600-97		min. 450	min. 650	min. 15	not required
Typical values	AW	700	800	20	50

## Packaging, available sizes and identification

	Diameter (mm)	2.0	2.5	3.2	4.0	5.0
	Length (mm)	300	350	350	350	350
Unit: Box	Pieces / unit (nominal)		125	150	100	72
	Net weight/unit (kg)		2.6	5.0	5.0	5.2
Unit: SRP	Pack Pieces / unit	53	69	52	31	24
	Net weight/unit (kg)	0.6	1.5	1.8	1.5	1.7

## Identification

Imprint: 312-16/Limarosta 312

Tip colour: black

Limarosta® 312: rev. EN 15

**Materials to be welded**

Various steels grades as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic austenitic steels
- Work hardening austenitic manganese steels
- Dissimilar steel grades (CMn-steels to stainless steel) up to max. thickness of 12 mm

**Calculation data**

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	40 - 55	DC+	41	45	0.59	12.0	150	1.80
2.5 x 350	50 - 70	DC+	57	91	0.73	20.7	87	1.79
3.2 x 350	70 - 100	DC+	60	126	1.1	33.0	52	1.72
4.0 x 350	100 - 130	DC+	72	273	1.4	49.7	35	1.72
5.0 x 350	130 - 140	DC+	79	313	2.4	71.5	19	1.36

\* stub end 35mm

**Welding parameters, optimum fill passes**

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	90	100	65	65	65
4.0	130	125	130	80		
5.0						

**Remarks**

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Stainless steel electrode

## Classification

AWS A5.4-92 : E307-16\*  
 EN 1600-97 : E 18 8 Mn R 12

\* Deviation: see remarks

## Temperature Range

pressurized parts: -60 ... +350°C  
 scaling resistance: n.a.

## General description

A rutile- basic all position 5%Mn-alloyed stainless steel electrode

Especially developed for steels difficult to weld, such as:

- Armour plate
- Austenitic high Mn-steels

Often used for buffer layers in "hardfacing" applications

Weldable on AC and DC+ polarity

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. +

## Approvals

TÜV

+

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.09	5.0	0.6	18.5	8.5

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-60°C
Required: AWS A5.4-92		not required	min. 590	min. 30	not required	
EN 1600-97		min. 350	min. 500	min. 25	not required	
Typical values	AW	450	650	35	110	75

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	125	135	85
	Net weight/unit (kg)	2.6	4.7	4.6

## Identification

Imprint: 307-16 /Arosta 307

Tip colour: dark blue

Arosta® 307: rev. EN 15



**Materials to be welded**

Various steel grades, such as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic austenitic steels
- Work hardening austenitic manganese steels
- Dissimilar steel grades (CMn-steels to stainless steel)
- Problem steels

**Calculation data**

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	70 - 80	DC+	52	108	0.74	20.4	94	1.92
3.2 x 350	90 - 120	DC+	56	148	1.2	34.7	54	1.87
4.0 x 350	110 - 140	DC+	84	251	1.3	53.6	33	1.77

\* stub end 35mm

**Welding parameters, optimum fill passes**

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	80	80	80	80	80	80
3.2	100	100	100	90		
4.0	140	115	130	110		

**Remarks**

Deviations: chemical composition:

Mn = 4.5 - 6.0%

AWS: Mn = 3.30 - 4.75%

## Stainless steel electrode

## Classification

AWS A5.4-92 : E307-15\*  
EN 1600-97 : E 18 8 Mn B 22

\* Deviation: see remarks

## Temperature Range

pressurized parts: -120 ... +400°C  
scaling resistance: n.a.

## General description

A fully basic all position 5%Mn-alloyed stainless steel electrode

Especially developed for steels difficult to weld, such as:

- Armour plate
- Austenitic high Mn-steels

Often used for buffer layers in "hardfacing" applications

Weldable on DC+ polarity

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. +

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.08	5.5	0.3	19.0	8.5

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-120°C
Required: AWS A5.4-92		not required	min. 590	min. 30	not required	
EN 1600-97		min. 350	min. 500	min. 25	not required	
Typical values	AW	500	650	35	100	35

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0	6.0
	Length (mm)	350	350	450	450	450
Unit: Box	Pieces / unit (nominal)	160	170	110	70	50
	Net weight/unit (kg)	2.8	5.0	6.5	6.5	6.4

## Identification

Imprint: 307-15 / Jungo 307

Tip colour: silver

Jungo® 307: rev. EN 15

**Materials to be welded**

Various steel grades, such as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic austenitic steels
- Work hardening austenitic manganese steels
- Dissimilar steel grades (CMn-steels to stainless steel)
- Problem steels

**Calculation data**

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	50 - 70	DC+	44	71	0.96	17.8	85	1.52
3.2 x 350	70 - 100	DC+	53	132	1.4	29.1	48	1.39
4.0 x 450	100 - 130	DC+	86	264	1.7	55.9	25	1.41
5.0 x 450	160 - 170	DC+	82	388	2.7	85.3	16	1.39
6.0 x 450	170 - 200	DC+						

\* stub end 35mm

**Welding parameters, optimum fill passes**

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	60	60	60	60	60
3.2	90	90	90	70		
4.0	140	115	130	95		
5.0	160	165				

**Remarks**

Deviations: chemical composition:

Mn = 4.5 - 6.5%

Ni = 5.7 - 9.5%

AWS: Mn = 3.30 - 4.75%

AWS: Ni = 9.0 - 10.7%

## Stainless steel electrode

### Classification

AWS A5.4-92 : E308H-16  
EN 1600-97 : E 19 9 H R 12

### Temperature Range

pressurized parts: -20 ... +730°C  
scaling resistance: to 800°C

### General description

A rutile-basic all position stainless steel electrode

Specially developed for high temperature applications (up to 730°C) - e.g. AISI 304H or W.Nr. 1.4948

Low sensitivity to precipitation of intermetallic phases

Weldable on AC and DC

Popular in petrochemical and nuclear industry

### Welding positions



### Current type

AC / DC electr. + / -

### Approvals

CTL

+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	FN
0.05	0.75	0.85	18.5	9.5	3-7

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-20°C
Required: AWS A5.4-92		not required	min. 550	min. 35	not required	
EN 1600-97		min. 350	min. 550	min. 30	not required	
Typical values	AW	450	600	44	70	50

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit: Box	Pieces / unit (nominal)	145	150	100	65
	Net weight/unit (kg)	2.8	4.8	4.9	4.8

### Identification

Imprint: 308H-16 /Arosta 304H

Tip colour: green

Arosta® 304H: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI	UNS
Medium carbon C >0.03%	X4 CrNi 18-10		1.4301	302 (TP)304 (TP)304H	S30400 S30409
		GX5 CrNi 19-10	1.4308 1.4948	CF8	J92600

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 75	DC+	51	89	0.99	19.4	79	1.54
3.2 x 350	60 - 110	DC+	58	121	1.3	31.5	48	1.52
4.0 x 350	80 - 150	DC+	64	258	1.8	48.0	32	1.54
5.0 x 350	140 - 220	DC+	72	493	2.3	72.6	22	1.56

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		
5.0	180	180	180			

For root passes DC- is recommended.

## Stainless steel electrode

## Classification

AWS A5.4-92 : E309-16\*  
EN 1600-97 : E 23 12 R 32\*

\* Deviation: see remarks

## Temperature Range

pressurized parts: -10 ... +400°C  
scaling resistance: 1100°C

## General description

A rutile basic all position stainless steel electrode

Special developed for high temperature applications like industrial furnaces (ovens)

High resistance to oxidation up to 1050°C

Weldable on AC and DC

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. + / -

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	FN
0.10	0.8	1.6	22.0	11.0	3-8

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.4-92		not required	min. 550	min. 30	not required
EN 1600-97		min. 350	min. 550	min. 25	not required
Typical values	AW	500	700	30	50

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	120	130	90
	Net weight/unit (kg)	2.6	4.8	4.9

## Identification

Imprint: 309-16/Arosta 309H

Tip colour: yellow

Arosta® 309H: rev. EN 15

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI	UNS
		GX30 CrSi 6	1.4710		
	X10 CrAl 7		1.4713	502	
	X10 CrAl 13		1.4724	410/414-TP405-CA15	
		GX40 CrSi 13	1.4729		
		GX40 CrSi 17	1.4740		
	X10 CrAl 18		1.4742	430-TP430-CB30	
	X10 CrAl 24		1.4762	TP443	
		GX25 CrNiSi 18-9	1.4825		J92502
		GX40 CrNiSi 22-9	1.4826		
	X15 CrNiSi 20-12		1.4828	TP309	S30900
		GX25 CrNiSi 20-14	1.4832		
	X12 CrNiTi 18-9				

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 110	DC+	47	71	1.1	19.7	73	1.44
3.2 x 350	60 - 120	DC+	58	140	1.5	31.9	42	1.33
4.0 x 350	80 - 140	DC+	58	226	2.2	53.7	29	1.55

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		

For root passes DC- is recommended.

## Remarks

Deviations: chemical composition:

Si = max. 2.0%

AWS: Si = max. 0.90%

EN: Si = max. 1.2%

Cr = 21.0 - 23.0%, AWS: Cr = 22.0 - 25.0%

Ni = 11.0 - 13.0%, AWS: Ni = 12.0 - 14.0%

## Stainless steel electrode

## Classification

AWS A5.4-92 : E310-16  
EN 1600-97 : E 25 20 R 12

## Temperature Range

pressurized parts: -20 ... +400°C  
scaling resistance: 1100°C

## General description

Rutile basic electrode for all position welding except vertical down  
Fully austenitic weld metal with high Cr and Ni content for very high service temperature  
High resistance against oxidation and scaling up to 1100°C  
Avoid service temperatures between 650 - 850°C  
Weldable on AC and DC

## Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

## Current type

AC / DC electr. +

## Approvals

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.12	2.5	0.5	26.0	20.5

## Mechanical properties, all weld metal

Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.4-92	not required	min. 550	min. 30	not required
EN 1600-97	min. 350	min. 550	min. 20	not required
Typical values	AW 440	600	30	80

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit: Box	Pieces / unit (nominal)	145	150	100	62
	Net weight/unit (kg)	3.0	5.1	5.1	5.0

## Identification

Imprint: 310-16 /Intherma 310

Tip colour: dark green

Intherma® 310: rev. EN 15



## Materials to be welded

	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A351	UNS
Heat resisting steel	X10 CrAl 24	GX25 CrNiSi 18-9 GX40 CrNiSi 22-9	1.4762	310S CK20 HK40	S31008 J94202
			1.4825		
			1.4826		
	X15 CrNiSi 20-12	GX25 CrNiSi 20-14	1.4828		
			1.4832		
	X15 CrNiSi 25-20	GX40 CrNiSi 25-20	1.4841		
			1.4845		
	X12 CrNi 25-21		1.4848		

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	90 - 140	DC+	56	155	1.31	31.8	49	1.56
4.0 x 350	130 - 175	DC+	72	233	1.55	50.7	32	1.64
5.0 x 350	165 - 200							

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
3.2	130	120	130	110	110	110
4.0	160	160	160	140		

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 100°C

## Stainless steel electrode

### Classification

AWS A5.4-92 : E310-15\*  
EN 1600-97 : E 25 20 B 12

\* Deviation: see remarks

### Temperature Range

pressurized parts: -20 ... +400°C  
scaling resistance: 1100°C

### General description

Basic coated electrode for all position welding except vertical down  
Fully austenitic weld metal with high Cr and Ni content for very high service temperature  
High resistance against oxidation and scaling up to 1100°C  
Avoid service temperatures between 650 - 850°C  
Weldable on DC only

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G

### Current type

DC electr. +

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.1	3.0	0.3	25.0	21.0

### Mechanical properties, all weld metal

Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.4-92	not required	min. 550	min. 30	not required
EN 1600-97	min. 350	min. 550	min. 20	not required
Typical values	AW 440	600	30	100

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	135	150	100
	Net weight/unit (kg)	2.4	4.3	4.3

### Identification

Imprint: 310-15 / Intherma 310 B

Tip colour: light green

Intherma® 310B: rev. EN 15

## Materials to be welded

	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI	UNS
Heat resisting steel	X10 CrAl 24		1.4762		
		GX25 CrNiSi 18-9	1.4825		
		GX40 CrNiSi 22-9	1.4826		
	X15 CrNiSi 20-12		1.4828		
		GX25 CrNiSi 20-14	1.4832		
	X15 CrNiSi 25-20		1.4841	310S CK20	S31008 J94202
	X12 CrNi 25-21		1.4845		
		GX40 CrNiSi 25-20	1.4848	HK40	

## Calculation data

Sizes Diam. x length (mm)	Current range type (A)	Current	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	60 - 70							
3.2 x 350	80 - 90							
4.0 x 350	110 - 130							

\* stub end 35mm

## Remarks

Deviations: chemical composition:

Mn = max. 5.0%

AWS: Mn = max. 2.5%

## Ni-base electrode

### Classification

AWS A5.4-92 : E383-16\*  
EN 1600-97 : E 27 31 4 Cu L R 12

\* Deviation: see remarks

### General description

A rutile-basic all position fully austenitic NiCrMoCu electrode  
Especially for phosphoric and sulphuric acid plants  
Designed for Mo and Cu alloyed high NiCr-alloyed grades  
Very smooth bead appearance and easy slag release  
Also approved for welding dissimilar metals for service up to 450°C  
High resistance to pitting (PREN ~40)

### Welding positions



### Current type

AC / DC electr. +

### Approvals

TÜV

+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cr	Mo	Cu
0.02	0.8	0.9	31.0	27.1	3.5	0.9

### Mechanical properties, all weld metal

Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.4-92	not required	min. 520	min. 30	not required
EN 1600-97	min. 240	min. 500	min. 25	not required
Typical values	AW 440	640	38	70

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: PE tube	Pieces / unit	91	66	45
	Net weight/unit (kg)	1.8	2.0	2.0

### Identification

Imprint: NiCro 31/27

Tip colour: orange

NiCro 31/27: rev. EN 15

## Materials to be welded

Material type	Code	Type	W.Nr.	ASTM/ACI	UNS
Copper alloyed CrNiMo- and NiCrMo-steels	EN 10088-1/-2	X1NiCrMoCu 31 27 4	1.4563		N08028
		X1NiCrMoCu 25-20-5	1.4539	Alloy 904L	N08904
	DIN 17744	NiCr 21 Mo	2.4858	Alloy 825	N08825
		NiCr 21 Mo 6Cu	2.4641	Alloy 825 h Mo	N08821
		X3NiCrMoTi 27 23	1.4503		

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ) E(kJ)	Dep.rate H(kg/h) H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	45-70	DC+	52	95	0.84	21.3	83	1.75
3.2x350	70-95	DC+	56	132	1.3	31.2	48	1.49
4.0x350	110-150	DC+	53	198	2.0	46.0	34	1.56

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	65	70	70	60	60	60
3.2	95	95	95	80	80	80
4.0	120	120				

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Ni-base electrode

### Classification

AWS A5.11M-97 : ENiCrMo-3  
ISO 14172-03 : E Ni 6625 (NiCr22Mo9Nb)

### General description

Fully basic Ni-base high CrMoNb alloyed austenitic all position electrode

Extreme high resistance to:

- general and intergranular corrosion
- pitting and crevice corrosion
- stress corrosion cracking

Suitable for welding dissimilar joints; high resistance to hot cracking

High resistance to high temperature oxidation (max. 1200°C) and carburization

Good impact toughness at low temperatures (down to -196°C), suitable for 9% Ni steel

### Welding positions



ISO/ASME



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

### Current type

DC electr. +

### Approvals

CTL	TÜV
+	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cr	Mo	Nb	Fe
0.03	0.5	0.35	62	22	9	3.4	2

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -196°C
Required: AWS A5.11-97		not required	min. 760	min. 30	not required
ISO 14172-02		min. 420	760	min. 27	not required
Typical values	AW	510	770	44	92

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	300	300	350
Unit: PE tube	Pieces / unit	94	61	45
	Net weight/unit (kg)	1.6	1.7	2.1

Identification Imprint: NiCrMo-3 / NiCro60/20 Tip colour: green

NiCro 60/20: rev. EN 15

## Materials to be welded

Material type	BS 1501 3076	DIN 17744/17465 SEW 595/680	W.Nr.	ASTM / ACI	UNS
NiCrMo-steel type 625 and welding dissimilar	NA 15	X10NiCrAlTi32 20 NiCr22Mo	1.4876 2.4605	Alloy800/800H	N08800/10
high NiCrMo-steels for corrosion and	NA 14	NiCr15Fe NiCr22Mo9Nb	2.4816 2.4856	B168-Alloy 600 B443-Alloy 625	N06600 N06625
heat resistant applications	NA 16	NiCr21Mo X1NiCrMoCuN25 20 6	2.4858 1.4529	B424-Alloy 825	N08825
		NiCr20Ti	2.4951	Alloy 75	N06075
		NiCr20TiA1	2.4952	Alloy 80A	N07080
		NiCr20CuMo	2.4660	Alloy 20	N08020
		X1NiCrMoCu25 20 5	1.4539		
		X2NiCrAlTi32 20	1.4558	Alloy 800L	N08800
		G-X10NiCrNb32 20	1.4859		
		X1CrNiMoCuN20 18 7	1.4547	254 SMO	S31254
Low alloyed steel		12Ni9	1.5680	A333-5%Ni	
		GS-10Ni19	1.5681	5%Ni cast	
		G-X8Ni9	1.5662	A353-9%Ni cast	K81340

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	45 - 70	DC+	44	80	0.95	17.2	87	1.51
3.2 x 300	70 - 100	DC+	44	101	1.5	26.8	55	1.48
4.0 x 350	100 - 130	DC+	53	215	2.2	46.4	30	1.41

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	55	60	60	60	60
3.2	90	80	85	80	80	80
4.0	120	120				

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Ni-base electrode

### Classification

AWS A5.11M-97 : ENiCrFe-2\*  
ISO 14172-03 : E Ni 6182 (NiCr15Fe6Mn)\*

\* Deviation: see remarks

### General description

Fully basic all position NiCr electrode  
High creep resistance up to 815°C  
High resistance to embrittlement  
High toughness at low temperature (-196°C)  
For welding, Ni base alloys (as Alloy 600) and dissimilar joints  
High resistance to carburization

### Welding positions



### Current type

DC electr. +

### Approvals

CTL	TÜV
+	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cr	Nb	Fe
0.02	4.4	0.45	bal.	18	1.9	6

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-196°C
Required: AWS A5.11-97		not required	min. 550	min. 30	not required	
ISO 14172-02		min. 360	min. 550	min. 27	not required	
Typical values	AW	430	680	40	145	130

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	300	300	350
Unit: PE tube	Pieces / unit	90	57	43
	Net weight/unit (kg)	1.6	1.9	2.1

Identification Imprint: NiCro70/15 Tip colour: silver

NiCro 70/15: rev. EN 15



## Materials to be welded

Material type	BS 3076	DIN 17742 SEW 470/595	W.Nr.	ASTM / ACI B366	UNS
Ni base on		LC-NiCr15Fe	2.4817		N06600
Cr alloyed steel,	NA14	NiCr15Fe	2.4816	Alloy600/B168	N06600
for high and low		NiCr23Fe	2.4851	Alloy601(H)	N06601
temperature service		NiCr60 15	2.4867		
		NiCr80 20	2.4869		
		NiCr20Ti	2.4951	Alloy75	N06075
	NA17	NiCr20TiAl	2.4952	Alloy80A	N07080
		X12NiCrSi36 16	1.4864	330	N08330
		G-X10NiCrNb32 20	1.4859		
	NA15	X10NiCrAlTi32 20	1.4876	Alloy800/800H	N08800/ N08810

Suitable for welding dissimilar metals:

- Mild- and low-alloyed steel to stainless steel
- Mild- and low-alloyed steel to Ni base alloys
- Stainless steel to low-alloyed creep resisting steel

Not sensitive for embrittlement after heattreatment

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	45 - 60	DC+	44	63	0.9	17.5	91	1.59
3.2 x 300	70 - 100	DC+	52	107	1.3	29.2	52	1.54
4.0 x 350	90 - 160	DC+	61	214	2.0	51.0	29	1.47

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	55	60	60	60	60
3.2	90	80	90	80	80	80
4.0	120	120				

## Remarks

Deviations: chemical composition:

Mn = 3.0 - 6.0%

Cr = max. 18.0%

AWS: Mn = 1.0 - 3.5%

AWS: Cr = max. 17.0%

ISO: Mn = 5.0 - 10%

ISO: Cr = max. 17%

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Ni-base electrode

### Classification

AWS A5.11M-97 : ENiCrFe-3  
ISO 14172-03 : E Ni 6182 (NiCr15Fe6Mn)

### General description

Fully basic all position NiCr electrode

For welding Ni-base alloys (as Alloy 600), claddings and dissimilar metals

High creep resistance up to 815°C, high resistance to embrittlement

High toughness also at low temperature (-196°C)

Low sensibility to carburization

Extra alloyed with ~6% Mn to provide hot cracking resistance

### Welding positions



### Current type

DC electr. +

### Approvals

CTL

+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	S	Ni	Cr	Nb
0.025	5.5	0.4	0.010	bal.	16	2.0

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -196°C
Required: AWS A5.11-97		not required	min. 550	min. 30	not required
ISO 14172-02		min. 360	min. 550	min. 27	not required
Typical values	AW	400	630	40	125

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	300	300	350	450
Unit: PE tube	Pieces / unit	91	57	39	45
	Net weight/unit (kg)	1.6	1.9	1.9	4.5

### Identification

Imprint: NiCrFe-3 / NiCro70/15Mn

Tip colour: yellow

NiCro 70/15Mn: rev. EN 15

## Materials to be welded

Material type	BS 3076	DIN 17742 SEW 470/595	W.Nr.	ASTM / ACI B366	UNS
Ni base on		LC-NiCr15Fe	2.4817		N06600
Cr alloyed steel,	NA14	NiCr15Fe	2.4816	Alloy600/B168	N06600
for high and low		NiCr23Fe	2.4851	Alloy601(H)	N06601
temperature service		NiCr60 15	2.4867		
		NiCr80 20	2.4869		
		NiCr20Ti	2.4951	Alloy75	N06075
		NiCr20TiAl	2.4952	Alloy80A	N07080
	NA17	X12NiCrSi36 16	1.4864	330	N08330
		G-X10NiCrNb32 20	1.4859		
	NA15	X10NiCrAlTi32 20	1.4876	Alloy800/800H	N08800/N08810

Suitable for welding dissimilar metals:

- Mild- and low-alloyed steel to stainless steel.
- Mild- and low-alloyed steel to Ni base alloys
- Stainless steel to low-alloyed creep resisting steel.

Not sensitive for embrittlement after heattreatment.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	40 - 70	DC+	80	119	0.52	17.4	86	1.49
3.2 x 300	70 - 100	DC+	77	193	0.84	29.0	56	1.61
4.0 x 350	90 - 140	DC+	74	289	1.7	50.9	29	1.47
5.0 x 450	130 - 160							

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	55	60	60	60	60
3.2	90	80	90	80	80	80
4.0	120	120				

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Ni-base electrode

### Classification

AWS A5.11-97 : ENiCrFe-2\*  
ISO 14172-03 : E Ni 6082 (NiCr20Mn3Nb)

\* Deviation: see remarks

### General description

Fully basic NiCr alloyed all position electrode  
For welding high Ni alloyed material such as Alloy 600 and Alloy 601  
Also applicable for welding dissimilar joints and for CMn- and low alloyed clad steel  
High resistance to oxidation at high temperature  
High impact toughness at low temperature (-196°C)

### Welding positions



### Current type

DC electr. +

### Approvals

TÜV  
+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cr	Mo	Nb	Fe
0.03	4.7	0.6	67.7	19.0	1.5	1.9	4.0

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-196°C
Required: AWS A5.11-97		not required	min. 550	min. 30	not required	
ISO 14172-02		min. 360	min. 600	min. 22	not required	
Typical values	AW	400	650	40	110	90

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	300	300	350
Unit: PE tube	Pieces / unit	76	57	31
	Net weight/unit (kg)	1.5	1.7	1.8

Identification Imprint: NiCro70/19 Tip colour: blue

NiCro 70/19: rev. EN 15

## Materials to be welded

Material type	BS3076	DIN 17744/17465 SEW 595	W.Nr.	ASTM/ACI B366	UNS
Ni base to	NA 14	NiCr15Fe	2.4816	B168-Alloy 600	N06600
CrNi alloyed steel		LC-NiCr15Fe	2.4817	Alloy 600L	N06600
for composition in		NiCr20Ti	2.4951	Alloy 75	
highly corrosive		NiCr20TiA1	2.4952	Alloy 80A	N07080
environments	NA 15	X10NiCrAlTi32 20	1.4876	Alloy 800/800H	N08800/10
		NiCr23Fe	2.4851	Alloy 601(H)	N06601
	NA 17	X12NiCrSi36 16	1.4864	330	N08330
		G-X40NiCrNb35 25	1.4852		
		G-X40NiCrSi35 25	1.4857	HP	

Suitable for welding dissimilar metals:

- Mild- and low-alloyed steel to stainless steel.
- Mild- and low-alloyed steel to Ni base alloys
- Stainless steel to low-alloyed creep resisting steel.

Not sensitive for embrittlement after heattreatment.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	45 - 65	DC+	41	61	0.95	19.3	92	1.79
3.2 x 300	70 - 95	DC+	59	127	1.2	32.7	51	1.64
4.0 x 350	100 - 140	DC+	75	314	1.7	59.3	29	1.72

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	55	60	60	55	60
3.2	90	80	90	80	80	80
4.0	120	120				

## Remarks

Deviations: chemical composition:

Mn = 2.0 - 6.0%

Cr = 18.0 - 22.0%

AWS: Mn = 1.0 - 3.5%

AWS: Mn = 13.0 - 17%

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Ni-base electrode

### Classification

AWS A5.11M-97 : ENiCrMo-4  
ISO 14172-03 : E Ni 6276 (NiCr15Mo15Fe6W4)

### General description

A basic all position Ni-base CrMoW-alloyed electrode.

For welding Alloy C276 and comparable compositions

Depending on the corrosion requirements also applicable for welding C-22 and C-4

Extreme high resistance to:

- general and intergranular corrosion
- pitting and crevice corrosion
- stress corrosion cracking

Applicable for surfacing in high temperature applications (up to 1200°C)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

### Current type

DC electr. +

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cr	Mo	W	Fe
0.015	0.5	0.05	bal.	15.5	16.0	3.5	6.5

### Mechanical properties, all weld metal

Condition	Condition	Yield Strength (N/mm <sup>2</sup> )	Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) 20 °C -196 °C
As welded					
Required: AWS A5.11M-97		not required	min. 690	min. 25	not required
ISO 14172-02		min. 400	min. 690	min. 22	not required
Typical values	AW	550	800	40	60 50

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	300	350	350
Unit: PE tube	Pieces/unit	xx	xx	xx
	Net weight/unit (kg)	xx	xx	xx

Identification Imprint: NiCrMo-4 / NiCrMo 60/16 Tip colour: grey

NiCrMo 60/16: rev. EN 15

# NiCroMo 60/16

SMAW

## Materials to be welded

Material type	DIN/EN	Mat. Nr.	ASTM/ACI	UNS
Ni Base high CrMo	NiMo 16Cr15W	2.4819	C-276	N10276
steel for high corrosion environments	NiCr21Mo14W	2.4602	C-22	N06022
	NiMo 16Cr16Ti	2.4610	C-4	N06455
9% Ni steel	X8Ni9	1.5662	A353/A353M	
9% Ni steel			A553/553M Type I	
8% Ni steel			A553/553M Type II	
5% Ni steel	X12Ni5	1.5680		

- NiCroMo 60/16 is developed for welding C-276 material

- Can also be applied for welding C-22 and C-4, depending on the corrosion requirements

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current (s)*	Energy E(kJ)	Dep.rate - H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	40-70	DC+						
3.2 x 350	70-100	DC+	61	137	1.34	32.5	44	1.43
4.0 x 350	90-140	DC+	65	219	1.92	50.9	29	1.47

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	55	60	60	60	60
3.2	90	80	85	80	80	80
4.0	130	130	120	120	120	120

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Ni-base electrode

### Classification

AWS A5.11M-97 : ENiCrMo-13  
ISO 14172-03 : E Ni 6059 (NiCr23Mo16)

### General description

Basic coated 22%Cr and 16% Mo alloyed Ni-base electrode for all positions without vertical down  
Excellent resistance against pitting-, crevice and stress corrosion in sulphur and phosphorus environments also at higher temperature

Suitable for welding Alloy 59 (UNS N06059), Alloy C 276 (UNS N10276), C4 (UNS N06455) and C 22 (UNS N06022) in the chemical industry

Suitable for dissimilar joints such as mentioned above to low alloyed steel grades

Wear resistant overlays for high temperature applications

Also for superaustenitic steel alloyed with 6% Mo (UNS S 31254)

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PE/4G PF/5G up

### Current type

DC electr. +

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cr	Mo
0.015	0.4	0.15	59.0	22.5	15.5

### Mechanical properties, all weld metal

Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.11-97	not required	min. 690	min. 25	not required
ISO 14172-02	min. 350	min. 690	min. 22	not required
Typical values	AW 450	720	30	75

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2
	Length (mm)	300	350
Unit: PE tube	Pieces / unit	85	52
	Net weight/unit (kg)	1.7	1.8

Identification Imprint: NiCrMo-13 / NiCrMo 59/23 Tip colour: light green

NiCrMo 59/23: rev. EN 15



# NiCroMo 59/23

## Materials to be welded

Material type	Code	Type	W.Nr.	ASTM/ACI	UNS
Ni base alloys with high CrMo content	DIN 17744	NiCr23Mo16	2.4605		N06059
		NiMo16Cr16Ti	2.4610	C-4	N06455
		NiMo16Cr15Ti	2.4819	C-276	N10276
		NiCr21Mo14W	2.4602	C-22	N06022
		NiCr22 Mo 9Nb	2.4856	625	N06625
High Mo-containing stainless steel with high corrosion resistance	EN 10088-1/-2	X1 NiCrMoCuN25-20-7	1.4529	904hMo	N08925
		X1 CrNiMoCuN20-18-7	1.4547		S31254

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	50 - 70	DC+	48	56	0.8	21.7	94	1.61
3.2 x 350	70 - 100	DC+	60	149	1.3	36.8	46	

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G
2.5	65	65	60
3.2	90	90	80

## Application advice

Welding with heat input max. 1.5 kJ/mm  
Interpass temperature max. 150°C

## Ni-base electrode

### Classification

AWS A5.11M-97 : ENiCu-7  
ISO 14172-03 : E Ni 4060 (NiCu30Mn3Ti)

### General description

Basic all position electrode for welding CuNi and NiCu-alloys  
High resistance to seawater corrosion (not stagnant)  
Applicable for welding NiCu-alloys to mild and low alloyed steel  
Very suitable for welding salt fabrication components  
Excellent weldability and slag release

### Welding positions



### Current type

DC electr. +

### Approvals

CTL	TÜV
+	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cu	Fe	Ti
0.03	3.0	0.4	bal.	30	1.75	0.35

### Mechanical properties, all weld metal

Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -196°C
Required: AWS A5.11M-97	not required	min. 480	min. 30	not required
ISO 14172-02	min. 200	min. 480	min. 27	not required
Typical values	AW 300	485	40	110

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	300	350	350
Unit: PE tube	Pieces / unit	105	61	45
	Net weight/unit (kg)	1.7	1.9	2.1

**Identification** Imprint: Ni-Cu-7 / NiCu70/30 Tip colour: black

NiCu 70/30: rev. EN 15

## Materials to be welded

Material type	BS3076	DIN 17743	W.Nr.	ASTM/ACI	UNS
	NA 13	NiCu30Fe	2.4360	Monel 400	N04400
		G-NiCu30Nb	2.4365		
	NA 18	NiCu30Al	2.4375	Monel K500	N05500

The NiCu 70/30 is also applicable for welding carbon steels to CuNi and NiCu alloys

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	45 - 70	DC+	50	72	0.80	20.7	90	1.85
3.2 x 350	70 - 90	DC+	65	129	1.2	32.5	46	1.49
4.0 x 350	90 - 130	DC+	67	245	1.75	47.17	31	1.51

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	65	60	65	55	55	55
3.2	90	85	90	75	75	75
4.0						

## Application advice

Welding with heat input max. 1.5 kJ/mm  
Interpass temperature max. 150°C

## Ni-base electrode

### Classification

AWS A5.11M-97 : ENiCrMo-6  
ISO 14172-03 : E Ni 6620 (NiCr14Mo7Fe)

### General description

Basic high recovery all position electrode for welding low temperature steels  
Recovery of approximately 150%, providing high deposition rates  
Especially developed for welding 9% Ni steel  
Linear expansion coefficient equivalent to that of 9% Ni steel  
Excellent impact toughness at -196°C, reliable 0.2%-Yield strength  
Weldable on AC as well as DC+ polarity  
Also available in vacuum sealed Sahara ReadyPack® (SRP)

### Welding positions



### Current type

AC / DC electr. +

### Approvals

GL TÜV  
5680 +

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cr	Mo	Nb	W	Fe
0.05	3.0	0.4	68	13	6	1.5	1.5	6

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-196°C
Required: AWS A5.11M-97		not required	min. 620	min. 35	not required	
ISO 14172-02		min. 350	min. 620	min. 32	not required	
Typical values	AW	475	725	40	100	90

### Packaging, available sizes and identification

Unit: SRP	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
	Pieces / unit	62	52	27	10
	Net weight/unit (kg)	1.7	2.2	1.8	1.5

Identification Imprint: NiCrMo-6 / Nyloid 2 Tip colour: white

Nyloid 2 SRP: rev. EN 15

## Materials to be welded

Material type	EN 10028-4	W.Nr.	ASTM
9% Ni steel	X8Ni9	1.5662	A353/A353M
9% Ni steel			A553/A553M Type I
8% Ni steel			A 553/A553M Type II
5% Ni steel	X12Ni5	1.5680	
3.5%Ni steel	12Ni14	1.5637	A333/A333M Grade 3

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	70 - 95	AC	54	128	1.3	26.5	53	1.39
3.2 x 350	85-145	AC	63	229	1.8	43.6	31	1.37
4.0 x 350	120 - 190	AC	73	355	2.4	65.8	21	1.33
5.0 x 450	180 - 280	AC	94	764	3.7	133.5	10	1.35

\* stub end 35 mm

## Welding parameters, optimum fill passes

Welding position: Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	90	80	90	85	80	80
3.2	145	140	135	115	100	100
4.0	140	150	155	130		
5.0	210	215				

## Aluminium electrode

### Classification

AWS A5.3 : E1100\*  
DIN 1732 : Al 1080A

\* Deviations see remarks

### General description

Aluminium electrode.  
Especially for welding pure aluminium.  
Good weldability, no porosity.

### Welding positions



ISO/ASME PA/1G PB/2F

### Current type

DC electr. +

### Chemical composition (w%), core wire

Al	Si	Fe	Cu	Mn	Zn	Others
99.8 min.	0.085 max.	0.13 max.	0.02 max.	0.02 max.	0.03 max.	0.02 max.

### Mechanical properties, all weld metal

	Condition	0,2% Proof Stress (N/mm <sup>2</sup> )	Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	AW	30	80	30

### Packaging, available sizes and identification

	Diameter(mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Can	Pieces/unit.	217	143	98
	Net weight/unit (Kg)	2.0	2.0	2.0

AI 99.8 : rev. EN 15

## Materials to be welded

Pure Aluminium like:  
 - Al99.8 (Werkstoff-Nr. 3.0285)  
 - Al99 (Werkstoff-Nr. 3.0205)

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current (s)*	Energy - per electrode at max.current E(kJ)	Dep.rate - H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	60-90	DC+				9.2		
3.2x350	80-110	DC+				14.0		
4.0x350	100-140	DC+				20.4		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F
2.5	80	80
3.2	100	100
4.0	130	130

## Remarks

Deviations: chemical composition:  
 Cu = max. 0.02%      AWS: Cu = 0.05 - 0.20%

## Application advice

If the thickness is more than 10 mm, it is advisable to preheat at 150 - 250°C

# Aluminium electrode

## Classification

AWS A5.3 : E3003\*  
ISO 18273 : Al 3103

\* Deviations see remarks

## General description

Aluminium electrode.

Especially for welding forged and cast aluminium-magnesium alloys and aluminium-manganese alloys.

Good weldability, no porosity.

## Welding positions



ISO/ASME

PA/1G



PB/2F



PF/3G up

## Current type

DC electr. +

## Chemical composition (w%). core wire

Si	Mg	Fe	Cu	Mn	Zn	Others	Al
0.3 max.	0.15 max.	0.6 max.	0.02 max.	0.9-1.2	0.09 max.	0.15 max.	Bal.

## Mechanical properties, all weld metal

	Condition	0,2% Proof Stress (N/mm <sup>2</sup> )	Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	AW	40	110	20

## Packaging, available sizes and identification

	Diameter(mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Can	Pieces/unit.	222	146	98
	Net weight/unit (Kg)	2.0	2.0	2.0

Al Mn : rev. EN 15



## Materials to be welded

Aluminium manganese alloys and Aluminium magnesium alloys like:

- AlMn1 (Werkstoff-Nr. 3.0515)
- AlMn1Mg1 (Werkstoff-Nr. 3.0526)
- AlMg1 (Werkstoff-Nr. 3.3315)

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	60-90	DC+				9.2		
3.2x350	80-110	DC+				14.0		
4.0x350	100-140	DC+				20.4		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PF/3G up
2.5	80	80	75
3.2	100	100	95
4.0	130	130	125

## Remarks

Deviations: chemical composition:

Cu = max. 0.02%

AWS: Cu = 0.05 - 0.20%

Mn = 0.9 - 1.2%

AWS: Mn = 1.0 - 1.5%

## Application advice

If the thickness is more than 10 mm, it is advisable to preheat at 150 - 250°C

## Aluminium electrode

### Classification

AWS A5.3	: E4043
ISO 18273	: Al 4043A*

### General description

Aluminium electrode.

Especially for welding forged and cast aluminium alloys containing less than 5% Si as main alloying element.

Good weldability, no porosity.

### Welding positions



PA/1G



PB/2F



PF/3G up

ISO/ASME

### Current type

DC electr. +

### Chemical composition (w%). core wire

Si	Fe	Cu	Mn	Mg	Zn	Ti	Others	Al
4.7-5.3	0.2 max.	0.05 max.	0.05 max.	0.05 max.	0.10 max.	0.10 max.	0.15 max.	Bal.

### Mechanical properties, all weld metal

	Condition	0.2% Proof Stress (N/mm <sup>2</sup> )	Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	AW	90	160	15

### Packaging, available sizes and identification

	Diameter(mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Can	Pieces/unit.	222	152	98
	Net weight/unit (Kg)	2.0	2.0	2.0

AlSi 5 : rev. EN 15

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## Materials to be welded

Several Aluminium alloys like :

- AlCuMg1 (Werkstoff-Nr. 3.1325)
- AlMgSi1 (Werkstoff-Nr. 3.2315)
- AlZn4.5Mg1 (Werkstoff-Nr. 3.4335)

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	60-90	DC+				9.2		
3.2x350	80-110	DC+				14.0		
4.0x350	100-140	DC+				20.4		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PF/3G up
2.5	80	80	75
3.2	100	100	95
4.0	130	130	125

## Application advice

If the thickness is more than 10 mm, it is advisable to preheat at 150 - 250°C

## Aluminium electrode

### Classification

ISO 18273

: AI 4047A

### General description

Aluminium electrode.

Especially for welding forged and cast aluminium alloys containing more than 7% Si as main alloying element.

Also applicable as surfacing electrode.

Good weldability, no porosity.

Applicable when Al-properties are unknown.

### Welding positions



PA/1G



PB/2F



PF/3G up

ISO/ASME

### Current type

DC electr. +

### Chemical composition (w%). core wire

Si	Fe	Cu	Mn	Mg	Zn	Ti	Others	Al
11.0-12.0	0.40 max.	0.05 max.	0.10 max.	0.05 max.	0.10 max.	0.10 max.	0.15 max.	Bal.

### Mechanical properties, all weld metal

	Condition	0,2% Proof Stress (N/mm <sup>2</sup> )	Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	AW	30	80	30

### Packaging, available sizes and identification

	Diameter(mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Can	Pieces/unit.	227	152	102
	Net weight/unit (Kg)	2.0	2.0	2.0

AISI 12 : rev. EN 15

## Materials to be welded

Aluminium cast alloys with silicon level up to approx. 12%, like:

- G-AISI 10Mg (Werkstoff-Nr. 3.2381)
- G-AISI 12 (Werkstoff-Nr. 3.2581)

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max.current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	60-90	DC+				8.8		
3.2x350	80-110	DC+				13.2		
4.0x350	100-140	DC+				19.6		

\* stub end = 35 mm

## Welding parameters, optimum fill passes

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PF/3G up
2.5	80	80	75
3.2	100	100	95
4.0	130	130	125

## Application advice

If the thickness is more than 10 mm, it is advisable to preheat at 150 - 250°C

## Hardfacing electrode

### Classification

DIN 855-83

: E1-UM-350-GP

### General description

Can be used both downhand and out of position, although the flat position is preferred

Arc characteristics are excellent with very low spatter levels

The electrode coating permits the use of the drag or contact welding technique

Good arc restriking

### Application

Wearshield BU 30 produces a crack-free wear resistant deposit with a hardness of 31-38 HRC (295-350 HB) depending on dilution and number of layers. It is particularly suitable under conditions of moderate abrasion and friction, combined with resistance to impact. Ideally suitable for applications involving rolling, sliding and metal to metal wear. It may also be used as a final overlay on parts which need to be machined or as a build-up layer for other hardfacing materials.

Typical applications include:

Buildup:

Shovel and bucket lips

Pump impellers and housings

Dredge and shovel bucket teeth

Mill and crushing hammers

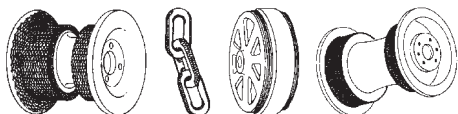
Hardfacing:

Crane and mine car wheels

Tractor rolls, idlers, links and sprockets

Cable drums

Roller guides



### Mechanical properties, all weld metal

#### Typical hardness values

1 Layer	31 HRC (295 HB)
2 Layer	35 HRC (330 HB)
3 Layer	38 HRC (350 HB)

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0	6.0
	Length (mm)	350	350	450	450
Unit: Box	Pieces / unit (nominal)	65	44	23	-
	Net weight (kg)	2.5	2.5	2.5	2.5

### Identification

Imprint: Wearshield BU-30

Tip colour: black

Wearshield® BU-30: rev. EN 15

# Wearshield® BU-30

## Additional information

When welding with Wearshield BU30, DC+ is preferred for most applications, although AC also provides satisfactory results. The bead width should be limited to between 12 - 20mm for all electrode diameters when applying a weaving technique. Narrow stringer beads are preferred for edge and corner buildup.

All workhardened base material should be removed prior to applying Wearshield BU30 in order to prevent embrittlement and cracking.

A preheat and interpass temperature of 150-250°C is necessary to prevent cracking, especially on large complex or high restrained components. The component should be completed without interruptions, however, if interruptions are unavoidable the component should be preheated again prior to welding.

The deposited weld metal can be machined to exact dimensions using high speed or carbide cutting tools.

There is no limit to the deposit buildup with this electrode.

Wearshield BU30 exhibits good resistance to spalling and peeling and moderate resistance to gouging and galling. If gouging is severe then Wearshield Mangjet or Wearshield 15CrMn would be more appropriate because of the higher work hardening effect. If galling is more severe then Wearshield MM or Wearshield MM40 would be preferred.

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo
0.2	0.8	1.0	1.5	0.5

## Structure

In the as welded condition the microstructure consists mainly of martensite with some bainite

## Welding parameters

CD3

Sizes

Current

Diam. x length  
(mm)

range  
(A)

3.2 x 350

90 - 130

4.0 x 350

140 - 180

5.0 x 450

180 - 220

6.0 x 450

220 - 260

## Complementary products

Complimentary products include flux cored wire Lincore® 33

# Wearshield® Mangjet (e)

## Hardfacing electrode

### Classification

DIN 8555-83

: E7-UM-200-KP

### General Description

A low hydrogen hardfacing electrode designed for operator appeal

Exhibits excellent arc striking characteristics, clean slag detachability and low spatter

The electrode coating permits the use of out of position welding

140% recovery

### Application

Wearshield Mangjet produces a 14% Mn deposit that rapidly work hardens under heavy impact and battering. Ideally suited to applications to high impact and gouging coupled with moderate abrasion.

Typical applications include:

Jaw and cone crushers

Heavy rock moving plant

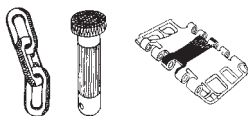
Hammer drills

Crusher screens

Dredge parts

Shovel tracks

Rail crossovers, frogs and switches



### Mechanical properties, all weld metal

	Typical hardness values
As deposited	18 HRC (210 HB)
Work hardened	47 HRC (450 HB)

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0
	Length (mm)	350	350
Unit: Box	Pieces / unit (nominal)	53	24
	Net weight (kg)	2.5	2.5

### Identification

Imprint: WEARSHIELD MANGJET(e)

Tip colour: Violet

Wearshield® Mangjet (e): rev. EN 15



# Wearshield® Mangjet (e)

## Additional information

When welding with Wearshield Mangjet DC+ is preferred for most applications especially positional work, although AC and DC - are also satisfactory. The weld width should be limited to 12-20mm for all electrode diameters when employing a weaving technique. Narrow stringer beads are preferred for edge and corner buildup.

All work-hardened base material and previously deposited material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking.

No preheat is required on austenitic manganese steels although a preheat of between 150-200°C maybe necessary on carbon and low alloy steels to prevent pullout.

It is important to avoid excessive heat build up in the base material. Temperatures above 260°C should be avoided as this can cause embrittlement.

For joint welding of manganese steel Wearshield 15CrMn or Arosta 307 are preferred.

There is no definite limitation to the number of passes that may be deposited, however, it is good practise to peen each pass immediately after welding to minimise internal stresses and possible distortion and cracking.

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G

## Current type

AC / DC electr. + / -

## Chemical composition (w%), typical, all weld metal

C	Mn	Cr
0.7	15	3.7

## Structure

In the as deposited condition, the microstructure consists of a soft manganese alloy austenite which rapidly work hardens under impact loading.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type DC E+	Arc time - per electrode at max. current (s)*	Energy E(kJ)	Dep.rate H(kg/h)
3.2 x 350	95 - 105	-	-	-	1.1
4.0 x 350	130 - 140	-	-	-	1.6

\* stub end = 35 mm

## Complementary products

Complimentary products include flux cored wire Lincore® M and submerged arc wire Lincore® M.

# Wearshield® 15CrMn

## Hardfacing electrode

### Classification

DIN 8555-83

: E7-UM-250-KP

### General Description

A rutile hardfacing electrode that exhibits excellent arc characteristics

Easy slag detachability, good arc restriking and low spatter

The electrode coating permits out of position welding

### Application

Application Wearshield 15CrMn produces a premium austenitic chromium-manganese deposit. The term premium is used because the weld metal has sufficient alloy content to produce a single pass austenitic deposit on ordinary carbon steel. The deposit rapidly work hardens under impact making it particularly suitable for applications of high impact and gouging, coupled with moderate abrasion. In addition to surfacing, the high crack resistance of this alloy design makes Wearshield 15CrMn an ideal electrode for joining manganese steel to itself or carbon steels with minimal risk of centreline cracking.

Typical applications include:

Railroad frogs

Track ends

Crusher hammers and screens

Earth moving equipment

Rebuilding of austenitic manganese plates and components

Construction equipment



### Mechanical properties, all weld metal

#### Typical hardness values

As deposited	18 - 24 HRc (210-250 HB)
Work hardened	40 - 50 HRc (375-490 HB)

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	4.8
	Length (mm)	355	355	455
Unit: Box	Pieces / unit (nominal)	49	33	24
	Net weight (kg)	2.5	2.5	2.5

### Identification

Imprint: Wearshield 15CrMn

Tip colour: none

Wearshield® 15CrMn: rev. EN 15

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# Wearshield® 15CrMn

## Additional information

When welding with Wearshield 15CrMn a short arc or contact drag technique is preferred. The weld width should be limited to 12-20mm for all electrode diameters. Narrow stringer beads are preferred for edge and corner build up.

All work-hardened base material and previously deposited material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking.

No preheat is required on austenitic manganese steels although a preheat of between 150-200°C maybe necessary on carbon and low alloy steels to prevent heat affected zone cracking.

It is important to avoid excessive heat build up in the base material. High heat input welds and interpass temperatures above 260°C should be avoided as this can cause embrittlement.

There is no definite limitation to the number of passes that may be deposited, however, it is good practise to peen each pass immediately after welding to minimise internal stresses and possible distortion and cracking.

Wearshield 15CrMn deposits workharden rapidly making them difficult to machine. For best results carbide or ceramic cutting tools and rigid tooling should be used. Grinding can also be successfully employed.

For applications involving severe impact and abrasion, a buildup of Wearshield 15CrMn coupled with a single pass of Wearshield 60 or Lincore 60-O should be employed.

The Wearshield 15CrMn deposit can not be cut using the Oxy-fuel process due to the high chromium content, however, plasma arc and air carbon arc processes are appropriate.

## Welding positions



PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G

ISO/ASME

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr
0.35	14.0	0.6	15.0

## Structure

In the as deposited condition, the microstructure consists of a soft chromium manganese alloy austenite which rapidly work hardens under impact loading

## Calculation data

Sizes Diam. x length (mm)	Current range (A)
3.2 x 355	140 - 160
4.0 x 355	190 - 210
4.8 x 355	220 - 250

## Complementary products

Complimentary products include flux cored wire Lincore® 15CrMn

## Hardfacing electrode

### Classification

DIN 8555-83 : E1-UM-400-G\*

\* Nearest classification

### General Description

An all position rutile/basic coated electrode that produces a machinable martensitic deposit

Designed for operator appeal and weld quality having excellent arc characteristics

Good restriking and low spatter

The electrode can be used with the drag or contact welding technique as well as out of position

### Application

Wearshield MM 40 produces a crack-free wear resistant deposit with a hardness of 42-45 HRC depending on upon material dilution and number of layers. It is particularly suitable for applications involving sliding, rolling and metal to metal wear, combined with resistance to mild abrasion.

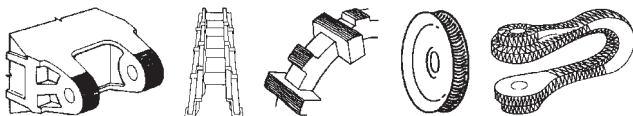
Typical applications include:

Buckets links, bucket bases

Guide rolls

Tractor rolls

Crane wheels



### Mechanical properties, all weld metal

#### Typical hardness values

1 Layer	39-42 HRC (360-400 HB)
2 Layer	40-45 HRC (375-425 HB)
3 Layer	42-45 HRC (400-425 HB)

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	450
Unit: Box	Pieces / unit (nominal)	66	43	22
	Net weight (kg)	2.5	2.5	2.5

### Identification

Imprint: Wearshield MM 40

Tip colour: red

Wearshield® MM 40: rev. EN 15

# Wearshield® MM 40

## Additional information

When welding with Wearshield MM40 the bead width should be limited to 12 - 20mm for all electrode diameters when using a weaving technique. For edge and corner build-up narrow stringer beads are preferred.

A preheat between 150-250°C is necessary to prevent cracking in situations of high restraint and/or heavy thicknesses.

The deposited weld metal is machinable, therefore, tempering and annealing are not generally necessary but may be carried out to decrease hardness and increase toughness. Annealing at 760°C for several hours and slow cooling followed by tempering at 520°C will reduce the hardness. This deposit can subsequently be flame hardened or furnace hardened.

The build up is usually limited to 4 layers.

## Welding positions



PA/1G



PC/2G



PF/5G up

ISO/ASME

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo
0.2	0.5	1.3	3.4	0.5

## Structure

In the as welded condition the microstructure consists mainly of martensite

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. Current (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	90 - 130	DC+	71	175	1.3	38.6	41	1.57
4.0 x 350	140 - 180	DC+	83	312	1.5	56.6	28	1.61
5.0 x 450	170 - 220	DC+	108	640	2.5	114.1	13	1.50

\* stub end = 35 mm

## Complementary products

Flux cored wire Lincore® 40-0

## Hardfacing electrode

### Classification

DIN 8555-83 : E2-UM-55-G\*

\* Nearest classification

### General Description

An all position rutile/basic coated electrode that produces a high carbon heat treatable martensitic deposit

Designed for operator appeal and weld quality

Excellent arc characteristics, good restriking and low spatter

The electrode can be used with drag or contact welding technique as well as out of position

### Application

Wearshield MM produces a crack-free wear resistant deposit with a hardness of 55-57 Rc depending on dilution and number of layers. It is particularly suitable for applications involving sliding, rolling and metal to metal wear, combined with resistance to mild abrasion.

Typical applications include:

Crane and mine car wheels

Sprockets and gear teeth

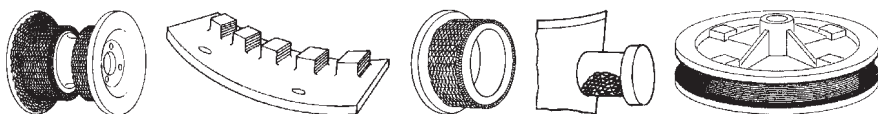
Skip guides

Dredger buckets

Scraper blades

Transfer tables

Cable sheaves



### Mechanical properties, all weld metal

#### Typical hardness values

1 Layer 45-55 HRC

2 Layer 52-57 HRC

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0	6.0
	Length (mm)	350	350	450	450
Unit: Box	Pieces / unit (nominal)	66	45	22	-
	Net weight (kg)	2.5	2.5	2.5	2.5

### Identification

Imprint: Wearshield MM

Tip colour: purple

Wearshield® MM: rev. EN 15

## Additional information

When welding with Wearshield MM the bead width should be limited to 12 - 20mm for all electrode diameters when using a weaving technique. For edge and corner buildup narrow stringer beads are preferred.

A preheat between 200-350°C is necessary to prevent cracking with interpass temperatures of up to 400°C in situations of high restraint and/or heavy thicknesses. After welding the component should be covered and slowly cooled.

The deposited weld metal is not machinable by conventional methods although the deposit can be shaped by grinding.

The deposit can be tempered at about 425°C to toughen the weld metal resulting in a hardness of approximately 50 HRC. Annealing at 760°C for several hours and slow cooling will reduce the hardness to approximately 30 HRC. This deposit can be readily machined. Rehardening is achieved by heating to about 950°C for several hours to dissolve all carbides and homogenise the structure, followed by either water or oil quench (thin sections may be air cooled). After quenching the component should be tempered.

Flame hardening is also possible after annealing, although full hardness may not be achieved due to the inability to homogenize the steel in the short heating cycle.

The build up should be limited to 4 layers.

## Welding positions



## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo	W
0.55	0.5	1.5	4.5	0.5	0.5

## Structure

In the as welded condition the microstructure consists mainly of martensite with carbides.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. Current (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	90 - 130	DC+	75	186	1.2	39.0	42	1.62
4.0 x 350	140 - 180	DC+	87	343	1.4	55.8	30	1.65
5.0 x 450	170 - 220	DC+	112	516	2.3	115.2	14	1.62
6.0 x 450	230 - 270	DC+						

\* stub end = 35 mm

## Complementary products

Complimentary products include flux cored wire Lincore® 55.

## Hardfacing electrode

### Classification

AWS A5.13-00 : EFe6  
DIN 8555-83 : E4-UM-60-SZ

### General Description

A basic coated electrode that produces a high speed steel deposit similar to M-1 tool steel

The deposited weld metal is air hardening

Designed for operator appeal and weld quality

Excellent arc characteristics, good restriking and low spatter

The electrode coating permits the use of the drag or contact welding technique.

### Application

Wearshield T & D produces a crack-free wear resistant tool steel deposit with a hardness of 58-62 HRC. This hardness can be further increased to between 63-65HRC after tempering (540-600°C). It is particularly suitable for applications involving severe metal to metal wear coupled with elevated temperatures (up to 540°C). Ideally suited to the buildup of worn steel dies, cutting tools or the application of wear resistant surfaces to carbon and low alloy steels.

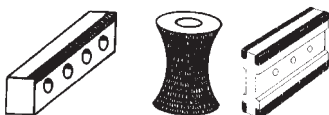
Typical applications include:

Punch and forging dies

Shear blades

Trimmers

Cutting tools



### Mechanical properties, all weld metal

#### Typical hardness values

As Welded 58-62 HRC

Tempered at 540-600°C 63-65 HRC

Welded on Mild Steel Plate (12 mm)

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	85	56	35
	Net weight (kg)	2.5	2.5	2.5

### Identification

Imprint: Wearshield T&D

Tip colour: none

Wearshield® T&D: rev. EN 15



## Additional information

When welding with Wearshield T & D the weld width should be limited to between 12 - 25mm for all electrode diameters when employing a weaving technique. For edge and corner buildup narrow stringer beads are preferred.

A preheat and interpass temperature of 325°C, or higher (up to 540°C), is necessary to avoid cracking. It is important to ensure that an adequate "soak" is achieved prior to the welding operation. After welding, the component should be covered and slow cooled down to room temperature. Once cooled, the deposited weldment should be post weld heat treated to temper the martensite and toughen the deposit. Tempering at 540-600°C normally produces the optimum combination of hardness and toughness.

The deposited weld metal is not machinable by conventional methods although the deposit can be shaped by grinding.

Annealing at 850°C for several hours and slow cooling will reduce the hardness to approximately 30 HRc. This deposit can be readily machined. Rehardening is achieved by heating to about 1200°C for several hours to dissolve all carbides and homogenise the steel, followed by air cooling and tempering (540-600°C).

The deposit thickness is usually limited to 4 layers.

Wearshield T & D cannot be cut by the oxy-fuel processes. Plasma arc and air-carbon arc processes can be used to both cut and gouge the weld deposit. Preheat temperature similar to those for welding may be necessary to prevent cracking along the cut edge.

## Welding positions



ISO/ASME PA/1G

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo	W	V
0.65	0.4	0.7	4	6.0	1.8	1.1

## Structure

In the as welded condition the microstructure consists mainly of martensite with some carbides.

After tempering the microstructure is tempered martensite with secondary carbides.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)
3.2 x 350	80 - 100
4.0 x 350	110 - 130
5.0 x 350	130 - 160

## Complementary products

Complementary products include flux cored wire Lincore® T&D

## Hardfacing electrode

### Classification

AWS A5.13-00 : EFe6  
DIN 8555-83 : E6-UM-60-GPS

### General Description

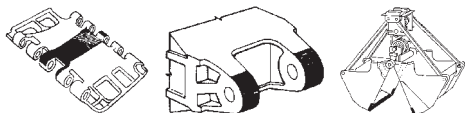
A basic coated electrode that produces a martensitic deposit with a considerable amount of retained austenite  
Designed for operator appeal and weld quality  
Excellent arc characteristics, good restriking and low spatter

### Application

Wearshield MI produces a wear resistant martensite/austenite deposit with a hardness of 45-58 HRC. It can be used to surface a variety of carbon, carbon manganese and alloy steels. The martensite/austenite deposit makes Wearshield MI particularly suitable for applications involving impact, metal to metal wear and mild abrasion such as by limestone. This deposit tends to cross check.

Typical applications include:

Dipper lips  
Construction machinery  
Earth moving equipment  
Rock crushers  
Hammer mills  
Conveyor screws  
Ditcher teeth  
Agricultural equipment



### Mechanical properties, all weld metal

#### Typical hardness values

1 Layer	45-55 HRC
2 Layer	50-58 HRC

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	450
Unit: Box	Pieces / unit (nominal)	117	69	38	25
	Net weight (kg)	2.5	2.5	2.5	2.5

### Identification

Imprint: Wearshield MI(e)

Tip colour: violet

Wearshield® MI (e): rev. EN 15

# Wearshield® MI (e)

## Additional information

A preheat and interpass temperature of over 200°C is preferred to help reduce check cracking and avoid chipping and fragmentation.

The deposited weld metal is not machinable by conventional methods although the deposit can be shaped by grinding.

The Wearshield MI deposit tends to cross check and is therefore usually limited to 2 layers to avoid chipping and fragmentation.

Wearshield MI cannot be cut by the oxy-fuel processes. Plasma arc and air-carbon arc processes can be used to both cut and gouge the weld deposit.

## Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. -

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr
0.5	0.4	1.8	9

## Structure

In the as welded condition the microstructure consists of a mixed structure of martensite and austenite.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. Current (s)*	Energy E(kJ)	Dep.rate H(kg/h)
2.5 x 350	60 – 70	AC/DC E-	-	-	7.6
3.2 x 350	70 – 120	AC/DC E-	-	-	1.10
4.0 x 450	110 – 150	AC/DC E-	-	-	1.45
5.0 x 450	150 - 200	AC/DC E-	-	-	2.00

\* stub end = 35 mm

## Complementary products

Solid wire LNM 420 FM.

## Hardfacing electrode

### Classification

DIN 8555-83 : E10-UM-50-GPZ

### General Description

A graphite coated electrode that produces a primary austenite and austenite-eutectic weld deposit.

Wearshield ABR is the most versatile product within the Wearshield range

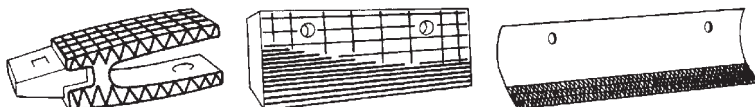
Good resistance to both abrasion and impact, as well as hot-forging properties.

### Application

Wearshield ABR produces an abrasion and impact resistant deposit with a hardness of 28-55HRC depending on base metal chemistry, dilution and number of layers. The combination of abrasion and impact resistance coupled with hot forging properties makes Wearshield ABR particularly suitable for applications involving transportation of abrasive media under heavy variable loading. Wearshield ABR is also suitable for metal to metal wear applications.

Typical applications include:

- Dipper and dredge cutter teeth
- Rock crusher hammers and mill hammers
- Rock crushers and crusher mantles
- Screw flights
- Coal mining cutters
- Conveyor buckets and rolls
- Plough shares, scraper blades and cultivator sweeps
- Truck chain and gears



### Mechanical properties, all weld metal

#### Typical hardness values

1 Layer	24-53 HRC
2 Layer	28-53 HRC
3 Layer	28-55 HRC

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	54	4.0	4.8
	Length (mm)	355	355	355
Unit: Box	Pieces / unit (nominal)	85	54	38
	Net weight (kg)	2.5	2.5	2.5

### Identification

Imprint: Wearshield ABR

Tip colour: none

Wearshield® ABR: rev. EN 15

## Additional information

When welding with Wearshield ABR a short arc should be employed. The weld width should be limited to between 12-20mm for all electrode diameters when employing a weaving technique. For edge and corner build up narrow stringer beads are preferred.

Preheat is not necessary when surfacing austenitic substrates such as stainless and manganese steels, although the interpass temperature should be limited to about 260°C for manganese steels. For low alloy and carbon steels a preheat of 200°C is usually sufficient, but is dependent on material thickness and chemistry. For optimum abrasion resistance the interpass temperature should be limited to 320°C.

The deposited weld metal is not machinable by conventional methods although the deposit can be shaped by grinding.

To obtain a deposit that can be machined by carbide cutting tools, the component should be heated to 750°C for one hour followed by air cooling to room temperature. For maximum machinability the component should be heated to 875-900°C for one hour, furnace cooled to 650°C at a rate not exceeding 10°C per hour, followed by furnace or air cooling to room temperature. The abrasion resistance can be restored by heating to 800°C, quenching and tempering at 200°C.

The deposit thickness is limited to 2 layers.

For applications requiring thicker deposits, an intermediate layer of an austenitic material such as Wearshield 15CrMn should be used and each layer peened to relieve residual stresses.

For maximum resistance to spalling one or more layers of Wearshield 15CrMn should be used as buildup.

There is no flux cored equivalent to Wearshield ABR.

## Welding positions



ISO/ASME

PA/1G

PC/2G

PF/3G up

PE/4G

## Current type

AC / DC electr. + / -

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo
2.1	1.1	0.75	6.5	0.40

## Structure

In the as welded condition the microstructure consists of primary austenite and a eutectic of austenite plus carbides.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)
3.2 x 355	40 - 150
4.0 x 355	75 - 200
5.0 x 355	110 - 250

## Complementary products

The closest product is Lincore® 50, however, the deposit varies significantly to Wearshield ABR.

## Hardfacing electrode

### Classification

DIN 8555-83 : E10-UM-45-GPZ

### General Description

A heavy coated rutile electrode that produces a primary austenite-chrome carbide eutectic weld deposit

Designed for operator appeal and weld quality

Excellent arc characteristics, good restriking, complete slag coverage and low spatter

The electrode coating permits the use of a light drag or contact welding technique

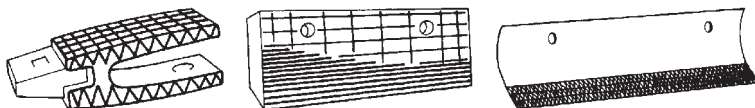
### Application

Wearshield 44 produces an abrasion and impact resistant deposit with a hardness of 42-48HRC.

The intended use of Wearshield 44 is to provide a combination of abrasion and impact resistance at service temperatures up to 600°C.

Typical applications include:

- Ingot tongs
- Scraper blades
- Rolling mill guides
- Screw flights
- Coal mining chutes
- Plough shares, scraper blades and cultivator sweeps
- Pulleys and chain links



### Mechanical properties, all weld metal

	Typical hardness values
1 Layer	42 HRC
2 Layer	49 HRC
3 Layer	48 HRC

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	4.8
	Length (mm)	355	355	355
Unit: Box	Pieces / unit (nominal)	59	-	2.7
	Net weight (kg)	2.5	2.5	2.5

### Identification

Imprint: Wearshield 44

Tip colour: none

Wearshield® 44: rev. EN 15

## Additional information

When welding with Wearshield 44 the bead width should be limited to 12-20mm for all electrode diameters when employing a weaving technique. For edge and corner build up narrow stringer beads are preferred.

Preheating is not necessary when surfacing austenitic substrates such as stainless steels and manganese steels, although the interpass temperature should be limited to about 260°C for manganese steels. For low alloy and carbon steels a preheat of 200°C is usually sufficient, but is dependent on base material thickness and chemistry.

The deposited metal is not machinable by conventional methods although the deposit can be shaped by grinding.

The build up is usually limited to 2-3 layers.

Wearshield 44 can be deposited on small components without check cracking, however, check cracking may not be preventable on larger sections.

Wearshield 44 may also be used to overlay cast irons, however, this is not possible without check cracking. To minimise the risk of spalling, closely spaced check cracks are preferred. These are obtained by employing stringer bead welding procedures.

## Welding positions



ISO/ASME

PA/1G

PC/2G

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo
2.0	0.16	0.9	24.2	2.5

## Structure

In the as welded condition the microstructure consists of primary austenite with an interdendritic eutectic of austenite and chromium carbides

## Calculation data

Sizes Diam. x length (mm)	Current range (A)
3.2 x 355	120-160
4.0 x 355	150 - 220
4.8 x 355	190 - 270

## Complementary products

There is no flux cored equivalent to Wearshield 44. The closest product is Lincore® 50, however, the deposit varies significantly to Wearshield 44.

# Wearshield® ME (e)

## Hardfacing electrode

### Classification

DIN 8555

: E10-UM-60-GRZ

### General Description

A heavily coated rutile electrode that produces a near eutectic mix of chromium carbides and austenite, with limited primary carbides weld deposit 170% recovery. Designed for operator appeal and weld quality having excellent arc characteristics, good restriking, complete slag coverage and low spatter levels. The electrode coating permits the use of a light drag or contact welding technique.

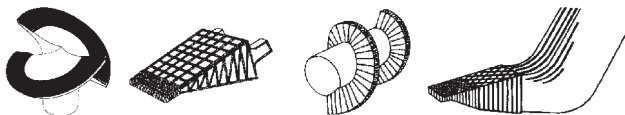
### Application

Wearshield ME produces an abrasion resistant deposit with a hardness range of 55-60HRC.

The intended use of Wearshield ME is to provide a combination of abrasion and impact resistance at service temperatures up to 600°C.

Typical applications include:

Ingot tongs  
Scraper blades  
Rolling mill guides  
Screw flights  
Coal mining chutes  
Plough shares, scraper blades and cultivator sweeps  
Pulleys and chain links



### Mechanical properties, all weld metal

Typical hardness values

1 Layer	55 HRc
2 Layer	60 HRc

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	450	450	450
Unit: Box	Pieces / unit (nominal)	37	23	15
	Net weight (kg)	2.5	2.5	2.5

### Identification

Imprint: WEARSHIELD ME (e)

Tip colour: violet

Wearshield® ME (e): rev. EN 15



# Wearshield® ME (e)

SAW

## Additional information

When welding with Wearshield ME the weld width should be limited to 20mm. Since wide weaves generally increase the check crack spacing which can result in deposit spalling on multiple layers. For edge, corner and general buildup, narrow stringer beads are preferred.

Wearshield ME generally check cracks except for single layers on thin base material. Stringer beads tend to produce a consistent crack spacing of between 12-25mm.

Preheat is not necessary when surfacing austenitic substrates such as stainless steels and manganese steels, although the interpass temperature should be limited to about 260°C for manganese steels. For low alloy and carbon steels a preheat of 200°C is usually sufficient, but is dependent on base material thickness and chemistry. The deposited weld metal is not machinable by conventional methods although the deposit can be shaped by grinding.

The deposit thickness is usually limited to 2-3 layers to avoid spalling.

To minimise the risk of spalling, stringer beads should be employed to produce closely spaced check cracks.

The resultant weld metal microstructure is determined by the level of dilution and base material chemistry. Low dilution welds on carbon and low alloy steels results in a microstructure that is a near eutectic mix of chromium carbides and austenite, with limited primary carbides. High dilution weld deposit produce a microstructure of primary austenite and eutectic resulting in higher toughness and lower abrasion resistance.

For maximum spalling resistance on carbon and low alloy steels, a buffer layer of Wearshield MM 40 or RepTec 126 should be applied prior to the Wearshield ME.

## Welding positions



ISO/ASME PA/1G PB/2F

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Cr	Si
3	33	1.0

## Structure

In the as welded condition the microstructure consists of a near eutectic mix of chromium carbides and austenite, with limited primary carbides

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type -	Arc time per electrode at max. current (s)*	Energy E(kJ)	Dep.rate H(kg/h)
3.2 x 450	100 - 140	DC+	-	-	1.15
4.0 x 450	130 - 190	DC+	-	-	1.70
5.0 x 450	160 - 260	DC+	-	-	2.25

\* stub end = 35 mm

## Complementary products

There is no flux cored equivalent to Wearshield ME. The closest product is Lincore® 60-O, however, the deposit varies significantly to Wearshield ME.

## Hardfacing electrode

### Classification

DIN 8555-83

: E10-UM-65-GRZ

### General Description

Basic coated electrode for hardfacing with an efficiency of about 200%.

Extreme resistance against abrasion up to temperatures of 700°C.

### Application

Typical applications include:

Ore-crushers, ore chutes, hot slag crushers, dragline teeth, diggers, etc.



### Mechanical properties, all weld metal

Typical hardness values

1 Layer

62-67 HRc

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0
	Length (mm)	350	350
Unit: Box	Pieces / unit (nominal)	41	27
	Net weight (kg)	2.5	2.5

### Identification

Imprint: Wearshield 50 MC

Tip colour: white

Wearshield® 50MC: rev. EN 15

# Wearshield® 50MC

## Additional information

By preference, weld under inclined angle of 20 degrees.

Weave during welding in a width of approx. 50 mm.

During solidification small cracks will occur.

These cracks, however, will have no detrimental effect on the weld metal properties regarding its abrasive wear resistance.

A maximum of two layers should be applied to prevent the weld from braking out.

## Welding positions



ISO/ASME

PA/1G

PF/3G up

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Cr	Nb	W	V	Si	B
5	2	21	6.4	3.1	0.7	2.1	0.8

## Structure

Supereutectic + primary carbides.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current* (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	120 - 160	DC+	156	699	1.28	67	18	1.21
4.0 x 350	160 - 200	DC+	172	1011	1.50	100	14	1.40

\* stub end = 35 mm

## Complementary products

Complimentary products include flux cored wire Lincore® 65-O.

# Wearshield® 60 (e)

## Hardfacing electrode

### Classification

DIN 8555-83

: E10-UM-60-GR

### General Description

A basic coated downhand 200% recovery electrode that produces a primary carbide weld deposit. The electrode coating facilitates easy arc control and arc visibility whilst maintaining a short arc.

### Application

Wearshield 60 produces a primary carbide deposit with a hardness range of 60-62 HRC.

The primary carbide microstructure makes Wearshield 60 ideally suitable for applications of severe abrasion

Typical applications include:

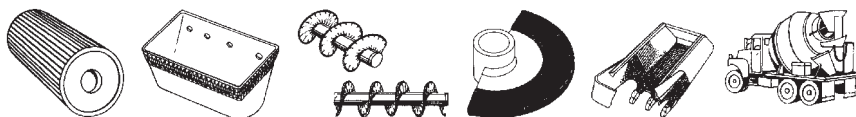
Crusher rolls, plates and jaws

Conveyor screws and sleeves

Shovel lips

Brick & coke machinery

Cement mill parts



### Mechanical properties, all weld metal

#### Typical hardness values

1 Layer 57-60 HRC

2 Layer 60-62 HRC

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0
	Length (mm)	450	450
Unit: Box	Pieces / unit (nominal)	37	23
	Net weight (kg)	2.5	2.5

### Identification

Imprint: Wearshield 60 (e)

Tip colour: Violet

Wearshield® 60 (e): rev. EN 15

# Wearshield® 60 (e)

## Additional information

When welding with Wearshield 60 stringer beads should be employed. Weaving is not advised since wide weaves generally increase the check crack spacing which can result in deposit spalling.

The as-welded deposit readily check cracks.

Preheat is not necessary when surfacing austenitic substrates such as stainless steels and manganese steels, although the interpass temperature should be limited to about 260°C for manganese steels.

The deposited weld metal is not machinable.

The deposit thickness is usually limited to 2 layers.

For applications requiring build-ups in excess of 2 layers, buttering layers of RepTec 126, Wearshield BU30 or Wearshield Mangjet (manganese steels) should be used prior to Wearshield 60. Alternatively, a preheat of 650°C can be used to eliminate the formation of check cracks.

Alternatively, a preheat of 650°C can be used to eliminate the formation of check cracks.

## Welding positions



ISO/ASME PA/1G PB/2F

## Current type

AC / DC electr. + / -

## Chemical composition (w%), typical, all weld metal

C	Cr	Si
5	35	4

## Structure

In the as welded condition the microstructure consists of primary chromium carbides in an austenite - carbide eutectic matrix

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current' (s)*	Energy E(kJ)	Dep.rate H(kg/h)
3.2 x 450	110 - 150	DC+	-	-	1.75
4.0 x 450	140 - 180	DC+	-	-	2.20

\* stub end = 35 mm

## Complementary products

Complimentary products include flux cored wire Lincore® 60-O and submerged arc wire Lincore® 60-S

## Hardfacing electrode

### Classification

DIN 8555-83

: E10-UM-65-GRZ

### General Description

A highly alloyed basic-graphite coated downhand hardfacing electrode that produces a "premium" carbide weld deposit. The electrode facilitates easy arc control whilst maintaining a long arc. Recovery 240%.

### Application

Wearshield 70 produces a "premium" carbide weld deposit with a hardness range of 68-70HRc. The premium carbide microstructure makes Wearshield 70 ideally suitable for applications of high stress abrasion (crushing of abrasive particles), severe abrasion and abrasion at elevated temperatures (>760°C)

Typical applications include:

Blast furnace bells (burden area)  
Hoppers and screens  
Sinter plants  
Cement mill parts



### Mechanical properties, all weld metal

Typical hardness values

1 Layer 68-70 HRc

Welded on Mild Steel Plate

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	350
Unit: Box	Pieces / unit (nominal)	28	18	12
	Net weight (kg)	2.5	2.5	2.5

### Identification

Imprint: Wearshield 70

Tip colour: violet

Wearshield® 70: rev. EN 15

## Additional information

When welding with Wearshield 70 stringer beads are preferred, although weld widths up to 50mm by weaving are acceptable. A short welding arc is preferred and the drag technique is not recommended.

In the as welded condition readily check cracks and the spacings between the cracks are small even at slow travel speeds

Preheat is not necessary when surfacing austenitic substrates such as stainless steels and manganese steels, although the interpass temperature should be limited to 260°C for manganese steels.

The deposited weld metal is not machinable or forgeable.

The deposit thickness is limited to 2 layers.

Optimum spalling resistance is achieved using austenitic substrates. For service conditions below 260°C an austenitic manganese substrate is preferred.

For high temperature applications >260°C, an austenitic stainless steel substrate should be used. F.i. RepTec 126.

Wearshield 70 will perform standard primary carbide electrodes (such as Wearshield 60) under either low stress or high temperature abrasion conditions.

## Welding positions



ISO/ASME PA/1G PB/2F

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Cr	Nb	Mo	W	Si
4.2	18	9	8.5	7	2.7

## Structure

The microstructure consists mainly of primary chromium carbides with premium carbides of molybdenum, niobium, tungsten and vanadium in an austenite - carbide eutectic matrix

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current' (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Elektrodes/ kg weldmetal B	kg Elektrodes/ kg weldmetal 1/N
3.2 x 350	120 - 160	AC	156	699	1.28	67	18	1.21
4.0 x 350	180 - 220	AC	172	1011	1.50	100	14	1.40
5.0 x 350	230 - 300	AC	194	1630	2.06	155	9	1.39

\* stub end = 35 mm

## Complementary products

Complimentary products include flux cored wire Lincore® 65-O.

## Hardfacing electrode

### Classification

DIN 8555-83

: E6-UM-55-RZ

### General Description

Heavily coated electrode that produces a martensitic deposit similar to AISI 420 stainless steel. Designed for operator appeal and weld quality having excellent arc characteristics, good restriking and low spatter levels. The electrode coating permits the use of the drag or contact welding technique as well as positional welding if required.

### Application

Wearshield 420 electrodes are intended to provide abrasion resistance under conditions of high corrosion, abrasion and impact.

The electrode can be used on carbon steels, low alloy steel and martensitic steel.

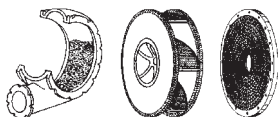
Typical applications include:

Sand pumps

Dredging equipment

Fans

Valve seats in steam and liquid pipes



### Mechanical properties, all weld metal

Typical hardness values: 55 HRC (560HB)

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	450
Unit: Box	Pieces / unit (nominal)	51	36	22
	Net weight (kg)	2.5	2.5	2.5

### Identification

Imprint: Wearshield 420

Tip colour: brown

Wearshield® 420: rev. EN 15



## Additional information

All work-hardened base material and previously deposited hardfacing material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking. Areas that contain irregularities such as cracks and deep gouges can be repaired locally using Wearshield BU30 or Wearshield 15CrMn prior to hardfacing with Wearshield 420.

Preheat would be needed if the welding is done over either highly restrained material or martensitic stainless base metal.

Preheat would be needed if the welding is done over either highly restrained material or

A preheat and interpass temperature in the range of 200-300°C can be used depending on the nature of the material to be welded.

Under conditions of low dilution, the microstructure is similar to that of AISI 420 martensitic stainless steel. This structure provides good abrasion resistance under conditions of severe corrosion and high impact. At higher dilutions, when overlaid on mild steel or low alloy steel, the weld metal microstructure will retain its martensitic stainless structure. But the reduced chromium level might adversely affect the corrosion resistance of the deposit.

## Welding positions



ISO/ASME PA/1G PC/2G PF/3G up PE/4G

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Mo	Ti
0.5	0.3	0.4	12.4	0.4	1.3

## Structure

Ferrite and martensite

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time -per electrode at max. current' (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	90 - 130	AC	83	324	1.08	45	40	1.80
4.0 x 350	120 - 170	AC	102	522	1.36	67	26	1.74
5.0 x 450	170 - 220	AC						

\* stub end = 35 mm

## Complementary products

Complimentary products include Lincore® 420

## Hardfacing electrode

### Classification

AWS A 5.13-00 : ECoCr-C  
DIN 8555-83 : E20-UM-50-CRZ

### General Description

Hardfacing electrode, cobalt base weld metal

Provides the highest abrasion resistance of the Wearshield cobalt alloy product line

### Application

Primary application is where resistance to abrasion and service temperatures exceed 600°C or corrosion is severe  
Screw components moving hot minerals, cokes, ores etc. at high temperature

### Welding positions



ISO/ASME PA/1G

### Current type

AC / DC electr. + / -

### Structure

Cobalt base

### Chemical composition (w%), typical, all weld metal

C	Cr	Ni	W
2.0	28.0	1.0	12

### Mechanical properties, all weld metal

	Typical values
Hardness	50HRc
Surface load max. approx.	1700 N/mm <sup>2</sup>
Welded on general structural steel	

### Packaging, available sizes and identification

	Diameter (mm)	3.2
	Length (mm)	355
Unit: Box	Pieces/unit (nominal)	-
	Net weight/unit (kg)	1

### Identification

Imprint:

Tip colour:

Wearshield® C1: rev. EN 15

## Welding instructions

Preheating 500°C and slow cooling to prevent cracking.

Sharp angels must be round off before hardfacing.

Can be applied over carbon steel, low alloy steel, stainless steel and nickel based alloys.

If necessary weld on a buffer layer of RepTec 29 or Arosta 309Mo and at high temperature applications with RepTec 7.

Spatter is slightly less with DC+ polarity.

A short arc length or dragging of the electrode lightly on the workpiece is usually most suitable.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	85-110	DC+	110	-	-	40	51	-

\* stub end 35 mm

## Hardfacing electrode

### Classification

AWS A5.13-00 : ECoCr-A  
DIN 8555-83 : E20-UM-45-CRSTZ

### General Description

Hardfacing electrode, cobalt base weld metal.

Principal application is resistance to metal to metal wear or erosion, when service temperatures exceed 900°C or corrosion is severe. Low resistance to friction.

High resistance to most aggressive chemicals.

### Application

Pump shafts  
Pump Impeller  
Valve seats

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/5G up

### Current type

AC / DC electr. +

### Chemical composition (w%), typical, all weld metal

C	Cr	W	Ni	Co
1.0	27.0	4.0	1.0	bal.

### Mechanical properties, all weld metal

Typical hardness values: HRC 43

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0
	Length (mm)	355	355
Unit: Box	Pieces/unit (nominal)	29	21
	Net weight/unit (kg)	1	1

### Identification

Imprint: CoCr-A Wearshield C6

Tip colour:

Wearshield® C6: rev. EN 15

## Welding instructions

Welding in two ore more layers

In one layer dilution influences hardness and corrosion resistance

Electrode perpendicular to weld surface, short arc length or dragging of the electrode lightly on the workpiece is usually most suitable to limit dilution

Limited weaving is preferred

Preheat- and interpass temperature workpiece 400-500°C to avoid risk of cracking

Maintain this temperature during welding and then alloy to cool gradually

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	85 - 110	DC+	93	195	1.0	56.0	39	1.66

\*Stub end 35 mm

## Welding parameters, optimum fill passes

Welding positions	PA/1G
Diameter (mm)	Current (A)
3.2	100

## Hardfacing electrode

### Classification

AWS A5.13-00 : ECoCr-E  
DIN 8555-83 : E20-UM-45-CKRZ

### General Description

Hardfacing electrode, cobalt base weld metal. Resists metal to metal wear, in a severe corrosion environment and/or high temperatures. Provides a deposits of essentially solid solution cobalt - chromium - molybdenum - nickel alloy. The hardness is a little lower as the Wearshield C6, which decreases the occurrence of cracks and make the weld machinable.

Recommended when wear resistance is necessary and service temperature up to 800°C or short time 1100°C corrosion is severe

### Application

Valve faces  
Valve seats

### Welding positions



ISO/ASME PA/TG

### Current type

AC / DC electr. + / -

### Chemical composition (w%), typical, all weld metal

C	Cr	Ni	Mo	Co
0.22	26	3.0	5.0	bal.

### Mechanical properties, all weld metal

	Typical hardness values
As deposited	25 HRC (255 HB)
Work hardened	45 HRC (425 HB)

### Packaging, available sizes and identification

	Diameter (mm)	3.2
	Length (mm)	355
Unit: Box	Pieces/unit (nominal)	19
	Net weight/unit (kg)	1

Identification Imprint: Tip colour:

Wearshield® C 21: rev. EN 15

# Wearshield® C 21

## Welding instructions

Preheat 250°C or higher depending on material

Welding with low current to limit dilution

Avoid sharp angles

If necessary weld on a buffer layer of Cr-Ni steels for example RepTec 29 or Arosta 309Mo and at high temperature applications RepTec 7

SMW

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 355	85-110	DC+						

\*Stub end 35 mm

## Remarks

Spatter is slightly less with DC+ polarity

A short arc length or dragging of the electrode lightly on the workpiece is usually most suitable

## Hardfacing electrode

### Classification

AWS A5.21-01 : EWC  
DIN 8555-83 : E21-GFUM-60-G

### General Description

Coated cored rod electrode for welding extremely wear-resistant hardfacings.  
60-70% of the weld metal comprises tungsten carbides

### Application

Welding extremely wear-resistant hardfacings, against high abrasive wear in sand, gravel, stone and cement industries, ceramics industry, well construction, ore mining, road building, and mining e.g. stripping devices, rippers, jaw cutters, dredger teeth, drill bits, crushers, wire-draw pulleys, elevator cages, earth borers, ore paring blades, guide rods, guide pulleys, horse shoe nails and horseshoes, coal plane blades, scraping blades, gravel pumps, loading teeth, loading shovels, pulverizers, mixer blades, mixer arms, mill hammers, plough blades, planing blades, pressure pipes, roller crown bits, stirring blades, stirring spindles, stirring shovels, ductors, slag breakers, worms of all kinds, chipping blades, pestles, fan blades, winnower blades, jagged crown bits

### Welding positions



ISO/ASME PA/1G

### Current type

AC / DC electr. + / -

### Mechanical properties, all weld metal

	Typical hardness values
Tungsten carbides	2000-2400 HV
Matrix	670-760HV (58-62 HRC)

### Packaging, available sizes and identification

	Diameter (mm)	4.0
	Length (mm)	355
Unit: Box	Pieces/unit (nominal)	
	Net weight/unit (kg)	2.5

### Identification

Imprint: Wearshield WC

Tip colour:

Wearshield® WC: rev. EN 15



## Welding instructions

The weld metal, the hardness of which remains unaltered by heat treatment, cannot be machined.

Weld deposit can only be grinded; therefore this cored-rod electrode should only be used if subsequent finishing is not required.

Hints for welding

Well-directed smooth arc; high beads. Set low current intensity and keep the arc short in order to guarantee minimum dilution. Weld string beads in maximum of two layers. If higher deposits are required first weld a buffer layer, e.g. with RepTec 29, RepTec 126 or Wearshield MI(e).

Preheat base material only if very thick parts are to be welded; subsequent heat treatment not required.

The weld deposit itself is likely to check crack in most cases.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
4.0 x 355	150-220							

\*Stub end 35 mm

## Repair electrode

## Classification

AWS A 5.11M-97 : ENi Cu-7  
ISO 14172-03 : E Ni 4060 (NiCu30Mn3Ti)

## General description

Basic coated all position electrode for welding NiCu 70/30 (Monel)  
High resistance to seawater corrosion (not stagnant)  
Applicable for welding NiCu-alloys to mild and low alloyed steel  
Very suitable for welding salt fabrication components  
Excellent weldability and slag release

## Welding positions



## Current type

DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cu	Fe	Ti
0.02	3.0	0.4	bal.	30	1.75	0.35

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -196°C
Required: AWS A5.11M-97		not required	min. 480	min. 30	not required
ISO 14172-02		min. 200	min. 480	min. 27	not required
Typical values	AW	300	485	40	110

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	300	350	350
Unit: PE tube	Pieces / unit (nominal)	148	77	47
	Net weight unit (kg)	2.5	2.5	2.5

## Identification

Imprint: RepTec 5

Tip colour: yellow

RepTec 5: rev. EN 15

## Materials to be welded

Material grades	BS3076	DIN 17743	W.Nr.	ASTM/ACI	UNS
	NA 13	NiCu30Fe	2.4360	Monel 400	N04400
		G-NiCu30Nb	2.4365		
	NA 18	NiCu30Al	2.4375	Monel K500	N05500

RepTec 5 is also applicable in carbon to CuNi- and NiCu alloys

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	45 - 65	DC+	50	72	0.80	20.7	90	1.85
3.2 x 350	70 - 90	DC+	65	129	1.2	32.5	46	1.49
4.0 x 350	90 - 130	DC+	67	245	1.75	47.17	31	1.51

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	65	60	65	55	55	55
3.2	90	85	90	75	75	75
4.0	120	120				

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Repair electrode

## Classification

AWS A5.11M-97 : ENiCrFe2\*  
 ISO 14172-03 : E Ni 6182 (NiCr15Fe6Mn)\*

\* Deviation: see remarks

## General description

Fully basic all position NiCr electrode  
 High creep resistance up to 815°C  
 High resistance to embrittlement  
 High toughness also at low temperature (-196°C)  
 For welding, Ni base alloys (as Alloy 600) and dissimilar joints  
 High resistance to carburization

## Welding positions



## Current type

DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Cr	Nb	Fe
0.02	4.4	0.45	bal.	18	1.9	6

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					+20°C	-196°C
Required: AWS A5.1-97		not required	min. 550	min. 30	not required	
ISO 14172-02		min. 360	min. 550	min. 27	not required	
Typical values	AW	430	680	40	145	130

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	300	350	350	450
Unit: PE tube	Pieces / unit (nominal)	140	73	50	26
	Net weight unit (kg)	2.5	2.5	2.5	2.5

## Identification

Imprint: RepTec 7

Tip colour: yellow

RepTec 7: rev. EN 15

## Materials to be welded

Material grades	BS 3076	DIN 17742 SEW 470/595	W.Nr.	ASTM / ACI B366	UNS
Ni base on		LC-NiCr15Fe	2.4817		N06600
Cr alloyed steel,	NA14	NiCr15Fe	2.4816	Alloy600/B168	N06600
for high and low		NiCr23Fe	2.4851	Alloy601(H)	N06601
temperature service		NiCr60 15	2.4867		
		NiCr80 20	2.4869		
		NiCr20Ti	2.4951	Alloy75	N06075
		NiCr20TiAl	2.4952	Alloy80A	N07080
	NA17	X12NiCrSi36 16	1.4864	330	N08330
		G-X10NiCrNb32 20	1.4859		
	NA15	X10NiCrAlTi32 20	1.4876	Alloy800/800H	N08800/N08810

Especially for repair welding of difficult to weld steels.

Suitable for welding dissimilar metals:

- Mild- and low-alloyed steel to stainless steel.
- Mild- and low-alloyed steel to Ni base alloys
- Stainless steel to low-alloyed creep resisting steel.

Not sensitive for embrittlement after heattreatment.

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	40 - 60	DC+	44	63	0.9	17.5	91	1.59
3.2 x 300	70 - 100	DC+	52	107	1.3	29.2	52	1.54
4.0 x 350	90 - 160	DC+	61	214	2.0	51.0	29	1.47

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions	PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
Diameter (mm)	Current (A)					
2.5	60	55	60	60	60	60
3.2	90	80	90	80	80	80
4.0	120	120				

## Remarks

Deviations: chemical composition:

Mn = 3.0 - 6.0%

Cr = max. 18.0%

AWS: Mn = 1.0 - 3.5%

AWS: Cr = max. 17.0%

ISO: Mn = 5.0 - 10.0%

ISO: Cr = max. 17%

## Application advice

Welding with heat input max. 1.5 kJ/mm

Interpass temperature max. 150°C

## Repair electrode

## Classification

AWS A5.4-92 : E312-16 \*  
EN 1600-97 : E 29 9 R 12

\* nearest classification, see remarks

## General description

A rutile-basic coated high CrNi-alloyed all position electrode

Most versatile electrode for repair welding

Specially developed for welding steels difficult to weld such as:

- armour plate - austenitic Mn-steel - high C-steel

Excellent weldability and self releasing slag

Weldable on AC and DC+ polarity

Not sensitive for porosity

## Welding positions



ISO/ASME



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.11	0.9	1.0	29.0	9.0

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.4-92		not required	min. 660	min. 22	not required
EN 1600-97		min. 450	min. 650	min. 15	not required
Typical values	AW	700	800	20	50

## Packaging, available sizes and identification

	Diameter (mm)	2.0	2.5	3.2	4.0	5.0
	Length (mm)	300	350	350	350	350
Unit: PE tube	Pieces / unit (nominal)	196	176	122	82	56
	Net weight unit (kg)	2.5	3.7	4.0	4.0	4.0

## Identification

Imprint: RepTec 29

Tip colour: red

RepTec 29: rev. EN 15

## Materials to be welded

Various steels grades, such as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic austenitic steels
- Work hardening austenitic manganese steels
- Dissimilar steel grades (CMn-steels to stainless steel) up to max. thickness of 12 mm

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.0 x 300	40 - 55	DC+	41	45	0.59	12.0	150	1.80
2.5 x 350	50 - 70	DC+	57	91	0.73	20.7	87	1.79
3.2 x 350	70 - 100	DC+	60	126	1.1	33.0	52	1.72
4.0 x 350	100 - 130	DC+	72	273	1.4	49.7	35	1.72
5.0 x 350	130 - 140	DC+	79	313	2.4	71.5	19	1.36

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	60	60	60
3.2	100	90	100	65	65	65
4.0	130	125	130	80		

## Remarks

Deviations: chemical composition:

Si = max. 1.2%

AWS: Si = max. 0.90%

## Repair electrode

## Classification

AWS A5.11M-97 : ENiCrMo-5\*  
 DIN 8555-83 : E23-UM-200-CKPTZ

\* Nearest classification

## General description

Rutile coated stick electrode - weld deposit rate 170% - for hardfacings on machine components and tools subjected to corrosion and heat.

Weld metal comprises low iron nickel-chromium-molybdenum-tungsten-alloy.

Smooth stable arc.

Low dilution with the parent material.

Slag easily removable.

## Welding positions



ISO/ASME PA/1G PB/2F

## Current type

AC / DC electrode +

## Chemical composition (w%), typical, all weld metal

C	Si	Mn	Cr	Mo	W	Fe	Ni
0.02	0.9	0.9	16	17	4.0	6.5	balance

## Mechanical properties, all weld metal

Typical hardness values

As deposited	225 HB
Work hardened	400 HB

## Packaging, available sizes and identification

	Diameter (mm)	3.2
	Length (mm)	350
Unit: PE tube	Pieces / unit (nominal)	40
	Net weight unit (kg)	2.5

## Identification

Imprint: RepTec 34

Tip colour: violet

RepTec 34: rev. EN 15



## Materials to be welded

Hardfacings on new or damaged hot working tools, such as: forging dies, forging saddles, hot-shearing blades, hot-trimming dies, hollow-

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	110-140	-	-	-	-	59	-	-

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	Current (A)
3.2	120

## Remarks

In the case of great hardfacing thicknesses, fill beforehand, e.g. with RepTec 29. Heat up to 300°C with components made from parent materials suscepti-

## Application advice

Untreated weld metal machinable

## Repair electrode

## Classification

AWS A5.4-92 : E310-16  
EN 1600-97 : E 25 20 R 12

## Temperature range

pressurized parts: -20 ... +400°C  
scaling resistance: 1100°C

## General description

Rutile basic coated electrode for all position welding except vertical down  
Fully austenitic weld metal with high Cr and Ni content for very high service temperature  
High resistance against oxidation and scaling up to 1100°C  
Avoid service temperatures between 650 - 850°C  
Weldable on AC and DC

## Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.12	2.5	0.5	26.0	20.5

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Required: AWS A5.4-92		not required	min. 550	min. 30	not required
EN 1600-97		min. 350	min. 550	min. 20	not required
Typical values	AW	440	600	30	80

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: PE tube	Pieces / unit (nominal)	121	74	49
	Net weight unit (kg)	2.5	2.5	2.5

## Identification

Imprint: RepTec 46

Tip colour: dark green

RepTec 46: rev. EN 15

### Materials to be welded

Material grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A351	UNS
Heat resisting steel	X10 CrAl 24	GX25 CrNiSi 18-9 GX40 CrNiSi 22-9	1.4762	310S CK20 HK40	S31008 J94202
			1.4825		
			1.4826		
	X15 CrNiSi 20-12	GX25 CrNiSi 20-14	1.4828		
			1.4832		
	X15 CrNiSi 25-20	GX40 CrNiSi 25-20	1.4841		
			1.4845		
	X12 CrNi 25-21		1.4848		

### Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	80 - 90	DC+	48	98	0.83	20.4	90	1.84
3.2 x 350	90 - 120	DC+	56	155	1.31	31.8	49	1.56
4.0 x 350	130 - 175	DC+	72	233	1.55	50.7	32	1.64

\* stub end 35mm

### Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	100	100	100	90	90	90
3.2	130	120	130	110	110	110
4.0	160	160	160	140		

### Application advice

Welding with heat input max. 1.5 kJ/mm  
Interpass temperature max. 100°C

## Repair electrode

## Classification

AWS A 5.4-92 : E307-26\*  
 EN 1600-97 : E 18 8 Mn R 53

\* Nearest classification, see remarks

## General description

A rutile 6%Mn-alloyed stainless steel electrode

Especially developed for steels difficult to weld, such as:

- Armour plate
- Austenitic high Mn-steels

Often used for buffer layers in "hardfacing" applications

Weldable on DC+ polarity

## Welding positions



ISO/ASME PA/1G PB/2F

## Current type

AC / DC electr. +

## Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni
0.06	5.0	1.0	18.0	8.0

## Mechanical properties, all weld metal

Condition	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -10°C
Required: AWS A5.4-92		not required	min. 590	min. 30	not required
EN 1600-97		min. 350	min. 500	min. 25	not required
Typical values	AW	425	650	35	85 60

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	450	450
Unit: PE tube	Pieces / unit (nominal)	116	48	25	17
	Net weight unit (kg)	2.5	2.5	2.5	2.5

## Identification

Imprint: RepTec 126

Tip colour: red

RepTec 126: rev. EN 15

## Materials to be welded

Various steel grades, such as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic austenitic steels
- Work hardening austenitic manganese steels
- Dissimilar steel grades (CMn-steels to stainless steel)

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	80 - 100	DC+	44	71	0.96	17.8	85	1.52
3.2 x 350	110 - 150	DC+	53	132	1.4	29.1	48	1.39
4.0 x 450	140 - 200	DC+	86	264	1.7	55.9	25	1.41
5.0 x 450	210 - 260	DC+	82	388	2.7	85.3	16	1.39

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G
2.5	60	60	60
3.2	90	90	90
4.0	140	115	130
5.0	160	165	

## Remarks

Deviations: chemical composition:

Mn = 4.5 - 7.5%

Cr = 18.0 - 21.5%

Ni = 7.0 - 10.0%

AWS: Mn = 3.30 - 4.75%

AWS: Cr = 18.0 - 21.5%

AWS: Ni = 9.0 - 10.7%

## Repair electrode

### Classification

AWS A5.4-92 : E316L-16  
EN 1600-97 : E 19 12 3 L R 12

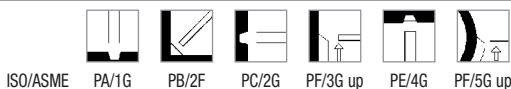
### Temperature range

pressurized parts: -120 ... +350°C  
scaling resistance: n.a.

### General description

Rutile-basic all position stainless steel electrode for 316L or equivalent steels  
Molybdenum level min. 2.7%  
High resistance to general and intergranular corrosion  
Smooth weld appearance  
Easy slag release  
Strong electrode coating  
Weldable on AC and DC

### Welding positions



### Current type

AC / DC electr. + / -

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Cr	Ni	Mo
0.020	0.8	0.8	18.0	11.5	2.85

### Mechanical properties, all weld metal

Condition	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C -120°C
Required: AWS A5.4-92 EN 1600-97		not required min. 320	min. 490 min. 510	min. 30 min. 25	not required not required
Typical values	AW	450	580	39	60 40

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit: PE tube	Pieces / unit (nominal)	125	77	50	33
	Net weight unit (kg)	2.5	2.5	2.5	2.5

### Identification

Imprint: RepTec 210

Tip colour: pink

RepTec 210: rev. EN 15

## Materials to be welded

Material grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMo 17-13-3		1.4429		
Medium carbon C >0.03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
Ti-, Nb stabilized	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	
	S31640				
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 75	DC+	50	86	0.88	19.9	82	1.61
3.2 x 350	60 - 110	DC+	57	157	1.3	32.9	49	1.61
4.0 x 350	80 - 150	DC+	64	240	1.7	49.2	32	1.59
5.0 x 350	140 - 220	DC+	67	396	2.6	77.1	20	1.59

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions	PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
Diameter (mm)	Current (A)					
2.5	70	70	70	60	60	60
3.2	100	100	100	70	70	70
4.0	140	140	140	80		
5.0	180	180	180			

For root passes DC- is recommended.

## Repair electrode

### Classification

AWS A5.6-84 : ECuMnNiAl

### General description

Basic coated Al-bronze stick electrode, alloyed with 12% Mn for porosity free welding of Mn and Ni containing copper-aluminium alloys. Also suitable for hot crack free cladding of mild steel as well as cast iron. Cladding of slide valves, valve seats, stirrers, ship shafts and propellers.

### Welding positions



### Current type

DC electr. +

### Chemical composition (w%), typical, all weld metal

Mn	Si	Al	Fe	Ni+Co	Cu
12	0.3	6.5	2	2	bal.

### Mechanical properties, all weld metal

Condition	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Hardness HB10/1000
Required: AWS A5.6-84		not required	min. 520	min. 15	160-200
Typical values	AW	450	650	15	180

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0
	Length (mm)	350	350
Unit: PE tube	Pieces / unit (nominal)	93	83
	Net weight unit (kg)	2.5	3.2

### Identification

Imprint: RepTec Cu 8

Tip colour: gold

RepTec Cu 8: rev. EN 15



## Materials to be welded

Material grades such as:

- Cu Al9 Mn2
- G-Cu Al8 Mn
- G-Al10 Ni5 Fe 4
- G-Cu Al10 Ni
- G-Cu Al11 Ni6 Fe
- G-Cu Al11 Ni
- Cu Be 1.7\*
- Cu Be 2\*

\* in case there are no special requirements to strength

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	60 - 100	-	-	-	-	26.7	-	-
4.0 x 350	80 - 130	-	-	-	-	39.3	-	-

\* stub end 35mm

## Application advice

Preheating is only needed with larger work pieces. During the cladding of steel, avoid too much base metal dilution by directing the arc on to the previously passes.

Welding with low current.

## Repair electrode

### Classification

AWS A5.15-90 : ENi-CI  
ISO 1071-01 : E C Ni-CI 1

### General description

Ni-electrode for repair welding of lamellar cast iron, malleable cast iron and cast iron to steel

Produces a soft malleable weld deposit

Hardness weld deposit ~ 175 HB

Preferable welding on DC-, gives pulsed arc welding, deep penetration, smooth surface, no lack of fusion

Welding on AC, lowest heat input, important at filling

Best choice for multilayer welding

### Welding positions



### Current type

AC / DC electr. + / -

### Chemical composition (w%), typical, all weld metal

C	Fe	Ni
0.7	2.0	97

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Hardness HB10
Required: AWS A5.15-90		262-414	276-448	3-6	135-218
ISO 1071-01		200	250	3	
Typical values	AW	270	445	8	175

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	300	350	400
Unit: PE tube	Pieces / unit (nominal)	146	76	44
	Net weight unit (kg)	2.5	2.5	2.5

### Identification

Imprint: RepTec Cast 1

Tip colour: black

RepTec Cast 1: rev. EN 15

## Materials to be welded

Material grades	DIN1691	DIN 1692	DIN 1693
For welding and repair	GG 10	GTS-35-10	G GG-40
	GG 15	GTS-45-06	G GG-50
	GG 20	GTS-55-4	G GG-60
	GG 25	GTW-35-04	
	GG 30	GTW-40-05	
	GG 35	GTW-45-07	
		GTW-S-38-12	

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	50 - 100	DC-	176	268	0.24	19.1	84	1.61
3.2 x 350	70 - 130	DC-	145	303	0.48	32.6	52	1.52
4.0 x 400	90 - 150	DC-	262	647	0.55	56.7	25	1.41

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	70	70	70	70	70	
3.2	100	100	100	80	80	
4.0	120	120	120	110	110	

## Application advice

Residual stresses are decreased by peening after each layer

Cold welding, interpass temperature (Ti<100°C)

Heavy parts preheat (to max. 300°C)

## Repair electrode

### Classification

AWS A5-15-90 : ENiFe-CI  
ISO 1071-01 : E C NiFe-CI 1

### General description

Basic graphite coated stick electrode with nickel iron core for cold welding of cast iron, malleable cast iron and joint welding to steel.

Specially developed for good peen- and machinable seams e.g. for thick joints.

In order to introduce as little heat into the work piece as possible, it is advisable to weld with DC positive.

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PG/3G down PE/4G

### Current type

AC / DC electr. +

### Chemical composition (w%), typical, all weld metal

C	Fe	Ni
0.6	40	balance

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Hardness HB10
Required: AWS A5.15-90		296-434	400-579	6-18	165-218
ISO 1071-01		250	350	6	
Typical values	AW	300	460	10	175

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	300	300	350
Unit: PE tube	Pieces / unit (nominal)	155	95	54
	Net weight unit (kg)	2.5	2.5	2.5

### Identification

Imprint: RepTec Cast 3

Tip colour: black

RepTec Cast 3: rev. EN 15

## Materials to be welded

Material grades	DIN 1691	DIN 1692	DIN 1693
For welding and repair	GG-10	GTS-35	G GG-40
	GG-15	GTS-45	G GG-50
	GG-20	GTS-55	G GG-60
	GG-25	GTW-35	G GG-70
	GG-30	GTW-40	G GG-80
	GG-35	GTW-45	
	GG-40	GTW-S-38	

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	50 - 70	AC	58	106	0.76	15.9	82	1.3
3.2 x 300	70 - 90	AC	69	161	1.24	30.8	42	1.3
3.2 x 350	70 - 90							
4.0 x 350	100 - 120	AC	75	234	1.78	46.2	27	1.2
4.0 x 400	100 - 120							

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G	PF/5G up
2.5	60	60	60	60		
3.2	80	80	80	75		
4.0	110	110	110	105		

## Application advice

Welding of short beads is recommendable.

Peening (with a ball hammer) immediately after welding eliminates shrinkage stresses.

Perlitic cast iron often needs 200°C preheating.

## Repair electrode

### Classification

AWS A5.15-90 : ENiFe-CI  
ISO 1071-01 : E C NiFe-CI 1

### General description

Electrode for repair welding of cast iron, malleable cast iron and cast iron to steel

The nickel-iron weld deposit is easily machineable

Particularly applicable for nodular cast iron

Hardness weld deposit ~ 180 HB

Excellent current carrying capacity cause bi-metal core wire

Welding on AC and DC- polarity

Best choice welding DC electrode -

### Welding positions



### Current type

AC / DC electr. -

### Chemical composition (w%), typical, all weld metal

C	Fe	Ni
0.7	45	balance

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Hardness HB10
Required: AWS A5.15-90		296-434	400-579	6-18	165-218
ISO 1071-01		250	350	6	
Typical values	AW	300	460	12	180

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	300	350	400
Unit: PE tube	Pieces / unit (nominal)	154	82	47
	Net weight unit (kg)	2.5	2.5	2.5

### Identification

Imprint: RepTec Cast 31

Tip colour: black

RepTec Cast 31: rev. EN 15

## Materials to be welded

Material grades	DIN 1691	DIN 1692	DIN 1693
For welding and repair	GG10	GTS-35-10	G GG-40
	GG15	GTS-45-06	G GG-50
	GG20	GTS-55-4	G GG-60
	GG25	GTW-35-04	
	GG30	GTW-40-05	
	GG35	GTW-45-07	
		GTW-S-38-12	

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 300	70 - 100	DC-	124	211	0.32	19.1	91	1.72
3.2 x 350	90 - 150	DC-	123	328	0.62	29.4	47	1.37
4.0 x 400	100 - 180	DC-	168	714	0.74	55.7	30	1.45

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G	PF/3G up	PE/4G
2.5	80	80	80	80	80
3.2	110	110	110	110	110
4.0	150	160	160	150	150

## Application advice

Residual stresses are decreased by peening after each layer

Cold welding, interpass temperature (Ti<100°C)

Heavy parts preheat (to max. 300°C)

## Repair electrode

### Classification

AWS A5.3-99 : E4043  
ISO 18273-01 : Al 4043A\*

\* Nearest classification

### General description

Coated electrode for welding aluminium-silicon alloys and dissimilar welding of aluminium alloys  
Weldmetal aluminium-silicon alloy

### Welding positions



### Current type

DC electr. +

### Chemical composition (w%), typical, all weld metal

Al	Si
bal.	5

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Required: AWS A5.3-99			95	
Typical values	AW	90	160	15

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2
	Length (mm)	350	350
Unit: Can	Pieces / unit (nominal)	227	152
	Net weight unit (kg)	2.0	2.0

### Identification

Imprint:

Tip colour:

RepTec AlSi 5: rev. EN 15



## Materials to be welded

Aluminium-silicon alloys, and dissimilar of several aluminium alloys

With restriction: precipitation hardening alloys such as:

- AlCuMg (3.1325)
- AlMgSi1 (3.2315)
- AlZn 4.5Mg1 (3.4335)

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 70	-	-	-	-	9.0	-	-
3.2 x 350	60 - 90	-	-	-	-	13.2	-	-

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PF/3G up
2.5	60	60	55
3.2	90	80	75

## Remarks

After welding of precipitation hardening alloys the strength in H.A.Z. is decreasing

## Application advice

Welding with short arc preferable

Electrode with 90° angle on material

At wall thickness >15 mm preheating 150 - 250°C

## Repair electrode

## Classification

ISO 18273-01 : Al 4047A

## General description

Coated aluminium electrode for welding cast aluminium-silicon alloys

Also applicable as surfacing electrode

Good weldability, no porosity

## Welding positions



ISO/ASME



PA/1G



PB/2F



PF/3G up

## Current type

DC electr. +

## Chemical composition (w%), typical, all weld metal

Al	Si	Mn
bal.	12	0.1

## Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	AW	80	180	5

## Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2
	Length (mm)	350	350
Unit: Can	Pieces / unit (nominal)	227	152
	Net weight unit (kg)	2.0	2.0

## Identification

Imprint:

Tip colour:

RepTec AlSi 12: rev. EN 15

## Materials to be welded

Cast aluminium alloys with silicon up to 12%, such as:

- G-AlSi 10 Mg (3.2381)
- G-AlSi 12 (3.2581)

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	40 - 70	-	-	-	8.9	8.8	-	-
3.2 x 350	60 - 90	-	32	66	0.7	13.2	164	2.16

\* stub end 35mm

## Welding parameters, optimum fill passes

Welding positions Diameter (mm)	PA/1G Current (A)	PB/2F	PF/3G up
2.5	60	60	55
3.2	80	80	75

## Remarks

Redrying generally speaking not necessary. If required max. 150°C

## Application advice

Welding with short arc preferable

Electrode with 90° angle on material

At wall thickness >15 mm preheating 150 - 250°C

## Cutting/Gouging electrode

### General description

RepTec 53GR is a coated electrode specially designed for gouging (very clean gouging)

Metal clears from pool

Cuts most metals

Ideal for maintenance, repair, site work

Applicable for mild steel, low alloyed steel, stainless steel, cast iron, copper- and aluminium alloys

### Current type

AC (open circuit voltage >70V)

DC electr. + / -

Ø3.2: 220-300A

Ø4.0: 270-360A

Ø5.0: 320-420A

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	450
Unit: PE tube	Pieces/unit (nominal)	99	58	42
	Nett weight/unit (kg)	3.0	2.9	4.2

RepTec 53GR: rev. EN 15

## Cutting/Gouging electrode

### General description

RepTec 53CT is a coated electrode special for cutting and piercing

It's preferable when cutting grooves that the electrode is held at an angle of 5° - 10° to the plate pointing in the direction of travel.

The rate of travel combined with variation of the angle dictates the depth of cut

The surface of the cut produced is clean and seldom requires further dressing

For piercing holes or chamfering, the electrode should be held at an angle of 90° to the work

It's always beneficial to pause slightly after the initial arc has been established

Applicable for mild steel, low alloyed steel, stainless steel, cast iron, copper- and aluminium alloys

### Current type

AC (open circuit voltage >70V)

DC electr. + / -

Ø3.2: 220-300A

Ø4.0: 270-360A

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0
	Length (mm)	450	450
Unit: PE tube	Pieces/unit (nominal)	69	72
	Nett weight/unit (kg)	3.0	4.7

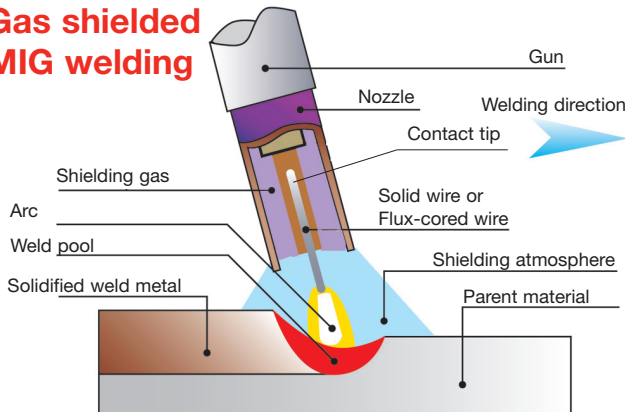
RepTec 53CT: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

[illegible]

# MIG and TIG Process

## Gas shielded MIG welding



The MIG/MAG welding process (or GMAW - Gas Metal Arc Welding) is when an electric Arc is created between a continuous consumable wire and the work piece to be welded, protected within a gas atmosphere. This atmosphere can be either inert (Argon) or active (CO<sub>2</sub> or mixture of Argon and CO<sub>2</sub>). The wire is continuously fed through a gun to the weld pool by a wire feeder. Either Solid Wire (GMAW) or Cored Wire (FCAW-GS - flux-cored arc welding, gas shielding) can be used.

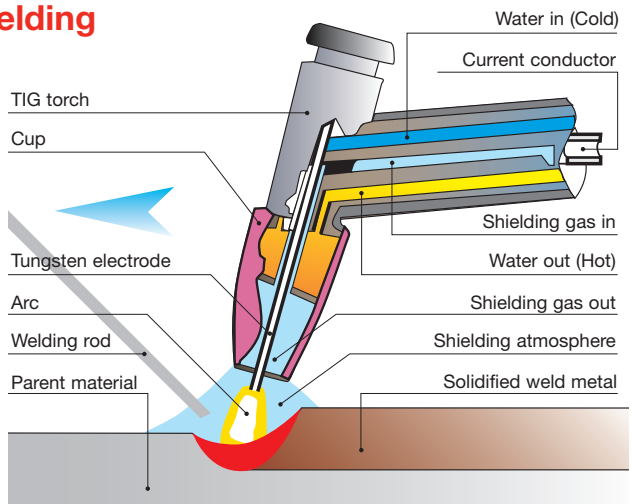
## Gas Tungsten Arc Welding

In this welding process, the electric arc is generated between a non-consumable tungsten electrode and the work piece to be welded. An inert gas atmosphere, usually argon, protects the weld pool. Welding can be done by simply fusing of the parent material together, or with the addition of welding rod similar to the parent material. The rod is allowed to melt in the electric arc and will fill and reinforce the weld joint.

Arc ignition is achieved by touching the work piece with the electrode and lifting it by a few millimetres (contact ignition and lift ignition) or by using a high frequency voltage discharge, a gap of about 4 millimetres is maintained from the tungsten electrode and the work piece, high frequency spark is generated, this makes the air gap conductive, and allows the arc to be established without touching of the work piece with the tungsten electrode, no tungsten contamination can occur (High Frequency ignition).

The following can be used:

- DC (continuous) current is used with most metals (steel / stainless steel).
- AC (alternative) current is ideal for welding aluminium and other materials containing surface refractory oxide.



## Mild steel solid wire

### Classification

AWS A5.18/A5.18M-01 : ER70S-3  
 EN 1668-94 : W 42 5 W2Si  
 EN 440-94 : G 42 2 M G2Si

### General description

**Solid wire/rod for welding general construction in mild steel**  
**High impact toughness**  
**Stable arc and excellent feedability (LNM 25)**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar 100%
GMAW	M21	Mixed gas Ar+ >5-25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

	ABS	BV	CTL	DNV	GL	LR	TÜV
GTAW			+				+
GMAW	3YSA	SA3,3YM	+	IIYMS	3Ys	3S,3YS	

### Chemical composition (w%) typical wire / rod

C	Mn	Si
0.08	1.1	0.6

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20° -50°C
Typical values	GTAW	I1	AW	450	560	26	170 100
	GTAW	I1	SR 15h/620°C	410	525	26	80
	GMAW	M21	AW	500	575	25	95 -

### Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L451MB, L415NB
	API 5LX	X42, X46, X52, X60
Boiler & pressure vessel steel	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

### Packaging

		Sizes (mm)						
Process	Unit	0.8	1.0	1.2	1.6	2.0	2.4	3.0
GTAW	2 and 5 kg tube				X	X	X	X
GMAW	15 kg spool B300	X	X	X				
	300 kg spool		X					

Other sizes and packaging on request

LNT/LNM 25: rev. EN 15

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## Mild steel solid wire

### Classification

AWS A5.18/A5.18M-01 : ER70S-6  
 EN 1668-94 : W 42 5 W3Si1  
 EN 440-94 : G 46 4 M G3Si1

### General description

Solid wire/rod for welding of general constructions in mild steel

Smooth bead appearance

Stable arc and excellent feedability (LNM 26)

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M21	Mixed gas Ar+ >5-25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

	ABS	BV	DB	DNV	GL	LR	RINA	TÜV	RMRS
GTAW			+					+	
GMAW	3SA,3YSA	SA3YM	+	IIYMS	3YS	3S,3YS	3YS	+	3S,3YS

### Chemical composition (w%) typical wire / rod

C	Mn	Si
0.08	1.1	0.6

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	-20°	Impact ISO-V(J)	-50°C
Typical values	GTAW	I1	AW	460	580	26	170	170	120
	GMAW	M21	AW	520	600	25	110	70	

### Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH 36.
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
Boiler & pressure vessel steel	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML
Fine grained steel		

### Packaging

		Sizes (mm)	0.6	0.8	1.0	1.2	1.6	2.0	2.4
Process	Unit								
GTAW	5 kg tube + 2 kg							X	X
GMAW	5 kg spool S200		X	X	X				
GMAW	15 kg spool B300			X	X	X	X		
GMAW	15 kg spool S300		X						
GMAW	250 kg AccuTrack®			X	X	X			
GMAW	300 kg metal coil					X			

Other sizes and packaging on request

LNT/LNM 26: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Mild steel solid wire

### Classification

AWS A5.18/A5.18M-01 : ER70S-6

EN 440-94 : G 42 3 M G4Si1

### General description

Solid wire with increased manganese content for GMA welding of structural steel

### Shielding gases (acc. EN 439)

GMAW	M21	Mixed gas Ar+ >5-25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

	DB	TÜV
GMAW	+	+

### Chemical composition (w%) typical wire

C	Mn	Si
0.08	1.70	0.85

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
							+20°C	-20°C	-50°C
Typical values	GMAW	M21	AW	500	650	26	150	80	50

### Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B,D, AH32 to DH 36.
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

### Packaging

Process	Unit	Sizes (mm)			
		0.8	1.0	1.2	1.6
GMAW	15 kg spool B300	X	X	X	X

Other sizes and packaging on request

LNМ 27: rev. EN 15

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[www.lincolnelectriceurope.com](http://www.lincolnelectriceurope.com)

## Mild steel solid wire

### Classification

AWS A5.18/A5.18 : ER70S-6 (nearest)  
EN 440-94 : G 42 3 M G3Si1

### General description

Solid wire for GMA welding of mild steel  
Smooth bead appearance  
Stable arc and excellent feedability  
Particularly suited for short arc.

### Shielding gases (acc. EN 439)

GMAW M21 Mixed gas Ar+ >5-25% CO<sub>2</sub>  
C1 Active gas 100% CO<sub>2</sub>

### Approvals

	DB	GL	LR	TÜV
GMAW	+	+	3YS	+

### Chemical composition (w%), typical, wire

C	Mn	Si
0.07	1.45	0.85

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -30°C
Typical values	GMAW	M21	AW	490	590	28	70

### Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH 36.
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275m, S275ML, S355M, S355ML, S420M, S420ML

### Packaging

Process	Unit	Sizes (mm)	0.6	0.8	1.0	1.2	1.6
GMAW	1 kg spool		x	x			
GMAW	5 kg spool S200		X	X	X		
GMAW	15 kg spool B300			X	X	X	X
GMAW	15 kg spool S300		X	X	X	X	X
GMAW	15 kg spool BS300			x	x	x	x
GMAW	250 kg AccuTrack® Drum			X	X	X	X
GMAW	500 kg AccuTrack® Drum			X	X	X	X

Other sizes and packaging on request

UltraMag™: rev. EN 15

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## Mild steel solid wire

### Classification

AWS A5.18/A5.18M-01 : ER70S-6

EN 440-94 : G 42 4 M G3Si1 / G 38 3 C G3Si1

### General description

**Solid wire for welding of structural steels**

**Excellent feedability and very consistent welding performance**

**No adjustments of welding parameters**

**Tight and stable arc with extremely low spatter**

**Better bead profile and appearance**

**Ultimate GMAW wire for robotics and hard automation**

**Also available in AccuTrak®**

### Shielding gases (acc. EN 439)

GMAW	M21	Mixed gas Ar+ >5-25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

	BV	DB	DNV	GL	LR	TÜV
GMAW	S3YM	+	IVY40	4Y40S	3S,3Y40S	+

### Chemical composition (w%), typical, wire

C	Mn	Si
0.08	1.55	0.85

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
							-30°C	-40°C	-50°C
Typical values	GMAW	M21	AW	490	590	27	100	60	40

### Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 t/m DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
Boiler & pressure vessel steel	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M
		S420ML

### Packaging

Process	Unit	Sizes (mm)			
		0.8	1.0	1.2	1.6
GMAW	15 kg spool B300	X	X	X	
GMAW	15 kg spool S300	X	X	X	X
	250 kg AccuTrack	X	X	X	

Other sizes and packaging on request

Supra MIG®: rev. EN 15

## Mild steel solid wire

### Classification

AWS A5.18/A5.18M-01 : ER70S-6

EN 440-94 : G 46 4 M G4Si1 / G 42 3 C G4Si1

### General description

**Solid GMAW wire with increased manganese for semi-automatic welding and robotic applications**

**Excellent feedability, very consistent welding performance**

**Very good weldability, tight and stable arc with extremely low spatter, low fume productions**

**Better bead profile and appearance**

**Highest productivity**

**Also available in AccuTrak®**

### Shielding gases (acc. EN 439)

GMAW	M21	Mixed gas Ar+ >5-25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

	BV	DB	DNV	GL	TÜV
GMAW	S3Y40M	+	IVY40MS	4Y42S	+

### Chemical composition (w%), typical, wire

C	Mn	Si
0.08	1.70	0.85

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C -40°C
Typical values	GMAW	M21	AW	500	650	26	80 80

### Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 t/m DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML, S460

### Packaging

		Sizes (mm)	0.8	1.0	1.2
Process	Unit				
GMAW	15 kg spool B300		X	X	X
	250 kg AccuTrack		X	X	X

Other sizes and packaging on request

Supra MIG Ultra®: rev. EN 15

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## Low alloy solid wire

### Classification

AWS A5.28-96 : ER80S-G

### General description

Solid wire for welding of weather resisiting steels

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M21	Mixed gas Ar+ >5 to 25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

	DB
GMAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Ni	Cu
0.1	1.4	0.75	0.8	0.3

Chemical composition (w%), typical, wire / rod

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strenght (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Typical values	GTAW	I1	AW	570	620	26	80
	GMAW	M21	AW	570	620	26	80

### Materials to be welded

Steel	Code	Type
Weather resisting steels like:	EN 10155	S 235 J 0 W
		S 235 J 2 W
		S 355 J 0 W
		S 355 J 2 W
		S 355 K 2 G 1 W

### Packaging

		Sizes (mm)	1.0	1.2	2.4
Process	Unit				
GTAW	5 kg tube				X
GMAW	15 kg spool B300		X	X	

Other sizes and packaging on request

LNT/LNM 28: rev. EN 15

## Low alloy solid wire

### Classification

AWS A5.28-96	: ER100S-G
EN 12534-99	: G 69 4 M Mn3Ni1CrMo

### General description

Solid wire for GMA welding at high strength steels with yield strength up to 690 N/mm<sup>2</sup>  
Good impact values at -50°C

### Shielding gases (acc. EN 439)

GMAW	M21	Mixed gas Ar+ >5 to 25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

	DB	TÜV
GMAW	+	+

### Chemical composition (w%), typical, wire

C	Mn	Si	Ni	Cr	Mo	V	Cu
0.08	1.7	0.44	1.35	0.23	0.3	0.08	0.25

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -40°C
Typical values	GMAW	M21	AW	710	790	20	70

### Materials to be welded

Steel	Code	Type
Pipe material	API-5LX	X65, X70, X80
	EN 10208-2	L480, L550
Fine grained steel	EN 10137-2	S460, S500, S550, S620 S690

### Packaging

Process	Unit	Sizes (mm)		
		0.8	1.0	1.2
GMAW	15 kg spool B300	X	X	X

Other sizes and packaging on request

LNM MoNiVa: rev. EN 15

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## Low alloy solid wire

### Classification

AWS A5.28-96	: ER80S-Ni 1 (GTAW) / ER80S-Ni 1 (GMAW)
EN 1668-97	: W 42 6 W3Ni1
EN 440-94	: G 46 5 MG3Ni1

### General description

**Solid wire for welding fine grained steel and low alloyed nickel steels**

**High impact value at low temperature (-60°C)**

**Typical offshore applications**

**Stable arc and excellent feedability**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M21	Mixed gas Ar+ >5 to 25% CO <sub>2</sub>

### Approvals

	CTL	DB	GL	TÜV
GTAW	+		4Y42	+
GMAW		+		+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Ni
0.09	1.2	0.6	0.9

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -60°C
Typical values	GTAW	I1	AW	480	560	24	80
	GMAW	M21	AW	480	580	31	60

### Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S275, S355
Ship plates	ASTM A131	Grade A, B, D, E, AH32 to EH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L290 GA, L360GA
	EN 10208-2	L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1	P275T1
	EN 10217-1	P275 T2, P355 N
Fine grained steel	EN 10113-2	S275, S355, S420
	EN 10113-3	S274, S355, S420

### Packaging

Process	Unit	Sizes (mm)					
		0.8	1.0	1.2	1.6	2.0	2.4
GTAW	2 and 5 kg tube				X	X	X
GMAW	15 kg spool B300	X	X	X			
GMAW	5 kg spool S200		X				

Other sizes and packaging on request

LNT/LNM Ni 1: rev. EN 15

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## Low alloy solid wire

### Classification

AWS A5.28-96	: ER80S-Ni2
EN 1668-97	: W 46 6 W2Ni2
EN 440-94	: G 46 6 M G2Ni2

### General description

**Solid wire for welding fine grained and low alloyed nickel steels**  
**High impact value at low temperature (-70°C).**  
**Typical offshore applications**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M21	Mixed Gas Ar+ >5% to 25 CO <sub>2</sub>

### Approvals

	TÜV
GTAW	+
GMAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Ni
0.1	1.1	0.6	2.5

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
							-62°C	-70°C	-90°C
Typical values	GTAW	I1	AW	480	620	24		80	60
	GTAW	I1	SR 620°C/1 h	540	640	25			50
	GMAW	M21	AW	510	620	22		90	
	GMAW	M21	SR 620°C/1 h	540	640	25	80		

### Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S355
Pipe material	EN 10208-2	L360, L415, L445
	API 5 LX	X52, X56, X60, X65
Fine grained steel	EN 10113-2	S355, S420
	EN 10113-3	S355, S420
Low temperature steel	EN 10028-4	11 MnNi 5-3, 13 MnNi 6-3, 15 NiMn 6 (12 Ni 14 G 1, G 2)
	EN 10222-3	13 MnNi 6-3, 15 NiMn 6

### Packaging

Process	Unit	Sizes (mm)			
		1.0	1.2	2.0	2.4
GTAW	2 and 5 kg tube			X	X
GMAW	15 kg spool B300	X	X		

Other sizes and packaging on request

LNT/LNM Ni 2.5: rev. EN 15

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## Low alloy solid wire

### Classification

AWS A5.28-96	: ER70S-A1
EN 12070-99	: W MoSi
EN 12070-99	: G MoSi
EN 1660-97	: W 46 3 W2Mo
EN 440-94	: G 46 3 M G2Mo

### General description

Solid wire for welding creep resistant 0.5%Mo steels and fine grained steels for low temperature applications in the as welded condition with service temperatures in range -30°C to +500°C

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M21	Mixed gas Ar+ >5 to 25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

	CTL	DB	DNV	TÜV
GTAW	+	+	For NV 0,3 Mo	+
GMAW	+			+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Mo
0.12	1.2	0.6	0.5

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%) <sup>1</sup>	Impact ISO-V(J)			
							+20°C	-20°C	-30°C	-40°C
Typical values	GTAW	I1	AW	500	620	24	150			40
	GMAW	M21	AW	520	610	26	110	100	70	

### Materials to be welded

Steel	Code	Type
Elevated temperature steel	EN 10028-2	P295 G H, P355 G H, 16 Mo 2
	EN 10222-2	17 Mo 3, 14 Mo 6
Fine grained steel	EN 10113-2	S275, S355, S420
	EN 10113-3	S275, S355, S420

### Packaging

Process	Unit	Sizes (mm)					
		1.0	1.2	1.6	2.0	2.4	3.0
GTAW	2 and 5 kg tube			X	X	X	X
GMAW	15 kg spool	X	X				

Other sizes and packaging on request

LNT/LNM 12: rev. EN 15

## Low alloy solid wire

### Classification

AWS A5.28-96 : ER80S-B2\*  
EN 12070-99 : W CrMo1Si / G CrMo1Si

\* Nearest classification

### General description

**Solid wire for welding creep and hydrogen resistant Cr-Mo steels**  
**Service temperature up to 550°C**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M21	Mixed gas Ar+ >5 to 25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

	CTL	TÜV
GTAW	+	+
GMAW	+	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Mo
0.1	1.0	0.5	1.2	0.5

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Typical values	GTAW	I1	AW	540	640	22	250
	GTAW	I1	SR 700°C/1h	540	640	22	250
	GMAW	M21	AW	480	590	24	125
	GMAW	M21	SR 700°C/1h	530	635	23	160

### Materials to be welded

Steel	Code	Type
Elevated temperature steel	EN 10028-2	13 CrMo4-5
	EN 10083-1	25 CrMo 4
	EN 10222-2	14 CrMo 4-5
Toolsteel	DIN 17210	16 MnCr 5

### Packaging

		Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4
Process	Unit							
GTAW	2 and 5 kg tube					X	X	X
GMAW	15 kg spool B300		X	X	X	X		

Other sizes and packaging on request

LNT/LNM 19: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Low alloy solid wire

### Classification

AWS A5.28-96 : ER90S-B3\*  
EN 12070-99 : W CrMo2Si / G CrMo2Si

\* Nearest classification

### General description

Solid wire for welding creep and hydrogen resistant Cr-Mo steels  
Service temperature up to 600°C

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M21	Mixed gas Ar+ >5 to 25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Mo
0.09	1.0	0.6	2.5	0.9

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C	Notes!
Typical values	GMAW	M21	AW	460	620	22	90	
	GMAW	M21	SR 690°C/1h	560	680	20	100	
	GTAW	I1	AW	560	640	22	140	

### Materials to be welded

Steel	Code	Type
Creep and hydrogen resistant steel	EN 10028-2	10CrMo 9-10
	EN 10222-2	12CrMo 9-10

### Packaging

Process	Unit	Sizes (mm)					
		0.8	1.0	1.2	2.0	2.4	3.0
GTAW	2 and 5 kg tube				X	X	X
GMAW	15 kg spool B300	X	X	X			

Other sizes and packaging on request

LNT/LNM 20: rev. EN 15

## Low alloy solid wire

### Classification

AWS A5.28-96 : ER80S-B6\*  
EN 12070-99 : W CrMo5Si

\* Nearest classification

### General description

Solid wire for welding of creep and hydrogen resistant 5%Cr, 0.5%Mo steels  
Service temperature up to 550°C

### Shielding gases (acc. EN 439)

GTAW I1 Inert gas Ar (100%)

### Approvals

### Chemical composition (w%), typical, rod

C	Mn	Si	Cr	Mo
0.08	0.5	0.5	5.8	0.6

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Typical values	GTAW	I1	AW	480	625	18	70
	GTAW	I1	SR 750°C/1h	560	650	20	80

### Materials to be welded

Steel	Code	Type
Creep and hydrogen resistant steels	SEW 028	12CrMo 19-5 and corresponding steels
	ASTM A182	F5
	ASTM A213	T5
	ASTM A335	P5
	ASTM A336	F5
	ASTM A369	FP5
	ASTM A387	Grade 5

### Packaging

		Sizes (mm)	1.6	2.0	2.4
Process	Unit				
GTAW	2 and 5 kg tube		X	X	X

Other sizes and packaging on request

LNT 502: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Low alloy solid wire

### Classification

AWS A5.28-96 : ER90S-B9\*  
EN 12070-99 : W CrMo91

\* Nearest classification

### General description

Solid wire for welding of creep and hydrogen resistant 9% Cr, 1% Mo steels  
Service temperature up to 650°C

### Shielding gases (acc. EN 439)

GTAW I1 Inert gas Ar (100%)

### Approvals

### Chemical composition (w%), typical, rod

C	Mn	Si	Cr	Mo	Ni	Nb	V	N
0.07	0.7	0.4	8.7	0.9	0.7	0.04	0.2	0.05

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Typical values	GTAW	I1	SR 750°C/3h	500	700	18	70

### Materials to be welded

Steel	Code	Type	Code	Type
Creep and hydrogen resistant steel	EN 10222-2 ASTM	X10CrMo V9-1	ASME	
		A199 Grade T91		SA 182-F91
		A200 Grade T91		
		A213 Grade T91		SA 213-T91
		A335 Grade P91		SA 335-P91
		A336 Grade F91		SA 336-F91
				SA 369-FP91
				SA 387-Grade 91
				SA 387-Grade 91

### Packaging

		Sizes (mm)	2.0	2.4
Process	Unit			
GTAW	2 and 5 kg tube		X	X

Other sizes and packaging on request

LNT 9Cr (P91): rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Stainless solid wire

### Classification

AWS A5.9-93	: ER308LSi
EN 12072-99	: W 19 9 LSi / G 19 9 LSi

### General description

**Solid wire with extra low carbon for welding austenitic CrNi-steels**  
**With increased silicon for improved wettability**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% O <sub>2</sub>
	M13	Mixed gas Ar+ >0-3% CO <sub>2</sub>

### Approvals

	ABS	BV	CTL	DB	DNV	GL	LR	TÜV
GTAW	ER 308LSi		+	+	308L		+	+
GMAW	ER308LSi	308L	+	+	308L	4306S	304L S	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo
0.010	1.7	0.8	20	10	0.2

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
							+20°C	-20°C	-196°C
Typical values	GTAW	I1	AW	390	590	36	120		50
	GMAW	M12	AW	420	570	45		85	55

### Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C < 0.03%	X2CrNi19 11		1.4306	(TP)304 L	S30403
	X2CrNiN18 10		1.4311	(TP)304LN	J92500
Medium carbon C > 0.03%	X4CrNi18 10		1.4301	302, 304	S30400
		GX5CrNi19 10	1.4308	(TP)304	S30409
Ti-,Nb stabilized	X6CrNiTi18 10		1.4541	CF-8	J92600
				(TP)321	S32100
				(TP)321H	S32109
	X6 CrNiNb 18 10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

### Packaging

Process	Unit	Sizes (mm)						
		0.8	1.0	1.2	1.6	2.0	2.4	3.2
GTAW	2 and 10 kg tube		X	X	X	X	X	X
GMAW	5 kg spool S200		X					
	15 kg spool BS300	X	X	X	X			

Other sizes and packaging on request

LNT/LNM 304LSi: rev. EN 15

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## Stainless solid wire

### Classification

AWS A5.9-93	: ER308L
EN 12072-99	: W 19 9 L / G 19 9 L

### General description

**Solid wire with extra low carbon for welding austenitic CrNi-steels**  
**High resistance to intergranular corrosion and oxidizing environments**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
GMAW	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	TÜV
GTAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo
0.010	1.6	0.5	20	10	0.2

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -196°C	
Typical values	GTAW	I1	AW	390	590	35	120	50
	GMAW	M12	AW	390	590	35		

### Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C < 0.03%	X2CrNi19 11		1.4306	(TP)304 L	S30403
	X2CrNi18 10		1.4311	CF-3 (TP)304LN	J92500 S30453
Medium carbon C > 0.03%	X4CrNi18 10		1.4301	302, 304 (TP)304	S30400 S30409
		GX5CrNi19 10	1.4308	CF-8 (TP)321	J92600 S32100/
Ti-,Nb stabilized	X6CrNiTi18 10		1.4541	(TP)321H	S32109
	X6 CrNiNb 18 10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

### Packaging

Process	Unit	Sizes (mm)				
		1.0	1.6	2.0	2.4	3.2
GTAW	5 and 10 kg tube		X	X	X	X
GMAW	15 kg spool BS300	X				

Other sizes and packaging on request

LNT/LNM 304L: rev. EN 15



## Stainless solid wire

### Classification

AWS A5.9-93	: ER347Si
EN 12072-99	: W 19 9 NbSi / G 19 9 NbSi

### General description

**Solid wire for welding Ti or Nb stabilized stainless CrNi-steels**  
**High resistance to intergranular corrosion and oxidizing environments**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub> M13 Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	CTL	DB	LR	TÜV
GTAW	+	+		+
GMAW		+	+	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo	Nb
0.04	1.3	0.9	19.2	9.9	0.30	0.6

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -196°C	
Typical values	GTAW	I1	AW	400	650	35	80	45
	GMAW	M12	AW	460	650	35	100	

### Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Ti-, Nb-stabilized	X6CrNiTi 18-10		1.4541	(TP)321	S32100
				(TP)321H	S32109
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
				(TP)347h	S34709
Non stabilized		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710
				302	
	X4 CrNi 18-10		1.4301	(TP)304	S30400
	X2 CrNi 19-11		1.4306	(TP)304L	S30403
		GX5 CrNi 19-10	1.4308	CF-8	J92600
			1.4312	(TP)304H	S30409

### Packaging

Process	Unit	Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2
GTAW	2 and 10 kg tube					X	X	X	X
GMAW	15kg spool BS300		X	X	X				

Other sizes and packaging on request

LNT/LNM 347Si: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Stainless solid wire

### Classification

AWS A5.9-93 : ER316L  
EN 12072-99 : W 19 12 3 L

### General description

**Solid wire with extra low carbon for welding austenitic CrNiMo-steels**  
**High resistance to intergranular corrosion and general corrosion conditions**

### Shielding gases (acc. EN 439)

GTAW I1 Inert gas Ar (100%)

### Approvals

### Chemical composition (w%), typical, rod

C	Mn	Si	Cr	Ni	Mo
0.010	1.5	0.5	18.5	12	2.7

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
							+20°C	-120°C	-196°C
Typical values	GTAW	I1	AW	400	620	35	100	80	40

### Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C < 0.03%	X2CrNiMo17 12 2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2CrNiMo18 14 3		1.4435	(TP)316L	S31603
	X2CrNiMoN 17 11 2		1.4406	(TP)316LN	S31653
	X2CrNiMoN 17 13 3		1.4429		
Medium carbon C > 0,03%	X4 CrNiMo 17 12 2		1.4401	(TP)316	S31600
	X4 CrNiMo 17 13 3		1.4436		
Ti-, Nb stabilized		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
	X6 CrNiMoTi 17 12 2		1.4571	316 Ti	S31635
	X6 CrNiMoNb 17 12 2		1.4580	316 Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

### Packaging

Process	Unit	Sizes (mm)	1.6	2.0	2.4	3.2
GTAW	10 kg tube		X	X	X	X

Other sizes and packaging on request

LNT 316L: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Stainless solid wire

### Classification

AWS A5.9-93	: ER316LSi
EN 12072-99	: W 19 12 3 LSi / G 19 12 3 LSi

### General description

**Solid wire with extra low carbon for welding stainless CrNiMo-steels**  
**See also LNT/LNM 316L, high silicon for improved wettability**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	ABS	BV	CTL	DB	DNV	GL	LR	TÜV
GTAW	ER 316LSi		+	+	316L MS		+	+
GMAW	ER316LSi	316L	+	+	316L	4571S	316L S	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo
0.010	1.6	0.8	18.5	12.2	2.5

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
							+20°C	-120°C	-196°C
Typical values	GTAW	I1	AW	400	620	35	100		40
	GMAW	M12	AW	420	620	39	150	70	45

### Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C < 0.03%	X2CrNiMo17 12 2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2CrNiMo18 14 3		1.4435	(TP)316L	S31603
	X2CrNiMoN 17 11 2		1.4406	(TP)316LN	S31653
	X2CrNiMoN 17 13 3		1.4429		
Medium carbon C > 0,03%	X4 CrNiMo 17 12 2		1.4401	(TP)316	S31600
	X4 CrNiMo 17 13 3		1.4436		
	GX5 CrNiMo 19-11		1.4408	CF 8M	J92900
Ti-, Nb stabilized	X6 CrNiMoTi 17 12 2		1.4571	316 Ti	S31635
	X6 CrNiMoNb 17 12 2		1.4580	316 Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

### Packaging

		Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2
Process	Unit								
GTAW	2,5 and 10 kg tube			X	X	X	X	X	X
GMAW	5 kg spool S200		X	X					
	15 kg spool BS300		X	X	X	X			

Other sizes and packaging on request

LNT/LNM 316LSi : rev. EN 15

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## Stainless solid wire

### Classification

AWS A5.9-93 : ER318\*  
EN 12072-99 : W 19 12 3 NbSi / G 19 12 3 NbSi

\* Nearest classification

### General description

**Solid wire for welding Ti or Nb stabilized stainless CrNiMo-steels**  
**High resistance to intergranular corrosion and general corrosion conditions**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	DB	TÜV
GTAW	+	+
GMAW	+	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo	Nb
0.04	1.4	0.85	18.9	11.7	2.7	0.5

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -196°C
Typical values	GTAW	I1	AW	420	680	35	70 45
	GMAW	M12	AW	410	630	35	100

### Materials to be welded

Steel grades	EN 10088-11-2	EN102 13-4	W.Nr.	ASTM/ACI A240/A312/A35	UNS
Extra low carbon C<0,03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon C>0,03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
Ti-,Nb stabilized		GX5 CrNiMo19-11	1.4408	CF 8M	J92900
	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316 Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	Cf-8C	J92710

### Packaging

		Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2
Process	Unit								
GTAW	2 and 10 kg tube				X	X	X	X	X
GMAW	15 kg spool BS300		X	X	X	X			

Other sizes and packaging on request

LNT/LNM 318Si: rev. EN 15

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# LNT/LNM 4439 Mn

## Stainless solid wire

### Classification

EN 12072-99 : W 18 16 5 N L\* / G 18 16 5 N L\*

\* Nearest classification

### General description

Solid wire for welding AISI 317L, 317LN or equivalent stainless steels

For welding 316L if increased molybdenum content is important

High resistance to pitting, intergranular and stress corrosion

Fully austenitic weld metal

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
	M13	Mixed gas Ar+ >0-3 O <sub>2</sub>

### Approvals

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo	N
0.02	7	0.7	19.1	16.9	4.6	0.15

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
							+20°C	-120°C	-196°C
Typical values	GTAW	I1	AW	440	650	35			80
	GMAW	M12	AW	410	620	30	120	80	50

### Materials to be welded

Steel grades	EN10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI	UNS
Fully austenitic	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429	(TP)316LN	S31653
CrNiMo-corrosion resistant steel	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMo 18-15-4		1.4438	317L	S31725
	X2 CrNiMoN 17-13-5		1.4439	317LN	S31726
	G-X2 CrNiMoN 17-13-4	GX2 CrNiMo 17-13-4	1.4446		
	G-X6 CrNiMo 17-13	GX6 CrNiMo 17-13	1.4448		

### Packaging

Process	Unit	Sizes (mm)							
		0.8	1.0	1.2	1.6	2.0	2.4	3.2	
GTAW	2 and 5 kg tube				X	X	X	X	
GMAW	15 kg spool BS300	X	X	X					

Other sizes and packaging on request

LNT/LNM 4439 Mn: rev. EN 15

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## Stainless solid wire

### Classification

EN 12072-99 : W 20 16 3 Mn L / G 20 16 3 Mn L

### General description

Solid wire for welding fully austenitic CrNiMnMo stainless steels and low temperature steels

Not susceptible for hot cracking

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
GMAW	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	TÜV
GTAW	+
GMAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo	N
0.015	7	0.35	20	16	2.8	0.15

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -196°C
Typical values	GTAW	I1	AW	430	650	35	75
	GMAW	M12	AW	400	600	30	50

### Materials to be welded

Steel grades		W.Nr.	ASTM/ACI	UNS
N-alloyed stainless	EN 10088-1/-2	X2 CrNiN 18-10	1.4311	(TP)304LN S30453
CrNi-and		X2 CrNiMoN 17-11-2	1.4406	(TP)316LN S31653
CrNiMo-steels		X2 CrNiMoN 17-13-3	1.4429	
Austenitic anti-magnetic steels		X2 CrNiMoN 17-13-5	1.4439	317LN S31726
	SEW 390	X2 CrNiMoN 22-15	1.3951	
		X2 CrNiMoN 18-14-3	1.3952	
		X2 CrNiMo 18-15	1.3953	
		X8 CrMnNi 18-8	1.3965	
Low temperature steels	SEW 685	GX6 CrNi 18-10	1.6902	
		GX5 CrNiNb 18-10	1.6905	
		12 Ni 14	1.5637	
		X12 Ni 5	1.5680	
	EN 10028-4			

### Packaging

Process	Unit	Sizes (mm)	1.2	1.6	2.0	2.4
GTAW	2 and 10 kg tube				X	X
GMAW	15 kg spool BS300		X	X		

Other sizes and packaging on request

LNT/LNM 4455: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Stainless solid wire

### Classification

EN 12072-99 : W 25 22 2 N L / G 25 22 2 N L

### General description

**Solid wire for welding high CrNiMo-alloyed austenitic steels of type 25/22/2**  
**Excellent resistance to strong oxidizing and moderate reducing conditions**  
**Especially for urea applications**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	TÜV
GTAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo	N
0.018	5.0	0.4	25.0	23.0	2.0	0.15

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength	Tensile strength	Elongation	Impact ISO-V(J)	
				(N/mm <sup>2</sup> )	(N/mm <sup>2</sup> )	(%)	+20°C	-10°C
Typical values	GTAW	I1	AW	360	620	30		80
	GMAW	M12	AW	360	620	30	80	

### Materials to be welded

Steel grades	EN 10088-1/-2	W.Nr.	ASTM / ACl	UNS
Fully austenitic corrosion resistant	X1 CrNiMoN 25-25-2	1.4465		
	X3 CrNiMoTi 25-25	1.4577		
	X2 CrNi 19-11	1.4306	(TP)304L CF-3	S30403 J92500
CrNiMo-steel	X2 CrNiN 18-10	1.4311	(TP)304LN 310S	S30453 S31008

Also very well applicable for build-up welding on low alloyed steel, such as pipe plates

Buffer layer -120 ...+350°C

### Packaging

Process	Unit	Sizes (mm)				
		0.8	1.0	1.2	2.0	2.4
GTAW	2 and 5 kg tube				X	X
GMAW	15 kg spool BS300	X	X	X		

Other sizes and packaging on request

LNT/LNM 4465: rev. EN 15

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## Stainless solid wire

### Classification

AWS A 5.9-93 : ER385  
EN 12072-99 : W 20 25 5 Cu L / G 20 25 5 Cu L

### General description

**Solid wire for welding of fully austenitic steels of type 20%Cr / 25%Ni / 4.5%Mo / 1.5%Cu**  
Highly corrosion resistant in sulphuric and phosphoric acid

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
GMAW	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	TÜV
GTAW	+
GMAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo	Cu
0.009	1.7	0.3	20	25	4.4	1.5

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -196°C
Typical values	GTAW	I1	AW	380	560	35	80
	GMAW	M12	AW	350	610	35	100

### Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.
Fully austenitic		GX7 NiCrMoCuNb 25-20	1.4500
NiCrMoCu- and CrNiMoCu-steels	X5 NiCrMoCuTi 20 18	G-X2 NiCrMoCuN 20 18	1.4506
		G-X2 NiCrMoCuN 25 20	1.4531
	X1 NiCrMoCuN 25 20 5	G-X2 NiCrMoCuN 25 20	1.4536
		G-X7 CrNiMoCuNb 18 18	1.4539
	X5 NiCrMoCuNb 22 18		1.4585
			1.4586

### Packaging

Process	Unit	Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4
GTAW	2 and 5 kg tube					X	X	X
GMAW	15 kg spool BS300		X	X	X			

Other sizes and packaging on request

LNT/LNM 4500: rev. EN 15



## Stainless solid wire

### Classification

AWS A5.9-93 : ER2209  
EN 12072-99 : W 22 9 3 N L / G 22 9 3 N L

### General description

Solid wire for welding duplex stainless steels  
High resistance to general corrosion, pitting and stress corrosion

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
GMAW	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	BV	CTL	GL	TÜV
GTAW		+		+
GMAW	2209	+	4462S	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo	N
0.018	1.5	0.5	22.7	8.5	3.0	0.15

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)			
							+20°C	-20°C	-46°C	-60°C
Typical values	GTAW	I1	AW	600	800	28	85	60		45
	GMAW	M12	AW	625	810	28	110	40		

### Materials to be welded

Steel grades	En 10088-1/-2	W.Nr.	ASTM/ACI A240	UNS
Duplex stainless steels	X2 CrNiMoN 22 5 3	1.4462		S31803
		1.4417		S31500
	X2 CrNiN 23-4	1.4362		S32304
		1.4460		S31200

Dissimilar joints such as un- and low alloyed steel to duplex stainless steel

### Packaging

		Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2
Process	Unit								
GTAW	2 and 10 kg tube					X	X	X	X
GMAW	15 kg spool BS300		X	X	X	X			

Other sizes and packaging on request

LNT/LNM 4462: rev. EN 15

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# LNT/LNM Zeron 100X

## Stainless solid wire

### Classification

EN 12072-99 : W 25 9 4 N L / G 25 9 4 N L

### General description

Solid wire for welding Zeron 100® and other super duplex stainless steel grades  
High resistance to pitting and crevice corrosion in seawater

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
GMAW	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	TÜV
GTAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo	Cu	W	N
0.015	0.7	0.4	25.0	9.8	3.7	0.6	0.7	0.22

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C	-46°C
Typical values	GTAW	I1	AW	680	885	26	80	60
	GMAW	M12	AW	655	845	23	75	55

### Materials to be welded

	EN 10088-1/-2	E 102 13-4	W.Nr.	ASTM/ACI A276/A351/A473	UNS
Regular duplex stainless steel grades	X4 CrNiMoN 27-5-2 X2 CrNiMoN 22-5-3		1.4460 1.4462 1.4463		
		GX6 CrNiMo 24-8-2		2205	S31803
				CD-4MCu Zeron 100	S32550 S32760

Super duplex stainless steel grades: chemical composition approximately:  
24-27% Cr, 6-9% Ni, 3-4% Mo, 0.10-0.25% N alloyed also with Cu and/or W (Zeron 100™)

### Packaging

		Sizes (mm)	1.0	1.2	1.6	2.4	3.2
Process	Unit						
GTAW	2 kg tube				X	X	X
GMAW	12.5 kg spool B300		X	X	X		

Other sizes and packaging on request

LNT/LNM Zeron 100X: rev. EN 15

## Stainless solid wire

### Classification

AWS A5.9-93	: ER309LSi
EN 12072-99	: W 23 12 L Si / G 23 12 L Si

### General description

**Solid wire for GMA welding of stainless steel to carbon steel**  
**With high silicon for improved wettability**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
GMAW	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	ABS	BV	CTL	DNV	GL	LR	TÜV
GTAW	ER 309LSi					+	+
GMAW	ER309LSi	309L	+	309	4332S	SS/CMn S	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo
0.010	1.8	0.8	23.3	13.8	0.14

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
							-20°C	-46°C	-120°C
Typical values	GTAW	I1	AW	400	600	35		65	
	GMAW	M12	AW	430	565	35	96		65

### Materials to be welded

Steel grades	EN 10088-1/-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resistant	X2 CrNiN 18-10	1.4311	(TP)304LN	S30453
Cladsteel	X2 CrNi 19-11	1.4306	(TP)304L	S30403
	X4 CrNi 18-10	1.4301	CF-3 (TP)304	J92500 S30400

- Dissimilar metals (mild and low alloyed steel to stainless steel)
- Build-up welding on mild and low alloyed steel

### Packaging

		Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2
Process	Unit								
GTAW	2.5 and 10 kg tube			X	X	X	X	X	X
GMAW	15 kg spool BS300		X	X	X	X			

Other sizes and packaging on request

LNT/LNM 309LSi: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Stainless solid wire

### Classification

AWS A5.9-93 : ER309L  
EN 12072-99 : W 23 12 L

### General description

Solid wire for welding stainless steel to carbon steel  
Low susceptibility to embrittlement  
Minimum 18FN ferrite in weldmetal

### Shielding gases (acc. EN 439)

GTAW I1 Inert gas Ar (100%)

### Approvals

### Chemical composition (w%), typical, rod

C	Mn	Si	Cr	Ni	Mo
0.010	1.65	0.35	24	13	0.05

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	390	600	35

### Materials to be welded

Steel grades	EN 10088-1/-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resistant	X2 CrNiN 18-10	1.4311	(TP)304LN	S30453
Cladsteel	X2 CrNi 19-11	1.4306	(TP)304L	S30403
	X4 CrNi 18-10	1.4301	CF-3 (TP)304	J92500 S30400

- Dissimilar metals (mild and low alloyed steel to stainless steel)
- Build-up welding on mild and low alloyed steel

### Packaging

Process	Unit	Sizes (mm)	1.6	2.0	2.4
GTAW	2 and 10 kg tube		X	X	X

Other sizes and packaging on request

LNT 309 LHF: rev. EN 15

## Stainless solid wire

### Classification

AWS A5.9-93 : ER307\*  
EN 12072-99 : W 18 8 Mn / G 18 8 Mn

\* Nearest classification

### General description

**Solid wire for welding steels with difficult weldability**  
**Often used as a buffer layer in hardfacing applications**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

	TÜV
GTAW	+
GMAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni
0.08	7.1	0.8	19.2	9

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -120°C
Typical values	GTAW	I1	AW	400	650	34	100 50
	GMAW	M12	AW	400	630	40	80 50

### Materials to be welded

Various steel grades as:

- Armour plate
- Hardenable steels including steels difficult to weld
- Non-magnetic steels
- Work hardening austenitic manganese steels
- Dissimilar joints (CMn-steels to stainless steels)

### Packaging

Process	Unit	Sizes (mm)		
		1.0	1.2	2.0
GTAW	2 kg tube			X
GMAW	15 kg spool BS300	X	X	

Other sizes and packaging on request

LNT/LNM 307: rev. EN 15

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## Stainless solid wire

### Classification

AWS A5.9-93 : ER308H  
EN 12072-99 : W 19 9 H / G 19 9 H

### General description

**Solid wire for welding austenitic CrNi-steels**  
**Especially for high temperature applications (730°C)**  
**Low sensitivity to precipitation of intermetallic phases**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo
0.05	1.8	0.5	20	10	0.2

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Typical values	GTAW	I1	AW	370	600	35	80
	GMAW	M12	AW	370	590	34	

### Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI	UNS
Medium carbon C > 0.03%	X4 CrNi 18-10		1.4301	302 (TP)304	S30400
			1.4308	(TP)304H	S30409
			1.4948	CF 8	J92600
		GX5 CrNi 19-10			

### Packaging

		Sizes (mm)				
Process	Unit	1.0	1.2	2.0	2.4	3.2
GTAW	2 and 10 kg			X	X	X
GMAW	15 kg spool BS300	X	X			
Other sizes and packaging on request						

LNT/LNM 304H: rev. EN 15

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## Stainless solid wire

### Classification

AWS A5.9-93 : ER309  
EN 12072-99 : G 23 12 L\*

\* Nearest classification

### General description

**Solid GMAW wire for high temperature applications like industrial furnaces**  
**High resistance to oxidation up to 1050°C**

### Shielding gases (acc. EN 439)

GMAW M12 Mixed gas Ar+ >0-5% CO<sub>2</sub>  
M13 Mixed gas Ar+ >0-3% O<sub>2</sub>

### Approvals

### Chemical composition (w%), typical, wire

C	Mn	Si	Cr	Ni	Mo
0.05	1.8	0.5	24.0	13.5	0.2

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Typical values	GMAW	M12	AW	400	640	35	110

### Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI	UNS
		GX30 CrSi6	1.4710		
	X10 CrAl7		1.4713	502	
	X10 CrAl13		1.4724	410/414-TP405-CA15	
		GX40 CrSi13	1.4729		
		GX40 CrSi17	1.4740		
	X10 CrAl18		1.4742	430-TP430-CB30	
	X10 CrAl24		1.4762	TP443	
		GX25 CrNiSi18-9	1.4825		J92502
		GX40 CrNiSi22-9			
	X15 CrNiSi20-12		1.4828	TP309	S30900
		GX25 CrNiSi20-14	1.4832		
	X12 CrNiTi18-9				

### Packaging

Process	Unit	Sizes (mm)	1.0	1.2
GMAW	15 kg spool BS300		X	X

Other sizes and packaging on request

LNM 309H: rev. EN 15

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## Stainless solid wire

### Classification

AWS A5.9-93	: ER310
EN 12072-99	: W 25 20 / G 25 20

### General description

**Solid wire for welding heat resistant Cr- and CrNi-steels (25%Cr-20%Ni)**  
**High resistance to oxidation and scaling up to approx. 1100°C**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	M12	Mixed gas Ar+ >0-5% CO <sub>2</sub>
	M13	Mixed gas Ar+ >0-3% O <sub>2</sub>

### Approvals

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Cr	Ni	Mo
0.1	1.8	0.45	26	21	0.2

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Typical values	GTAW	I1	AW	360	600	35	100
	GMAW	M12	AW	355	610	35	110

### Materials to be welded

Steel grades	EN 10088-1/-2	EN 102 13-4	W.Nr.	ASTM/ACI	UNS
	X10 CrAl24		1.4762		
		GX25 CrNiSi18-9	1.4825		
		GX40 CrNiSi22-9	1.4826		
	X15 CrNiSi20-12		1.4828		
		GX25 CrNiSi20-14	1.4832		
	X15 CrNiSi25-20		1.4841	310S CK20	S31008 J94202
	X12 CrNi25-21		1.4845		
		GX40 CrNiSi 25-20	1.4848	HK40	

### Packaging

Process	Unit	Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2
GTAW	2 and 10 kg tube					X	X	X	X
GMAW	15 kg spool BS300		X	X	X				

Other sizes and packaging on request

LNT/LNM 310: rev. EN 15

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# LNT/LNM NiCro 31/27

## Ni-base solid wire

### Classification

AWS A5.9-93 : ER383

### General description

Solid wire for welding of Cu-alloyed NiCrMo-steels

Excellent resistance to general corrosion, pitting and stress corrosion in acid and alkaline environments

Especially for applications in phosphoric and sulphuric acid

### Shielding gases (acc. EN 439)

GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Ni	Cr	Mo	Cu
0.01	1.5	0.2	31.0	27.0	3.5	1.0

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -196°C	
Typical values	GTAW	I1	AW	400	610	35	100	50
	GMAW	I1	AW	400	610	35	100	50

### Materials to be welded

Steel grades	EN 10088-1/2	W.Nr.	ASTM/ACI	UNS
Copper alloyed CrNiMo- and NiCrMo-steels	X1NiCrMoCu 31-27-4	1.4563		N08028
	X1NiCrMoCu 25-20-5	1.4539	Alloy 904L	N08904
	DIN 17744			
	NiCr 21 Mo	2.4858	Alloy 825	N08825
	NiCr 21 Mo 6Cu	2.6410	Alloy 825 h Mo	N08821
	X3NiCrMoTi 27-23	1.4503		

### Packaging

Process	Unit	Sizes (mm)		
		1.2	2.0	2.4
GTAW	2 kg tube		X	X
GMAW	15 kg spool B300	X		

Other sizes and packaging on request

LNT/LNM NiCro 31/27: rev. EN 15

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GMAW / GTAW

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# LNT/LNM NiCro 60/20

## Ni-base solid wire

### Classification

AWS A5.14/A5.14M-97 : ERNiCrMo-3  
ISO 18274-01 : S Ni 6625 (NiCr22Mo9Nb)

### General description

**Solid wire for welding of nickel alloys**  
**Extreme resistance to various corrosion forms**  
**High chromium and molybdenum content**

### Shielding gases (acc. EN 439)

GTAW/GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	TÜV
GTAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Ni	Cr	Mo	Nb	Fe
0.02	0.06	0.07	64	21.9	9	3.5	1.7

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -196°C	
Typical values	GTAW	I1	AW	520	800	35	130	100
	GMAW	I1	AW	520	770	34	80	60

### Materials to be welded

Steel grades	BS 1501 3076	DIN 17444/17465 SEW 595/680	W.Nr.	ASTM / ACI	UNS
NiCrMo-steel type 625 and welding dissimilar high NiCrMo-steels for corrosion and heat resisting purposes	NA 15	X10NiCrAlTi32 20	1.4876	Alloy800/800H	N08800/-10
		NiCr22Mo	2.4605		
	NA 14	NiCr15Fe	2.4816	B168-Alloy 600	N06600
		NiCr22Mo9Nb	2.4856	B443-Alloy 625	N06625
	NA 16	NiCr21Mo	2.4858	B424-Alloy 825	N08825
		X1NiCrMoCuN25 20 6	1.4529		
		NiCr20Ti	2.4951	Alloy 75	N06075
		NiCr20TiAl1	2.4952	Alloy 80A	N07080
		NiCr20CuMo	2.4660	Alloy 20	N08020
		X1NiCrMoCu25 20 5	1.4539		
		X2NiCrAlTi32 20	1.4558	Alloy 800L	N08800
		G-X10NiCrNb32 20	1.4859		
Low alloyed steel		12Ni9	1.5680	A333-5%Ni	
		GS-10Ni19	1.5681	5%Ni cast	
		G-X8Ni9	1.5662	A353-9%Ni cast	K81340
		10Ni14	1.5637		

### Packaging

		Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2
Process	Unit								
GTAW	2 and 10 kg tube					X	X	X	X
GMAW	5 kg spool S200			X					
	15 kg spool BS300		X	X	X				

Other sizes and packaging on request

LNT/LNM NiCro 60/20: rev. EN 15

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# LNT/LNM NiCro 70/19

## Ni-base solid wire

### Classification

AWS A5.14/A5.14M-97 : ERNiCr-3

ISO 18274-01 : S Ni 6082 (NiCr20Mn3Nb)

### General description

Solid wire for welding nickel based alloys, dissimilar metals and cladding

High resistance to oxidation and high impact toughness at low temperature

### Shielding gases (acc. EN 439)

GTAW/GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	TÜV
GTAW	+
GMAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Ni	Cr	Nb	Fe	Cu
0.03	3.1	0.08	72.5	20.5	2.6	0.8	0.01

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -196°C	
Typical values	GTAW	I1	AW	400	680	40	150	120
	GMAW	I1	AW	390	640	35	150	50

### Materials to be welded

Steel grades	BS3076	DIN 17744/17465 SEW 595	W.Nr.	ASTM/ACI B366	UNS
Ni-base high Cr alloyed steel for low and high corrosion searching application	Na 14	NiCr15Fe	2.4816	B168-Alloy 600	N06600
		LC-NiCr15Fe	2.4817	Alloy 600L	N06600
		NiCr20Ti	2.4951	Alloy 75	
		NiCr20TiA1	2.4952	Alloy 80A	N07080
	Na 15	X10NiCrAlTi32 20	1.4876	Alloy 800/800H	N0800/10
		NiCr23Fe	2.4851	Alloy 601(H)	N06601
		X12NiCrSi36 16	1.4864	330	N08330
	Na 17	G-X40NiCrNb35 25	1.4852		
		G-X40NiCrSi35 25	1.4857	HP	

Un- and low alloyed heat and creep resistant steel to stainless steel

### Packaging

Process	Unit	Sizes (mm)				
		1.0	1.2	2.0	2.4	3.2
GTAW	2 and 10 kg tube			X	X	X
GMAW	15 kg spool BS300	X	X			

Other sizes and packaging on request

LNT/LNM NiCro 70/19: rev. EN 15

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# LNT NiCrMo 59/23

## Ni-base solid wire

### Classification

AWS A5.14/5.14-M-97 : ERNiCrMo-13

ISO 18274-01 : S Ni 6059 (NiCr23Mo16)

### General description

**Solid wire for welding nickel base alloys with high CrMo content**

**Excellent resistance against pitting, stress, and crevice corrosion in acid sulfur phosphorus and chlorine surroundings**

**Suitable for dissimilar joints**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	TÜV
GTAW	+

### Chemical composition (w%), typical, rod

C	Mn	Si	Ni	Cr	Mo	Fe	Al
0.015	0.5	0.06	59	23	16	1.5	0.4

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	400	720	30

### Materials to be welded

Steel grades	DIN 17744	W.Nr.	ASTM / ACI	UNS
Ni-base high CrMo steel	NiCr23Mo16	2.4605		N06059
	NiMo16Cr16Ti	2.4610	C-4	N06455
	NiMo16Cr15Ti	2.4819	C-276	N10276
	NiCr21Mo 14W	2.4602	C-22	N06022
	NiCr22Mo 9Nb	2.4856	625	N06625
High Mo-steel	EN 10088-1/-2			
stainless steel for high corrosion environments	X1 NiCrMoCuN25-20-7	1.4529	904hMo	N08925
	X1 CrNiMoCuN20-18-7	1.4547		S31254

### Packaging

		Sizes (mm)	2.0
Process	Unit		
GTAW	2 kg tube		X
Other sizes and packaging on request			

LNT NiCrMo 59/23: rev. EN 15

# LNT/LNM NiCrMo 60/16

## Ni-base solid wire

### Classification

AWS A5.14/A5.14M-97 : ERNiCrMo-4

ISO 18274-04 : S Ni 6276 (NiCr15Mo16Fe6W4)

### General description

Solid wire for welding CrMoW-alloyed nickel alloys (e.g. Alloy C276)

Depending on the corrosion requirements also applicable for welding C-22 and C-4

Extreme resistance to corrosion environments containing sulphuric acid and chlorides

Applicable for surfacing in high temperature applications (up to 1200°C)

### Shielding gases (acc. EN 439)

GTAW/G MAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Ni	Cr	Mo	W	Fe
0.015	0.5	0.04	bal	15.5	16.0	3.6	5.8

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield Strength (N/mm <sup>2</sup> )	Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) +20 °C
Typical values	GTAW	I1	AW	410	720	27	100
	GMAW	I1	AW	400	700	25	90

### Materials to be welded

Steel grades	DIN/EN	Mat. Nr.	ASTM/ACI	UNS
Ni Base high CrMo	NiMo 16Cr15W	2.4819	C-276	N10276
steel for high corrosion	NiCr21Mo14W	2.4602	C-22	N06022
environments	NiMo 16Cr16Ti	2.4610	C-4	N06455

- LNT/LNM NiCrMo 60/16 is developed for welding C-276 material

- Can also be applied for welding C-22 and C-4, depending on the corrosion requirements

### Packaging

		Sizes (mm)	1.0	1.2	1.6	2.0	2.4	3.2
Process	Unit							
GTAW	2 kg tube				X	X	X	X
GMAW	15 kg spool B301		X	X				

LNT/LNM NiCrMo 60/16 : rev. EN

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GTAW / GMAW

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# LNT/LNM NiCu 70/30

## Ni-base solid wire

### Classification

AWS A5.14/A5.14M-97 : ERNiCu-7

ISO 18274-01 : S Ni 4060 (NiCu30MnTi)

### General description

Solid wire for welding Monel and NiCu-alloys to mild and low-alloyed steels

High resistance to seawater corrosion

### Shielding gases (acc. EN 439)

GTAW/GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	TÜV
GTAW	+
GMAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Ni	Cu	Fe	Ti
0.10	3.3	0.6	64	29	1.5	2.4

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C -196°C	
Typical values	GTAW	I1	AW	350	550	40	160	140
	GMAW	I1	AW	300	500	35	150	

### Materials to be welded

Steel grades	BS3076	DIN 17743	W.Nr.	ASTM/ACI	UNS
	NA 13	NiCu30Fe	2.4360	Monel 400	N04400
		G-NiCu30Nb	2.4365		
	NA 18	NiCu30Al	2.4375	Monel K500	N05500

### Packaging

		Sizes (mm)	1.0	1.2	1.6	2.0	2.4	3.2
Process	Unit							
GTAW	2 and 10 kg tube				X	X	X	X
GMAW	15 kg spool BS300		X	X				

Other sizes and packaging on request

LNT/LNM NiCu 70/30: rev. EN 15

## Ni-base solid wire

### Classification

AWS A5.14/A5.14M-97 : ERNi1

ISO 18274-01 : S Ni 2061 (NiTi3)

### General description

Solid wire for welding pure nickel and nickel alloys and joining these materials with unalloyed/low-alloyed steel  
Suitable for surfacing carbon steels

### Shielding gases (acc. EN 439)

GTAW/GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	TÜV
GMAW	+

### Chemical composition (w%), typical, wire / rod

C	Mn	Si	Ni	Ti	Fe
0.02	0.4	0.2	bal.	3.1	0.06

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C
Typical values	GTAW	I1	AW	250	460	30	120
	GMAW	I1	AW	250	460	30	120

### Materials to be welded

DIN-classification	W.Nr.	ASTM/ACI
Ni 99.6	2.4060	
Ni 99.8	2.4050	
Ni 99.6Si	2.4056	
Ni 99.4Fe	2.4062	
Ni 99.2	2.4066	Alloy 200
LC-Ni 99	2.4068	Alloy 201
LC-Ni 99.6	2.4061	Alloy 205
NiMn 10	2.4108	
NiMn 5	2.4116	

### Packaging

Process	Unit	Sizes (mm)	1.2	2.0	2.4
GTAW	2 and 10 kg tube			X	X
GMAW	15 kg spool BS300		X		

Other sizes and packaging on request

LNT/LNM NiTi: rev. EN 15

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## Ni-base solid wire

### Classification

AWS A5.15-90 : ENiFe-CI  
ISO 1071-01 : S NiFe-CI

### General description

Solid wire for butt welds and hardfacing application in cast iron  
Suitable for dissimilar joints cast iron/steel  
Hardness approximately 200HB  
Optimal welding characteristics

### Shielding gases (acc. EN 439)

GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

### Chemical composition (w%), typical, wire

C	Mn	Si	Ni	Fe	Cu
0.05	0.83	0.14	54.8	bal.	0.4

### Mechanical properties, typical, all weld metal

Typical hardness values	
2 Layers, AW	approx. 200 HB

### Packaging

Process	Unit	Sizes (mm)	1.2
GMAW	15 kg spool BS300		X

Other sizes and packaging on request

LNM NiFe: rev. EN 15



## Cu-base solid wire

### Classification

AWS A5.7-84R	: ERCuAl-A1
DIN 1733-88	: SG-CuAl8

### General description

Solid wire for welding copper-aluminium alloys, as aluminiumbronze  
High resistance to corrosion and wear

### Shielding gases (acc. EN 439)

GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

### Chemical composition (w%), typical, wire

Cu	Al	Mn
bal.	8	0.3

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Hardness HB
Typical values	GMAW	I1	AW	185	430	30	95

### Materials to be welded

Material	Code	Type	W.Nr.
Copper-aluminium wrought alloys	DIN 17665	CuAl5As CuAl8	2.0918 2.0920
Copper-aluminium cast alloys	DIN 1714	G-CuAl8Mn	2.0962

### Packaging

		Sizes (mm)	0.8	1.0	1.2	1.6	2.0
Process	Unit						
GTAW	2 kg tube						X
GMAW	12 kg spool B300		X	X	X	X	
Other sizes and packaging on request							

LNT/LNM CuAl 8: rev. EN 15

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## Cu-base solid wire

### Classification

AWS A5.7-84R	: ERCuNi
DIN 1733-88	: SG-CuNi30Fe

### General description

Solid wire for welding copper-nickel alloys containing 10-30%Ni

### Shielding gases (acc. EN 439)

GTAW/GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	TÜV
GTAW	+

### Chemical composition (w%), typical, wire / rod

Cu	Mn	Ni
bal.	0.8	31

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C	Hardness HB
Typical values	GTAW	I1	AW	250	400	30	100	70
	GMAW	I1	AW	220	380	30		70

### Materials to be welded

Material	Code	Type	W.Nr.	UNS
Copper-nickel wrought alloys	DIN 17664	CuNi10Fe1Mn	2.0872	C 70600
		CuNi30Mn1Fe	2.0882	C 71500
		CuNi30Fe2Mn2	2.0883	C 71600
Copper-nickel cast alloys	DIN 17658	G-CuNi10	2.0815	
		G-CuNi30	2.0835	

### Packaging

		Sizes (mm)	0.8	1.2	1.6	2.0	2.4	3.2
Process	Unit							
GTAW	2 kg tube				X	X	X	X
GMAW	12 kg spool B300		X	X				

Other sizes and packaging on request

LNT/LNM CuNi30: rev. EN 15

## Cu-base solid wire

### Classification

AWS A5.7-84R : ERCu  
DIN 1733-88 : SG-CuSn

### General description

Solid wire for GMA-welding of copper

### Shielding gases (acc. EN 439)

GMAW I1 Inert gas Ar (100%)  
I3 Inert gas Ar+ >0-95% He

### Approvals

### Chemical composition (w%), typical, wire

Cu	Mn	Si	Sn	Ni
bal.	0.2	0.3	0.8	0.1

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Hardness HB
Typical values	GMAW	I1	AW	100	220	60	35

### Materials to be welded

Material	Code	Type	W.Nr.
Copper	DIN 1787	OF-Cu	2.0040
		SE-Cu	2.0070
		SW-Cu	2.0076
		SF-Cu	2.0090
Wrought low alloyed copper alloys	DIN 17666	CuFe2P	2.1310
		CuSP	2.1498
		CuTeP	2.1546

### Packaging

Process	Unit	Sizes (mm)	
		1.0	1.2
GMAW	12 kg spool B300	X	X

Other sizes and packaging on request

LNM CuSn: rev. EN 15

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## Cu-base solid wire

### Classification

AWS A5.7-84R : ERCuSn-A\*  
DIN 1733-88 : SG-CuSn6

\* Nearest classification

### General description

Solid wire for GTA-welding of copper-tin alloys

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

### Chemical composition (w%), typical, rod

Cu	Sn	P
bal.	6	0.2

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C	HB
Typical values	GTAW	I3	AW	150	260	20	80	75

### Materials to be welded

Material	Code	Type	W.Nr.
Copper-tin wrought alloys	DIN 17662	CuSn4	2.1016
		CuSn6	2.1020
		CuSn8	2.1030
Copper-tin cast alloys	DIN 1705	G-CuSn2ZnPb	2.1098
		G-CuSn5ZnPb	2.1096
		G-CuSn6ZnNi	2.1093

### Packaging

Process	Unit	Sizes (mm)			
		2.0	2.4	3.2	4.0
GTAW	2 kg tube	X	X	X	X

Other sizes and packaging on request

LNT CuSn6: rev. EN 15

## Cu-base solid wire

### Classification

DIN 1733-88 : SG-CuSn12

### General description

Solid wire for GMA-welding of copper-tin and copper-zinc alloy

### Shielding gases (acc. EN 439)

GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

### Chemical composition (w%), typical, wire

Cu	Sn	P
bal.	12	0.2

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm²)	Tensile strength (N/mm²)	Elongation (%)
Typical values	GMAW	I1	AW	100	250	30

### Materials to be welded

Copper-tin alloys, e.g. bronze with 10-12% tin  
Copper-zinc alloys e.g. brass

### Packaging

Process	Unit	Sizes (mm)	0.8
GMAW	12 kg spool B300		X

Other sizes and packaging on request

LNLM CuSn 12: rev. EN 15

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GMAW / GTAW

## Cu-base solid wire

### Classification

AWS A5.7-84R : ERCuSi-A  
DIN 1733-88 : SG-CuSi3

### General description

Solid wire for GTA-welding of low-alloyed copper grades  
High temperature and corrosion resistant

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

GTAW

### Chemical composition (w%), typical, rod

Cu	Mn	Si	Sn	Zn
bal.	1.0	3.0	0.1	0.1

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) +20°C	Hardness HB
Typical values	GTAW	I1	AW	120	350	40	60	95

### Materials to be welded

Copper, low alloyed copper and copper-zinc alloys

### Packaging

		Sizes (mm)	2.0	2.4
Process	Unit			
GTAW	2 kg tube		X	X

Other sizes and packaging on request

LNT CuSi 3: rev. EN 15

## Aluminium wire

## Classification

AWS A5.10-99	: ER4043
ISO 18273-01	: Al 4043A

## General description

Solid wire for welding of aluminium-silicium alloys

Excellent feedability and very consistent welding performance.

Tight and stable arc.

Also available in 120 kg AccuPak®, that increases productivity by reducing time to change spools.

## Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

## Approvals

	DB	TÜV
GTAW	+	+
GMAW	+	+

## Chemical composition (w%), typical, wire / rod

Al	Mn	Si	Ti	Fe	Zn	Cu	Mg
bal.	0.01	4.7	0.001	0.3	0.002	0.01	0.004

## Mechanical properties, typical

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	100	160	15
	GMAW	I1	AW	100	160	15

## Physical properties

Melting range	573 - 625°C
Density	approximately 2680 kg/m <sup>3</sup>

## Materials to be welded

Material	Code	Type	W.Nr.	Int.Reg.Nr.	Int.Cast.Nr.
Aluminium cast alloys	DIN 1725-1	Al Mg Si 0.5	3.3206	6060	
		Al Mg Si 0.7	3.3210	6005A	
		Al Mg Si 0.8	3.2316	6181	
Aluminium cast alloys	DIN 1725-2	G-Al Si 5			443.0

## Packaging

Process	Unit	Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2	4.0
GTAW	2.5 and 5 kg tube					X	X	X	X	X
GMAW	0.5 kg plastic spool S100		X	X	X	X				
	7.26 kg plastic spool S300		X	X	X	X				
	7.0 kg basket spool BS300		X	X	X	X				
	120 kg AccuPak					X				

Other sizes and packaging on request

SuperGlaze® 4043: rev. EN 15

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## Aluminium wire

## Classification

AWS A5.10-99	: ER5183
ISO 18273-01	: Al 5183

## General description

Solid wire for welding of high strength aluminium alloys and low temperature applications (-196°C)

Excellent feedability and very consistent welding performance.

Tight and stable arc.

Also available in 90 kg AccuPak®, that increases productivity by reducing time to change spools.

## Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

## Approvals

	ABS	BV	DB	DNV	GL	LR	TÜV
GTAW			+				+
GMAW	WC	WC	+	5183	SAIMg4.5Mn	+	+

## Chemical composition (w%), typical, wire / rod

Al	Mn	Si	Ti	Mg	Zn	Cr	Fe	Cu
bal.	0.8	0.09	0.02	4.5	0.15	0.15	0.14	0.02

## Mechanical properties, typical

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	150	290	25
	GMAW	I1	AW	140	300	30

## Physical properties

Melting range	568 - 638°C
Density	approximately 2400 kg/m <sup>3</sup>

## Materials to be welded

Material	Code	Type	W.Nr.	Int.Reg.Nr.	Int.Cast.Nr.
Aluminium-wrought alloys	DIN 1725-1	Al Mg 3	3.3535	5754	
		Al Mg 4.5 Mn	3.3547	5083	
		Al Mg 5	3.3555	6082	
		Al Mg Si 1			
Aluminium cast alloys	DIN 1725-2	G-Al Mg 3	3.3541		
		G-Al Mg 3 Si	3.3241		512.0
		G-Al Mg 5	3.3561		B 535.0
		G-Al Mg 5 Si	3.3261		

## Packaging

Process	Unit	Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2	4.0
GTAW	5 kg tube					X	X	X	X	X
GMAW	7.26 kg plastic spool S300		X	X	X	X				
	7.0 kg basket spool BS300		X	X	X	X				
	90 kg AccuPak					X				

Other sizes and packaging on request

SuperGlaze® 5183: rev. EN 15



## Aluminium wire

## Classification

AWS A5.10-99	: ER5356
ISO 18273-01	: Al 5356

## General description

Solid wire for welding aluminium alloys containing more than 3% Mg

Excellent feedability and very consistent welding performance.

Tight and stable arc.

Also available in 90 kg AccuPak®, that increases productivity by reducing time to change spools.

## Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

## Approvals

	ABS	BV	DB	DNV	GL	LR	TÜV
GTAW			+				+
GMAW	WB	WB	+	5356	S ALMg5	+	+

## Chemical composition (w%), typical, wire / rod

Al	Mn	Si	Ti	Mg	Cr	Cu	Fe	Zn
bal.	0.11	0.08	0.06	4.9	0.07	0.01	0.2	0.03

## Mechanical properties, typical

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	130	285	25
	GMAW	I1	AW	110	250	25

## Physical properties

Melting range	562 - 633°C
Density	approximately 2640 kg/m <sup>3</sup>

## Materials to be welded

Material	Code	Type	W.Nr.	Int.Reg.Nr.	Int.Cast.Nr.
Aluminium wrought alloys	DIN 1725-1	Al Mg 3	3.3535	5754	
		Al Mg 4,5	3.3345	5082	
		Al Mg 5	3.3555	5056A	
		Al Mg 2 Mn 0,8	3.3527	5049	
		Al Mg 2,7 Mn	3.3537	5454	
		Al Mg 4 Mn	3.3545	5086	
		Al Zn 4,5 Mg 1	3.4335	7020	
		G-Al Mg 3	3.3541		
Aluminium cast alloys	DIN 1725-2	G-Al Mg 3 Si	3.3241		512.0
		G-Al Mg 5	3.3561		B 535.0
		G-Al Mg 5 Si	3.3261		

## Packaging

Process	Unit	Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2	4.0	5.0
GTAW	5 kg tube					X	X	X	X	X	X
GMAW	0.5 kg plastic spool S100		X	X	X	X					
	2.0 kg plastic spool S200				X						
	7.26 kg plastic spool S300		X	X	X	X					
	7.0 kg basket spool BS300		X	X	X	X					
	90 kg AccuPak				X						

Other sizes and packaging on request

SuperGlaze® 5356: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Aluminium wire

## Classification

AWS A5.10-99 : ER1100\*

\* Nearest classification

## General description

Solid wire for welding pure aluminium with maximum of 0.5% alloying elements

## Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

## Approvals

## Chemical composition (w%), typical, wire / rod

Al	Zn	Ti	Cu	Mn	Si	Si+Fe	Fe
bal.	0.02	0.04	0.04	<0.01	0.05	0.2	0.12

## Mechanical properties, typical

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	30	80	40
	GMAW	I1	AW	30	80	40

## Physical properties

Melting range	647 - 658°C
Density	approximately 2700 kg/m <sup>3</sup>

## Materials to be welded

Code	Type	W.Nr.	Int.Reg.Nr.
DIN 1712-3	Al 99.9	3.0305	1090 A
	Al 99.8	3.0285	1080 A
	Al 99.7	3.0275	1070 A
	Al 99.5	3.0255	1050 A
	E-Al	3.0257	1350 A
	Al 99	3.0205	1200

## Packaging

		Sizes (mm)	1.0	1.2	1.6	2.0	2.4	3.2	4.0
Process	Unit								
GTAW	5 kg tube					X	X	X	X
GMAW	7 kg spool B300		X	X	X				

Other sizes and packaging on request

LNT/LNM AI 99.5: rev. EN 15

## Aluminium wire

### Classification

ISO 18273-01 : AI 5754

### General description

Solid wire for welding of aluminium alloys up to 3%Mg

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	TÜV
GTAW	+
GMAW	+

### Chemical composition (w%), typical, wire / rod

Al	Mg	Zn	Cr	Ti	Mn	Si	Cu	Fe
bal.	3.4	0.1	0.19	0.09	0.01	0.06	0.01	0.13

### Mechanical properties, typical

### Physical properties

Melting range	580 - 642°C
Density	approximately 2660 kg/m3

### Materials to be welded

Material	Code	Type	W.Nr.	Int.Reg.Nr.	Int.Cast.Nr.
Aluminium wrought alloys	DIN 1725-1	Al Mg 1	3.3315	5005 A	
		Al Mg 1.5	3.3316	5050 B	
		Al Mg 1.8	3.3326	5051 A	
		Al Mg 2.5	3.3523	5052	
		Al Mg 3	3.3535	5754	
		Al Mg 1	3.0515	3103	
		Al Mg Si 0.5	3.3206	6060	
		Al Mg Si 0.7	3.3210	6005 A	
		Al Mg Si 0.8	3.2316	6181	
		G-AIMg 3	3.3541		
Aluminium cast alloys	DIN 1725-2	G-AIMg 3 Si	3.3241		512.0

### Packaging

Process	Unit	Sizes (mm)	1.0	1.2	1.6	2.0	2.4	3.2	4.0
GTAW	5 kg tube				X	X	X	X	X
GMAW	7 kg spool B300		X	X	X				

Other sizes and packaging on request

LNT/LNM AIMg 3: rev. EN 15

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## Aluminium wire

### Classification

AWS A5.10-99	: ER5356
ISO 18273-01	: AI 5356

### General description

**Solid wire for welding aluminium alloys containing more than 3% Mg**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	ABS	BV	DB	DNV	GL	LR	RINA	TÜV
GTAW			+				RC	+
GMAW	WB	WB	+	5356	S ALMg5	+	*	+

### Chemical composition (w%), typical, wire / rod

Al	Mn	Si	Ti	Mg	Cr	Cu	Fe	Zn
bal.	0.11	0.08	0.06	4.9	0.07	0.01	0.2	0.03

### Mechanical properties, typical

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	130	285	25
	GMAW	I1	AW	110	250	25

### Physical properties

Melting range	562 - 633°C
Density	approximately 2640 kg/m <sup>3</sup>

### Materials to be welded

Material	Code	Type	W.Nr.	Int.Reg.Nr.	Int.Cast.Nr.
Aluminium wrought alloys	DIN 1725-1	Al Mg 3	3.3535	5754	
		Al Mg 4,5	3.3345	5082	
		Al Mg 5	3.3555	5056A	
		Al Mg 2 Mn 0,8	3.3527	5049	
		Al Mg 2,7 Mn	3.3537	5454	
		Al Mg 4 Mn	3.3545	5086	
		Al Zn 4,5 Mg 1	3.4335	7020	
		G-Al Mg 3	3.3541		
Aluminium cast alloys	DIN 1725-2	G-Al Mg 3 Si	3.3241		512.0
		G-Al Mg 5	3.3561		B 535.0
		G-Al Mg 5 Si	3.3261		

### Packaging

Process	Unit	Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2	4.0	5.0
GTAW	5 kg tube					X	X	X	X	X	X
GMAW	7 kg spool B300		X	X	X	X					

Other sizes and packaging on request

LNT/LNM AIMg 5: rev. EN 15

# LNT/LNM AIMg 4.5Mn

## Aluminium wire

### Classification

AWS A5.10-99	: ER5183
ISO 18273-01	: Al 5183

### General description

Solid wire for welding of high strength aluminium alloys and low temperature applications (-196°C)

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	ABS	BV	DNV	GL	LR	TÜV
GTAW						+
GMAW	WC	WC	5183	S AIMg4.5Mn	+ *	+

### Chemical composition (w%), typical, wire / rod

Al	Mn	Si	Ti	Mg	Zn	Cr	Fe	Cu
bal.	0.65	0.09	0.02	5	0.03	0.06	0.14	0.02

### Mechanical properties, typical

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	150	290	25
	GMAW	I1	AW	150	290	25

### Physical properties

Melting range	568 - 638°C
Density	approximately 2400 kg/m <sup>3</sup>

### Materials to be welded

Material	Code	Type	W.Nr.	Int.Reg.Nr.	Int.Cast.Nr.
Aluminium-wrought alloys	DIN 1725-1	Al Mg 3	3.3535	5754	
		Al Mg 4.5 Mn	3.3547	5083	
		Al Mg 5	3.3555	6082	
		Al Mg Si 1			
Aluminium cast alloys	DIN 1725-2	G-Al Mg 3	3.3541		
		G-Al Mg 3 Si	3.3241		512.0
		G-Al Mg 5	3.3561		B 535.0
		G-Al Mg 5 Si	3.3261		

### Packaging

		Sizes (mm)	1.0	1.2	1.6	2.0	2.4	3.2	4.0
Process	Unit								
GTAW	5 kg tube					X	X	X	X
GMAW	7 kg spool B300		X	X	X				

Other sizes and packaging on request

LNT/LNM AIMg 4.5Mn: rev. EN 15

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## Aluminium wire

### Classification

ISO 18273-01 : AI 5087

### General description

Solid wire for welding of high strength aluminium alloys and low temperature applications (-196°C)  
Zr added to increase hot cracking resistance and improve structure

### Shielding gases (acc. EN 439)

GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	DB	TÜV
GMAW	+	+

### Chemical composition (w%), typical, wire

Al	Mn	Si	Ti	Mg	Zn	Cr	Zr
bal.	0.8	0.2	0.15	4.5	0.15	0.15	0.1

### Mechanical properties, typical

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GMAW	I1	AW	140	300	30

### Physical properties

Melting range	568 - 638°C
Density	approximately 2400 kg/m <sup>3</sup>

### Materials to be welded

Material	Code	Type	W.Nr.	Int.Reg.Nr.	Int.Cast.Nr.
Aluminium wrought alloys	DIN 1725-1	Al Mg 3	3.3535	5754	
		Al Mg 4,5 Mn	3.3547	5083	
		Al Mg 5	3.3555	6082	
		Al Mg Si 1			
Aluminium cast alloys	DIN 1725-2	G-Al Mg 3	3.3541		
		G-Al Mg 3 Si	3.3241		512.0
		G-Al Mg 5	3.3561		B 535.0
		G-Al Mg 5 Si	3.3261		

### Packaging

		Sizes (mm)	1.0	1.2	1.6
Process	Unit				
GMAW	7 kg spool B300		X	X	X

Other sizes and packaging on request

LNM AlMg 4.5MnZr: rev. EN 15

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## Aluminium wire

### Classification

AWS A5.10-99	: ER4043
ISO 18273-01	: Al 4043A

### General description

Solid wire for welding of aluminium-silicium alloys

### Shielding gases (acc. EN 439)

GTAW/GMAW	I1	Inert gas Ar (100%)
	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

	DB	TÜV
GTAW	+	+
GMAW	+	+

### Chemical composition (w%), typical, wire / rod

Al	Mn	Si	Ti	Fe	Zn	Cu	Mg
bal.	0.01	4.7	0.001	0.3	0.002	0.01	0.004

### Mechanical properties, typical

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	100	160	15
	GMAW	I1	AW	100	160	15

### Physical properties

Melting range	573 - 625°C
Density	approximately 2680 kg/m <sup>3</sup>

### Materials to be welded

Material	Code	Type	W.Nr.	Int.Reg.Nr.	Int.Cast.Nr.
Aluminium cast alloys	DIN 1725-1	Al Mg Si 0.5	3.3206	6060	
		Al Mg Si 0.7	3.3210	6005A	
		Al Mg Si 0.8	3.2316	6181	
Aluminium cast alloys	DIN 1725-2	G-Al Si 5			443.0

### Packaging

		Sizes (mm)	0.8	1.0	1.2	1.6	2.0	2.4	3.2	4.0
Process	Unit									
GTAW	5 kg tube					X	X	X	X	X
GMAW	7 kg spool B300		X	X	X	X		X		

Other sizes and packaging on request

LNT/LNM AISi 5: rev. EN 15

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## Aluminium wire

### Classification

AWS A5.10-99	: ER4047
ISO 18273-01	: AI 4047A

### General description

**Solid wire for welding of cast aluminium alloys containing up to 12% Si**

### Shielding gases (acc. EN 439)

GTAW	I1	Inert gas Ar (100%)
GMAW	I1	Inert gas Ar (100%)
	I3	Inert gas Ar+ >0-95% He

### Approvals

GTAW  
GMAW

### Chemical composition (w%), typical, wire / rod

Al	Si	Ti	Fe	Zn	Mn	Cu
bal.	11.4	0.01	0.4	0.01	0.01	0.04

### Mechanical properties, typical

	Process	Shielding gas	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)
Typical values	GTAW	I1	AW	80	180	5
	GMAW	I1	AW	80	180	6

### Physical properties

Melting range	573 - 585°C
Density	approximately 2650 kg/m <sup>3</sup>

### Materials to be welded

Materials	Code	Type	W.Nr.	Int.Cast.Nr.
Aluminium cast alloys:	DIN 1725-2	G-Al Si 12	3.3581	A 413.0
		G-Al Si 12 (Cu)	3.3583	
		G-Al Si 11		
		G-Al Si 10 Mg	3.2381	361.0
		G-Al Si 10 Mg (Cu)	3.2383	
		G-Al Si 9 Mg	3.2373	359.0
		G-Al Si 9 Cu 3	3.2161	
		G-Al Si 7 Mg	3.2371	356.0
		G-Al Si 6 Cu 4	3.2151	319.0

### Packaging

		Sizes (mm)	1.0	1.2	1.6	2.0	2.4	3.2	4.0
Process	Unit								
GTAW	5 kg tube					X	X	X	X
GMAW	7 kg spool B300		X	X	X				

Other sizes and packaging on request

LNT/LNM AISi 12: rev. EN 15

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Hardfacing solid wire

Classification

DIN 8555-83 : MSG 6-GZ-60-PS

General description

Solid wire for wear resistant overlays  
High resistance against corrosion, abrasion and impact deformation  
Hardness approximately 55-60HRC  
Optimal weldability

Shielding gases (acc. EN 439)

GMAW M21 Mixed gas Ar+ >5-25% CO<sub>2</sub>

Structure

Ferritic and martensitic

Chemical composition (w%), typical, wire

C	Mn	Si	Cr
0.5	0.4	3	9

Mechanical properties, all weld metal

	Typical hardness values
2 Layers, AW	approx. 60 HRC
Heat resistant to 450°C	

Packaging

		Sizes (mm)	1.2
Process	Unit		
GMAW	15 kg spool B300		X

## Hardfacing solid wire

### Classification

DIN 8555-83 : MSG 2-GZ-350

### General description

Solid wire for hardfacing applications  
Hardness approximately HB 325-375  
Optimal welding characteristics

### Shielding gases (acc. EN 439)

GMAW M21 Mixed gas Ar+ >5-25% CO<sub>2</sub>

### Application

Forming dies  
Dies

Impact resistance tools

### Structure

Martensitic

### Chemical composition (w%), typical, wire

C	Mn	Si	Cr
0.7	1.9	0.45	1.0

### Mechanical properties, all weld metal

Typical hardness values	
2 Layers, AW	approx. 38 HRc (360 HB)

### Packaging

		Sizes (mm)	1.2
Process	Unit		
GMAW	15 kg spool B300		X

LNM 4M: rev. EN 15

# Autogenous wire

## Classification

AWS A-5.2-89 : R45\*  
EN 12536-00 : O I

\* Nearest classification

## General description

Rods for oxy-acetylene gas welding of general construction steel

Suitable for mild steel

max. design temperature 350°C

## Chemical composition (w%), typical, rod

C	Mn	Si	P	S
0.07	0.4	0.07	0.01	0.01

## Mechanical properties, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) +20°C
Typical values	AW	280	390	16	50

## Packaging

	Sizes (mm)	2.0	3.0	4.0	5.0
Unit					
25 kg		X	X	X	X

LNG I: rev. EN 15

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## Autogenous wire

### Classification

AWS A-5.2-89 : R60\*  
EN 12536-00 : O II

\* Nearest classification

### General description

Rods for oxy-acetylene gas welding of general construction steel  
Suitable for mild steel  
max. design temperature 350°C  
Higher strength as LNG I

### Chemical composition (w%), typical, rod

C	Mn	Si	P	S
0.06	1.1	0.15	0.01	0.01

### Mechanical properties, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) +20°C
Typical values	AW	320	430	17	60

### Packaging

	Sizes (mm)	2.0	3.0	4.0	5.0
Unit					
25 kg		X	X	X	X

LNG II: rev. EN 15

## Autogenous wire

## Classification

AWS A-5.2-89 : R60\*  
 EN 12536-00 : O III

\* Nearest classification

## General description

Rods with 0.4% Ni for oxy-acetylene gas welding of joints in pipes

Excellent rootwelding

Applicable for design temperatures from -20°C to +350°C

## Chemical composition (w%), typical, rod

C	Mn	Si	P	S	Ni
0.06	1.1	0.15	0.01	0.01	0.40

## Mechanical properties, typical, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) +20°C
Typical values	AW	340	470	26	65

## Packaging

Sizes (mm)	2.0	2.5	3.0	4.0	5.0
Unit					
25 kg	X	X	X	X	X

LNG III: rev. EN 15

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## Autogenous wire

### Classification

AWS A5.2-89 : R65\*  
EN 12536-00 : 0 IV

\* Nearest classification

### General description

Rods with 0.5% Mo for oxy-acetylene gas welding of fine grained and creep resisting steel  
Design temperature max. 500°C

### Chemical composition (w%), typical, rod

C	Mn	Si	P	S	Mo
0.09	1.0	0.19	0.010	0.010	0.5

### Mechanical properties, typical, all weld metal

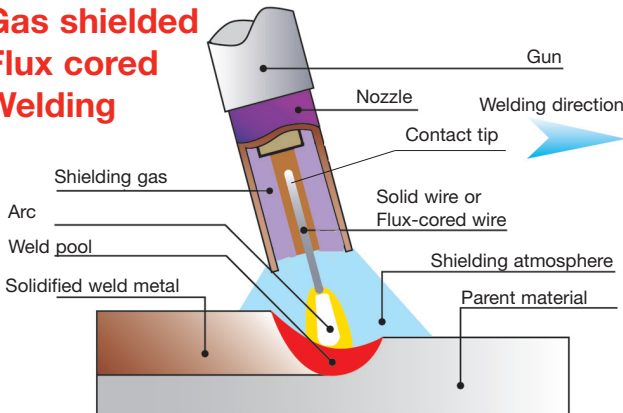
	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) +20°C
Typical values	AW	380	500	22	60

### Packaging

	Sizes (mm)	2.0	3.0
Unit			
25 kg		X	X

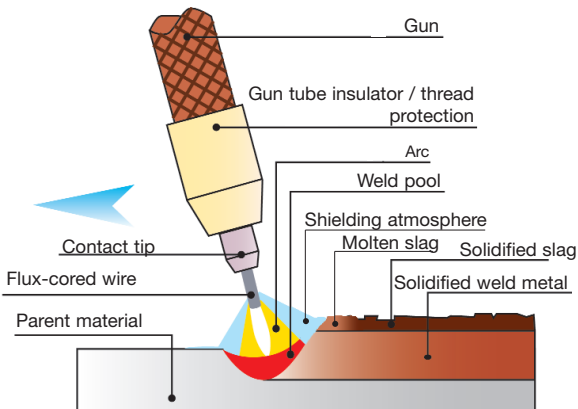
LNG IV: rev. EN 15

## Gas shielded Flux cored Welding



The MIG/MAG welding process (or GMAW - Gas Metal Arc Welding) is when an electric Arc is created between a continuous consumable wire and the work piece to be welded, protected within a gas atmosphere. This atmosphere can be either inert (Argon) or active (CO<sub>2</sub> or mixture of Argon and CO<sub>2</sub>). The wire is continuously fed through a gun to the weld pool by a wire feeder. Either Solid Wire (GMAW) or Cored Wire (FCAW-GS - flux-cored arc welding, gas shielding) can be used.

## Self shielded Flux-Cored welding



Innershield welding is an Arc welding process in which welding heat is created from an arc between a continuous flux cored wire and the work piece. The flux provides gas shielding for the arc and a slag covering of the weld deposit.

## Mild steel rutile cored wire

### Classification

AWS A5.20-95 : E70T-1 H8 / E70T-1M H8  
EN 758-97 : T 46 0 R C 3 H10 / T 46 0 R M 3 H10

### General description

Gas shielded flux cored wire for semi-automatic or mechanized downhand welds  
Low spatter, good slag removal, smooth appearance, excellent operator appeal  
High deposition rate and deep penetration, good resistance to scale and rust  
Reliable weld metal properties  
Low hydrogen content  $H_{DM} < 8\text{ml}/100\text{g}$   
Excellent wire feeding  
Superior product consistency with optimal alloy control

### Welding positions



### Current type/Shielding gas

DC +  
100%CO<sub>2</sub> (EN 439: C1)  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
15-25 l/min.

### Approvals

Shielding gas TÜV  
C1 +

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H <sub>DM</sub> ml/100g
C1	0.06	1.30	0.50	0.015	0.010	< 8
M21	0.06	1.70	0.35	0.015	0.010	< 8

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)		
						0°C	-18°C	-20°C
Required: AWS A5.20-95			min. 400	min. 480	min. 22			min. 27
EN 758-97			min. 460	530-680	min. 20		min. 47	
Typical values	C1	AW	480	560	26	80		40
	M21	AW	530	610	27	70		40

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)	
		1.6	2.4
Wire reel B300	15	X	
Wire reel B435	25		X

Outershield® 70: rev. EN 15



## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/kg weld metal
1.6	20	320	170	23-25	2.1	1.15
		510	235	25-27	3.4	1.15
		635	275	25-28	4.2	1.15
		760	310	27-29	5.0	1.15
		955	365	29-31	6.4	1.15
2.4	28	320	340	24-27	4.5	1.15
		510	450	28-31	7.3	1.15
		635	510	30-32	9.1	1.15
		700	535	31-34	10.0	1.15
		825	585	33-35	11.8	1.15

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25%) CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position		
		PA/1G	PB/2F	PC/2G
1.6	(A)	290-380	210-375	290-340
	(V)	25-34	25-32	25-32
2.4	(A)	410-560	410-510	
	(V)	27-34	28-32	

## Mild steel rutile cored wire

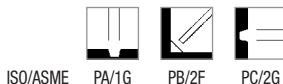
### Classification

AWS A5.20-95 : E70T-1 H4 / E70T-1M H4  
EN 758-97 : T 46 0 R C 3 H5 / T 46 0 R M 3 H5

### General description

Gas shielded flux cored wire for semi-automatic or mechanized downhand welds  
Low spatter, good slag removal, smooth appearance, excellent operator appeal  
High deposition rate and deep penetration, good resistance to scale and rust  
Reliable weld metal properties  
Low hydrogen content  $H_{DM} < 5\text{ml}/100\text{g}$   
Excellent wire feeding  
Superior product consistency with optimal alloy control  
New formulation results in 50% less fume emission!

### Welding positions



### Current type/Shielding gas

DC +  
100%CO<sub>2</sub> (EN 439: C1)  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
15-25 l/min.

### Approvals

Shielding gas	DB
M21	+
C1	+

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H <sub>DM</sub> ml/100g
C1	0.06	1.30	0.50	0.015	0.010	< 5
M21	0.06	1.70	0.35	0.015	0.010	< 5

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)		
						0°C	-18°C	-20°C
Required: AWS A5.20-95			min. 400	min. 480	min. 22	min. 27		
EN 758-97			min. 460	530-680	min. 20	min. 47		
Typical values	C1	AW	480	560	26	80		40
	M21	AW	530	610	27	70		40

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm) 2.4
Wire reel B435	25	X
Wooden reel	270	X

Outershield® 70-H: rev. EN 15

# Outershield® 70-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM 131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S275, S355, S420
Fine grained steel	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
2.4	28	320	340	24-27	4.5	1.15
		510	450	28-31	7.3	1.15
		635	510	30-32	9.1	1.15
		700	535	31-34	10.0	1.15
		825	585	33-35	11.8	1.15

## Welding parameters, optimum fill, shielding gas 100% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position	
		PA/1G	PB/2F
2.4	(A)	410-560	410-510
	(V)	27-34	28-32

# Outershield® 70E-H

## Mild steel rutile cored wire

### Classification

AWS A5.20-95 : E70T-1J H4/E70T-1MJ H4  
EN 758-97 : T 46 3 R C 1 H5/T 46 3 R M 1 H5

### General description

Gas shielded flux cored wire for high quality welding in downhand position  
Excellent operator appeal due to superior welding characteristics  
Capability with high deposition rate  
Exceptional mechanical properties (CVN > 47J at -30°C)  
Low hydrogen  $H_{DM} < 5$  ml/100g  
Superior product consistency with optimal alloy control  
Excellent wire feeding  
Very suitable for welding of root runs on ceramic backing and welding on primed plate

### Welding positions



ISO/ASME PA/1G PB/2F

### Current type/Shielding gas

DC +  
100% CO<sub>2</sub> (EN 439: C1)  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H <sub>DM</sub> ml/100g
C1/M21	0.04	1.4	0.6	0.013	0.010	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) -30°C -40°C
Required: AWS A5.20-95			min. 400	min. 480	min. 22	min. 27
EN 758-97			min. 460	530-680	min. 20	min. 47
Typical values	C1/M21	AW	570	620	25	55 40

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		1.6
Wire reel B300	15	X
AccuTrack®	200	X

Outershield® 70E-H: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

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# Outershield® 70E-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-25	3.1	1.20
		635	275	24-26	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.5	1.20
		1015	385	28-30	6.3	1.20
		1080	400	29-31	6.7	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position					
		PA/1G	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G
1.6	(A)	250-350	250-350	230-280	220-260	170-240	170-240
	(V)	24-32	24-32	24-30	22-28	22-28	22-28

## Mild steel rutile cored wire

### Classification

AWS A5.20-95 : E71T-1MJ H8  
EN 758-97 : T 46 3 P M 1 H10

### General description

All position gas shielded flux cored wire for high quality welding  
Excellent operator appeal due to superior welding characteristics  
Full out-of-position capability with higher deposition rates  
Exceptional mechanical properties (CVN > 47J at -30°C)  
Superior product consistency with optimal alloy control  
Excellent wire feeding

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H <sub>02</sub> ml/100g
M21	0.05	1.25	0.7	0.015	0.015	< 8

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) -30°C -40°C
Required: AWS A5.20-95			min. 400	min. 480	min. 22	min. 27
EN 758-97			min. 460	530-680	min. 20	min. 47
Typical values	M21	AW	600	650	24	100 75

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
Wire reel B300	15	X

Outershield® 71E: rev. EN 15

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## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-25	3.1	1.20
		635	275	24-26	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.5	1.20
		1015	385	28-30	6.3	1.20
		1080	400	29-31	6.7	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position					
		PA/1G	PB/2F	PG/2G	PF/3G up	PG/3G down	PE/4G
1.6	(A)	250-350	250-350	230-280	220-260	170-240	170-240
	(V)	24-32	24-32	24-30	22-28	22-28	22-28

## Mild steel rutile cored wire

### Classification

AWS A5.20-95 : E71T-1MJ H4  
EN 758-97 : T 46 3 P M 1 H5

### General description

All position gas shielded flux cored wire for high quality welding  
Excellent operator appeal due to superior welding characteristics  
Full out-of-position capability with higher deposition rates  
Exceptional mechanical properties (CVN > 47J at -30°C)  
Low hydrogen H<sub>DM</sub> < 5 ml/100g  
Superior product consistency with optimal alloy control  
Excellent wire feeding  
Very suitable for welding of root runs on ceramic backing

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

Shielding gas	ABS	BV	CTL	DB	DNV	FORCE	GL	LR	RINA	RMRS	TÜV
M21	3YSA,H5	SA3YMHH	+	+	IIYMSH5	+	3YH5S	3S,3YSH15	3YS	3S,3YSH5	+
C1	3YSA,H5	SA3YMHH		+	IIYMSH5		3HH5S		2YS		+

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H <sub>DM</sub> ml/100g
M21	0.04	1.4	0.6	0.013	0.010	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)		
						-20°C	-30°C	-40°C
Required: AWS A5.20-95			min. 400	min. 480	min. 22			min. 27
EN 758-97			min. 460	530-680	min. 20		min. 47	
Typical values	M21	AW	570	620	25	90	65	40

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		1.2
Plastic spool S200	4.5	X
Wire reel B300	15	X
AccuTrack®	200	X

Outershield® 71E-H: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request



# Outershield® 71E-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S275, S355, S420
Fine grained steel	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	20	445	130	21-23	1.5	1.20
		700	180	22-24	2.3	1.20
		955	220	25-27	3.2	1.20
		1270	265	27-29	4.3	1.20
		1590	305	30-32	5.4	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position		PC/2G	PF/3G up	PG/3G down	PE/4G
		PA/1G	PB/2F				
1.2	(A)	230-260	230-260	200-240	200-240	160-220	160-220
	(V)	26-32	26-32	25-30	25-28	23-26	23-26

# Outershield® 71M-H

## Mild steel rutile cored wire

### Classification

AWS A5.20-95 : E71T-1J H4  
EN 758-97 : T 46 2 P C 1 H5

### General description

Rutile gas shielded flux cored wire for high quality welding  
Excellent operator appeal due to superior welding characteristics  
Specially developed for welding with 100% CO<sub>2</sub>; smooth arc with low spatter  
Suitable for welding coated plate with use of 100% CO<sub>2</sub>  
Also suitable for welding on ceramic backing  
Good mechanical properties (CVN > 47J at -20°C)  
Low hydrogen H<sub>DM</sub> < 5 ml/100g  
By pref. use OS 71 E-H for Ar/CO<sub>2</sub> shielding gas

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PG/3G down PE/4G

### Current type/Shielding gas

DC +  
100% CO<sub>2</sub> (EN 439:C1)  
15-25 l/min

### Approvals

Shielding gas	ABS	BV	CRS	CTL	DB	DNV	GL	LR	RINA	RMRS
C1	3Y,H5	SA3M,SA3YMMH	3YH5	+	+	III Y40H5	3Y46H5S	3S,3YSH10	3YSH5	3S,3YSH5

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H <sub>DM</sub> ml/100g
C1	0.05	1.3	0.4	0.015	0.010	4

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) -20°C -40°C
Required: AWS A5.20-95			min. 400	min. 480	min. 22	min. 27
EN 758-97			min. 460	530-680	min. 20	min. 47
Typical values	C1	AW	580	620	24	80 40

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		1.2 1.6
Plastic spool S200	4.5	X
Wire reel B300	15	X X
Wire reel B435	25	X

Outershield® 71M-H: rev. EN 15

# Outershield® 71M-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S275, S355, S420
Fine grained steel	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	19	445	130	21-23	1.7	1.20
		700	170	22-24	2.3	1.20
		955	220	25-27	3.3	1.20
		1270	260	27-29	4.5	1.20
		1590	290	30-32	5.6	1.20
1.6	19	320	180	21-23	2.2	1.20
		510	255	22-25	3.3	1.20
		635	300	24-26	4.2	1.20
		760	335	25-27	5.0	1.20
		890	370	27-29	5.8	1.20
		1015	395	28-30	6.5	1.20
		1080	415	29-31	7.0	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position							
		PA/1G	PB/2F	PC/2G	PF/3G up	PG/3G down	PE/4G	PF/3F up	PG/3Fdown
1.2	(A)	230-280	230-280	200-240	200-240	160-220	160-220	170-220	170-220
	(V)	26-32	26-32	25-30	25-28	23-26	23-26	26-28	26-28
1.6	(A)	250-380	250-380	230-280	220-260	170-240	170-240		
	(V)	24-32	24-32	24-30	22-28	22-28	22-28		

# Outershield® T55-H

## Mild steel basic cored wire

### Classification

AWS A5.20-95 : E71T-5J H4/E71T-5MJ H4  
EN 758-97 : T 42 4 B C 2 H5/T 42 4 B M 2 H5

### General description

All position gas shielded basic flux cored wire  
Good weldability, also vertical up (3G)  
Exceptional mechanical properties (CVN >47J at -50°C)  
Very low hydrogen  $H_{DM}$  <5ml/100g  
Superior product consistency with optimal alloy control  
Excellent wire feeding

### Welding positions



### Current type/Shielding gas

DC -  
Ar+ (>25)% CO<sub>2</sub> (EN 439: M21)  
CO<sub>2</sub> (EN 439: C1)  
15-25 l/min

### Approvals

Shielding gas	ABS	BV	CTL	DB	DNV	FORCE	GL	LR	RINA	TÜV
M21	3SA,3YSA	SA3,3YMH	+	+	IVYMSH5	+	4YH10S	4Y40SH15		+
C1	3SA,3YSA	SA3,3YMH	+	+	IVYMSH5		4YH10S	4Y40SH15	3YS	+

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	$H_{DM}$ ml/100g
C1	0.05	1.5	0.55	0.012	0.010	3
M21	0.06	1.5	0.6	0.012	0.010	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)		
						-20°C	-40°C	-50°C
Required: AWS A5.20-95			min. 400	min. 480	min. 22		min. 27	
EN 758-97			min. 420	500-640	min. 20		min. 47	
Typical values	M21/C1	AW	480	570	27	130	85	60

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)			
		1.0	1.2	1.6	2.4
Plastic spool S200	4.5	X	X		
Wire reel B300	15		X	X	
Wire reel B435	25			X	X

Outershield® T55-H: rev. EN 15

# Outershield® T55-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	20	510	130	25-27	1.6	1.20
		760	185	26-28	2.5	1.20
		1015	225	27-29	3.3	1.20
		1270	260	28-30	4.1	1.20
		1525	290	29-31	5.0	1.20
		1780	310	30-32	5.8	1.20
1.6	20	380	170	24-26	2.5	1.15
		510	225	25-27	3.1	1.15
		760	310	27-29	4.7	1.15
		1015	380	29-31	6.3	1.15
		1270	430	31-33	7.9	1.15

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position			
		PA/1G	PB/2F	PC/2G	PF/3G up
1.2	(A)	215-290	215-290	215-250	110-150
	(V)	28-34	28-34	28-30	17-20
1.6	(A)	320-390	320-390	280-350	130-180
	(V)	28-34	28-34	28-32	18-22
2.4	(A)	350-550	350-550		
	(V)	30-34	30-34		

# Outershield® MC710-H

## Mild steel metal cored wire

### Classification

AWS A5.18/A5.18M-01 : E70C-6M H4

EN 758-97 : T 42 3 M M 2 H5 (ø1.2 and 1.6 mm) / T 42 2 M M 2 H5 (ø2.0 and 2.4 mm)

### General description

All position high efficiency gas shielded metal cored wire

Excellent arc characteristics give outstanding operator appeal

Little slag and spatter, fast travel speed, excellent wire feeding- "robotic" quality

Superior on scaly plate, good resistance to porosity

Very good mechanical properties (CVN >47J at -30°C)

Superior product consistency with optimal alloy control

### Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PG/3G down



PE/4G

### Current type/Shielding gas

DC +

Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)

15-25 l/min

### Approvals

Shielding gas	ABS	BV	CTL	DB	DNV	FORCE	GL	LR	RINA	RMRS	TÜV
M21	3SA,3YSA,H	SA3,3YMH	+	+	IIYMSH5	+	3YH10S	3S,3YSH15	3YS	3S,3YSH5	+

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H <sub>018</sub> ml/100g
M21	0.05	1.35	0.6	0.015	0.023	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)		
						-20°C	-29°C	-30°C
Required: AWS A5.18-01			min. 400	min. 480	min. 22		min. 27	
EN 758-97 (1.2/1.6)			min. 420	500-640	min. 20			min. 47
Typical values	M21	AW	495	570	26	90		60

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)				
		1.2	1.4	1.6	2.0	2.4
Plastic spool S200	4.5	X				
Wire reel B300	15	X	X	X		
Wire reel B435	25		X	X	X	X
AccuTrack®	200	X	X	X		
Metal coil	270	X		X	X	X

Outershield® MC710-H: rev. EN 15

# Outershield® MC710-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH36
Caststeel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Arc mode	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	short-arc	15	460	90	15	1.1	1.10
			655	120	16	1.4	1.10
			870	150	17	1.9	1.10
1.2	spray-arc	20	635	180	28-30	2.7	1.10
			1145	275	31-34	4.8	1.10
			1650	340	35-38	6.8	1.10
1.4	spray-arc	25	445	170	27-29	2.5	1.10
			890	270	29-32	5.0	1.10
			1400	355	32-34	8.1	1.10
1.6	spray-arc	25	635	325	29-32	5.0	1.10
			890	400	34-37	7.0	1.10
			1145	460	36-38	9.1	1.10
2.0	spray-arc	28	320	290	25-27	3.7	1.05
			510	385	28-31	6.1	1.05
			760	510	32-35	9.3	1.05
2.4	spray-arc	30		400	28-32		
				475	28-32		
				550	30-34		

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position				
		PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	(A)	230-380	230-380	230-300	130-170	140-175
	(V)	26-36	26-36	26-30	15-17	16-17
1.4	(A)	240-385	240-385	240-340	160-180	175-185
	(V)	26-36	26-36	26-31	14-15	15-16
1.6	(A)	280-460	280-460	270-300		
	(V)	28-36	28-36	28-30		
2.0	(A)	300-510	300-510			
	(V)	28-33	28-33			
2.4	(A)	400-550	400-550			
	(V)	32-36	32-36			

# Outershield® MC715-H

## Mild steel metal cored wire

### Classification

AWS A5.18/A5.18M-01 : E70C-6 M H4  
EN 758-97 : T 42 4 M M 2 H5

### General description

Metal cored gas shielded wire for all positions  
Little slag and spatter, fast travel speed and very good wire feeding  
Excellent arc characteristics give outstanding operator appeal  
Excellent mechanical properties (CNV >47J at -40°C)  
Depending on application good alternative for basic flux cored wires  
Very low hydrogen  $H_{DM} < 5 \text{ ml/100 gr}$

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

Shielding gas	ABS	BV	CTL	DB	DNV	GL	LR	RINA	TÜV
M21	4Y40SA,HH SA3,3YMH		+	+	IV Y40H5	4Y40H5S	4Y40SH5	4YSH5	+

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H <sub>DM</sub> ml/100g
M21	0.04	1.5	0.4	0.012	0.020	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)			
						-29°C	-30°C	-40°C	-50°C
Required: AWS A5.18-01 EN 758-97			min. 400 min. 420	min. 480 500-640	min. 22 min. 20	min. 27		min. 47	
Typical values	M21	AW	480	540	27		120	110	80

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)		
		1.2	1.4	1.6
Plastic spool S200	4.5	X		
Wire reel B300	15	X	X	X
Wire reel B435	25			X
AccuTrack®	200	X	X	

Outershield® MC715-H: rev. EN 15



# Outershield® MC715-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S275, S355, S420
Fine grained steel	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Arc mode	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	short-arc	15	460	90	15	1.1	1.10
			655	120	16	1.4	1.10
			870	150	17	1.9	1.10
1.2	spray-arc	20	635	180	28-30	2.7	1.10
			1145	275	31-34	4.8	1.10
			1650	340	35-38	6.8	1.10
1.4	short-arc	15	205	105	14.5	1.2	1.10
			255	125	15.0	1.5	1.10
			280	135	15.5	1.6	1.10
1.4	spray-arc	25	445	170	27-29	2.5	1.10
			890	270	29-32	5.0	1.10
			1400	355	32-34	8.1	1.10
1.6	short-arc	18	180	145	15	1.5	1.10
			205	160	16	1.7	1.10
			230	170	18	1.9	1.10
1.6	spray-arc	25	380	235	25-26	2.9	1.10
			635	325	29-32	5.0	1.10
			890	400	34-37	7.0	1.10
			1145	460	36-38	9.1	1.10

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position				
		PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	(A)	230-380	230-380	230-300	130-170	140-175
	(V)	26-36	26-36	26-30	15-17	16-17
1.4	(A)	240-385	240-385	240-340	160-180	175-185
	(V)	26-36	26-36	26-31	14-15	15-16
1.6	(A)	280-460	280-460	270-300		
	(V)	28-36	28-36	28-30		

# Outershield® MC460VD-H

## Mild steel metal cored wire

### Classification

AWS A5.18/A5.18M-01 : E70C-6M H4  
EN 758-97 : T 46 2 M M 1 H5

### General description

Metal cored wire for welding with high efficiency  
Especially for vertical down welding in thin plate  
Excellent arc characteristics give outstanding operator appeal  
No slag, only silicon islands, less spatter  
Superior product consistency with optimal alloy control

### Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3G up



PG/3G down



PE/4G

### Current type/Shielding gas

DC- for all welding positions  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

Shielding gas	ABS	BV	CTL	DNV	GL	LR
M21	3YSA,H5	SA3YMH5H	+	IIIMSH5	3YH5S	3S,3YSH5

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	H <sub>DM</sub> ml/100g
M21	0.05	1.25	0.6	0.015	0.015	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) -20°C -29°C
Required: AWS A5.18-01			min. 400	min. 480	min. 22	min. 27
EN 758-97			min. 460	530-680	min. 20	min. 47
Typical values	M21	AW	510	600	25	90 60

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
Plastic spool S200	4.5	X
Wire reel B300	15	X

Outershield® MC460VD-H: rev. EN 15

# Outershield® MC460VD-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	15-20	800	250-280	26-30	3.4	1.10

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position			
		PB/2F	PG/3F down	PG/3G down	PE/4F
1.2	(A)	250 - 300	250 - 300	200-220	200-220
	(V)	26-30	26-30	21-24	23-25

# Outershield® 81Ni1-H

## Low temperature rutile cored wire

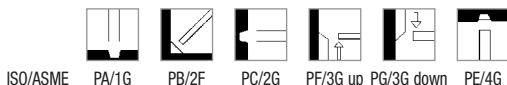
### Classification

AWS A5.29-98 : E81T1-Ni1MJ H4 (all diameters)  
EN 758-97 : T 50 5 1Ni P M 2 H5 (only diameter 1.2 mm)

### General description

All position gas shielded 1% Ni flux cored wire, offshore and similar applications  
Superior weldability, low spatter, good bead appearance  
Outstanding operators appeal  
Exceptional mechanical properties (CVN >47J at -40°C)  
Very low hydrogen  $H_{DM} < 5$  ml/100g  
Superior product consistency with optimal alloy control  
Excellent wire feeding

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

Shielding gas	BV	CTL	DNV	FORCE	GL	LR	RINA
M21	SA3,3YMH	+	IVYMSH5	+	4YH10S	3Y,4Y40SH5	4YSH5

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	H <sub>DM</sub> ml/100g
M21	0.05	1.4	0.2	0.013	0.010	0.95	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) -40°C -50°C
Required: AWS A5.29-98			min. 470	550-690	min. 19	min. 27
EN 758-97			min. 500	560-720	min. 18	min. 47
Typical values	M21	AW	530	600	24	90 60

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)	
		1.2	1.6
Plastic spool S200	4.5	X	
Wire reel B300	15	X	X
Wire reel B435	25		X

Outershield® 81Ni1-H: rev. EN 15

# Outershield® 81Ni1-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S275, S355, S420
Fine grained steel	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position				
		PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	(A)	230-280	230-280	200-240	200-240	160-220
	(V)	26-32	26-32	25-32	25-28	23-28
1.6	(A)	250-350	250-350	230-280	220-260	170-240
	(V)	24-32	24-32	24-32	24-28	22-28

# Outershield® 81Ni1-HSR

## Low temperature rutile cored wire

### Classification

AWS A5.29-98 : E81T1-Ni1MJ H4  
EN 758-97 : T 50 5 1Ni P M 2 H5

### General description

All position gas shielded 1% Ni flux cored wire, offshore and similar applications  
Specific design for stress relieved applications, guaranteed impact properties after PWHT  
Superior weldability, low spatter, good bead appearance  
Outstanding operators appeal  
Exceptional mechanical properties (CVN >47J at -40°C)  
Very low hydrogen  $H_{DM}$  <5 ml/100g  
Superior product consistency with optimal alloy control  
Very good wire feeding

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PG/3G down PE/4G

### Current type/Shielding gas

DC +  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

DNV  
IVMSH5

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	H <sub>DM</sub> ml/100g
M21	0.06	1.4	0.3	0.013	0.010	0.95	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)	
						-40°C	-50°C
Required: AWS A5.29-98 EN 758-97			min. 470	550-690	min. 19	min. 27	
			min. 500	560-720	min. 18	min. 47	
Typical values:	M21	AW	570	620	24	120	100
	M21	SR	550	600	24	120	100

SR 1h/600°C, 3G up - V45°

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)	
		1.2	1.6
Plastic spool S200	4.5	X	
Wire reel B300	15	X	X
Wire reel B435	25		X

Outershield® 81Ni1-HSR: rev. EN 15

# Outershield® 81Ni1-HSR

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, C, D, AH32 to DH36
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S275, S355, S420
	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position				
		PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	(A)	230-280	230-280	200-240	200-240	160-220
	(V)	26-32	26-32	25-32	25-28	23-28
1.6	(A)	250-350	250-350	230-280	220-260	170-240
	(V)	24-32	24-32	24-32	24-28	22-28

# Outershield® 81K2-H

## Low temperature rutile cored wire

### Classification

AWS A5.29-98 : E81T1-K2MJ H4 (all diameters)  
EN 758-97 : T 50 6 1.5Ni P M 2 H5 (only diameter 1.2 mm)

### General description

All position gas shielded 1.5% Ni, Ti and B alloyed flux cored wire  
Used in off-shore and similar applications  
Superior weldability, low spatter, good bead appearance  
Outstanding operators appeal  
Exceptional mechanical properties (CVN >80J at -60°C)  
Very low hydrogen  $H_{DM}$  <5 ml/100g  
Superior product consistency with optimal alloy control  
Excellent wire feeding

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

Shielding gas	DNV	LR	RINA
M21	IVY46MSH5	4Y40SH5	4YS

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	$H_{DM}$ ml/100g
M21	0.04	1.4	0.2	0.012	0.010	1.4	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)
						-40°C -50°C -60°C
Required: A5.29-98			min. 470	550-690	min.19	min. 27
EN 758-97			min. 500	560-720	min.18	
Typical values	M21	AW	590	630	23	130 100 min. 47 80

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		1.2 1.6 2.0
Plastic spool S200	4.5	X
Wire reel B300	15	X X
Wire reel B435	25	X X X
AccuTrack®	200	X

Outershield® 81K2-H: rev. EN 15



# Outershield® 81K2-H

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to EH40
Cast steel	EN 10213-2	G P 240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240NB, L290NB, L360NB, L360QB, L240MB, L290MB, L360MB, L415MB, L415NB
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S275, S355, S420
Fine grained steel	EN 10113-3	S275M, S275ML, S355M, S355ML, S420M, S420ML

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position				
		PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	(A)	230-280	230-280	200-240	200-240	160-220
	(V)	26-32	26-32	25-32	25-28	23-30
1.6	(A)	250-350	250-350	230-280	220-260	170-240
	(V)	24-32	24-32	24-32	24-28	22-28

# Outershield® 500CT-H

## Weather resistant rutile cored wire

### Classification

AWS A5.29-98 : E81T1-G H4  
EN 758-97 : T 50 5 Z P M 2 H5

### General description

All position gas shielded 0.8% Ni and 0.4% Cu flux cored wire, for welding weather resistant steel (CorTen)

For welding in all positions

Superior weldability, low spatter, good bead appearance

Outstanding operator appeal

Exceptional mechanical properties (CVN >47J at -50°C)

Very low hydrogen H<sub>DM</sub> <5ml/100g

Superior product consistency with optimal alloy control

Excellent wire feeding

### Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PF/3G up



PG/3G down



PE/4G

### Current type/Shielding gas

DC +

Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)

15-25 l/min

### Approvals

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Cu	H <sub>DM</sub> ml/100g
M21	0.05	1.3	0.2	0.014	0.010	0.84	0.4	<5

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)	
						-40°C	-50°C
Required: AWS A5.29-98			min. 470	550-690	min. 19	min. 27	
EN 758-97			min. 500	560-720	min. 18		min. 47
Typical values	M21	AW	580	610	23		80

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)	
		1.2	
Plastic spool S200	4.5	X	
Wire reel B300	15	X	

Outershield® 500CT-H: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

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# Outershield® 500CT-H

## Materials to be welded

Steel	Code	Type
Weather resisting steel	EN 10155	S235 J0W
		S235 J2W
		S355 J0W
		S355 J2W
		S355 K2G1W

Weather resistant steels like: Cor-Ten®, Patinax®-F, Patinax®-37 and similar Ni- and Cu-alloyed steels

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position				
		PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	(A)	230-280	230-280	200-240	200-240	160-220
	(V)	26-32	26-32	25-32	25-28	23-28

# Outershield® 550-H

## High strenght rutile cored wire

### Classification

AWS A5.29-98 : E101T1-K3MJ H4  
EN 12535-00 : T 55 4 Z P M 1 H5

### General description

All position gas shielded rutile flux cored wire, for high strength steel grades for welding pipes and plates  
Outstanding operators appeal  
Excellent mechanical properties (CVN >50J at -40°C)  
Very low hydrogen  $H_{DM} < 5$  ml/100g)  
Superior product consistency with optimal alloy control  
Good wire feeding

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Mo	H <sub>DM</sub> ml/100g
M21	0.04	1.4	0.2	0.012	0.010	2.0	0.3	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) -40°C
Required: AWS A5.29-98			min. 610	690-800	min.15	min. 27
EN 12535-00			min. 550	640-820	min.18	min. 47
Typical values	M21	AW	700	730	19	60

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		1.2
Plastic spool S200	4.5	X
Wire reel B300	15	X

Outershield® 550-H: rev. EN 15

# Outershield® 550-H

## Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X52, X60, X60, X65, X70, X80
Fine grained steel	EN 10137-2	S500 - S550

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position				
		PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	(A)	230-280	230-280	200-240	200-240	160-220
	(V)	26-32	26-32	25-32	25-28	23-30

## High strenght rutile cored wire

### Classification

AWS A5.29-98 : E111T1-K3MJ H4  
EN 12535-00 : T 69 4 Z P M 2 H5

### General description

All position gas shielded rutile flux cored wire, for high strength steel grades like grade S690  
Outstanding operators appeal  
Excellent mechanical properties (CVN >50J at -40°C)  
Very low hydrogen  $H_{DM} < 5$  ml/100g)  
Superior product consistency with optimal alloy control  
Good wire feeding

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

Shielding gas ABS  
M21 AWS

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Mo	H <sub>DM</sub> ml/100g
M21	0.06	1.5	0.2	0.015	0.010	2.0	0.5	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	-18°C	Impact ISO-V (J) -29°C -40°C -50°C
Required: A5.29-98			min. 680	760-900	min.15		min. 27
EN 12535-00			min. 690	770-970	min.17		min. 47
Typical values	M21	AW	800	830	17	80	60 50

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm) 1.2 1.6
Plastic spool S200	4.5	X
Wire reel B300	15	X X

Outershield® 690-H: rev. EN 15

# Outershield® 690-H

## Materials to be welded

Steel	Code	Type
Fine grained steel	EN 10137-2	S500-S690

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position				
		PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	(A)	230-280	230-280	200-240	200-240	160-220
	(V)	26-32	26-32	25-32	25-28	23-30
1.6	(A)	250-350	250-350	230-280	220-260	170-240
	(V)	24-29	24-29	24-28	24-26	22-26

# Outershield® 690-HSR

## High strenght rutile cored wire

### Classification

AWS A5.29-98 : E111T1-K3MJ H4  
EN 12535-00 : T 69 4 Z P M 2 H5 T

### General description

All position gas shielded rutile flux cored wire, for high strength steel grades like grade S690  
Specific design for stress relieved applications  
Outstanding operators appeal  
Excellent mechanical properties (CVN >50J at -40°C)  
Very low hydrogen  $H_{DM}$  <5 ml/100g  
Superior product consistency with optimal alloy control  
Good wire feeding

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25)% CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

### Chemical composition (w%), typical, all weld metal

Shielding gas	C	Mn	Si	P	S	Ni	Mo	$H_{DM}$ ml/100g
M21	0.06	1.5	0.2	0.015	0.010	2.0	0.5	3

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) -30°C -40°C
Required: AWS A5.29-98			min. 680	760-900	min.15	27
EN 12535-00			min. 690	770-970	min.17	47
Typical values:	M21	AW	740	790	19	75
	M21	SR	720	770	20	60

SR: 1h/580°C, 3G up - V60°

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		1.2 1.6
Plastic spool S200	4.5	X
Wire reel B300	15	X X

Outershield® 690-HSR: rev. EN 15



# Outershield® 690-HSR

## Materials to be welded

Steel	Code	Type
Fine grained steel	EN 10137-2	S500-S690

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.2	20	445	130	20-22	1.6	1.20
		700	180	23-25	2.5	1.20
		950	220	25-27	3.4	1.20
		1270	265	27-29	4.5	1.20
		1590	305	30-32	5.9	1.20
1.6	20	320	170	21-23	1.9	1.20
		510	235	22-24	3.1	1.20
		635	275	24-25	3.9	1.20
		760	310	25-27	4.7	1.20
		890	350	27-29	5.6	1.20
		1015	385	28-30	6.4	1.20
		1080	400	30-31	6.8	1.20

## Welding parameters, optimum fill, shielding gas Ar + (>5 - 25)% CO<sub>2</sub>

Diameter (mm)	Current/ Voltage	Welding position				
		PA/1G	PB/2F	PC/2G	PF/3G up	PE/4G
1.2	(A)	230-280	230-280	200-240	200-240	160-220
	(V)	26-32	26-32	25-32	25-28	23-30
1.6	(A)	250-350	250-350	230-280	220-260	170-240
	(V)	24-29	24-29	24-28	24-26	22-26

## Self-shielded cored wire

### Classification

AWS A5.20-95 : E71T-14

### General description

Self shielded: easiest equipment arrangement

Welding galvanized steel

Single pass automatic and semi-automatic

Recommended for sheets from 1.2 to 5.0mm

### Welding positions



ISO/ASME PA/1G PC/2G PG/3G down PG/5G down

### Current type

DC -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al	Ti	N
0.30	0.99	0.24	0.013	0.007	1.63	0.003	0.051

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20-95	not required	480	not required	not required
Typical values	AW		525*		

\* Flat tensile test specimen

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
Coils 50C	22.68	X

Innershield® NR®-152: rev. EN 15

# Innershield® NR®-152

## Suggestions for use

Spot welds on 0.75mm to 1.5mm thick material

These procedures include automatic processes where excellent striking is required

Galvanized or zinc coated steel may be welded with Innershield NR-152 at travel speeds of 75 to 100 cm/min. The joint design must permit the zinc oxide vapor to diffuse through the molten puddle or to the atmosphere

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 t/m DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360
	API 5LX	X42, X46, X52
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355
	EN 10113-3	S275, S355

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.6	13	30	75	90	13	0.55	1.11
		50	125	150	15	0.9	1.11
		110	280	250	19	2.0	1.11

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position		
		PA/1G PB/2F	PC/2G	PG/3G (down)
1.6	(cm/min.)	180	150	200
	(A)	205	170	220
	(V)	16.5	18.5	19.5

# Innershield® NR®-203 NiC

## Self-shielded cored wire

### Classification

AWS A5.29-98 : E61T8-K6

### General description

Self shielded: easiest equipment arrangement

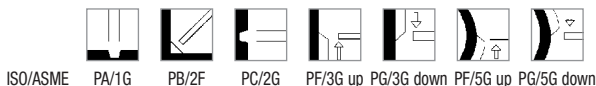
All position welding

Easy to weld in vertical up position

All passes

Good impact and CTOD toughness

### Welding positions



### Current type

DC -

### Approvals

ABS	DNV	LR
3SA	IIIMSH15	3SH15

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Cr	Al	V	Mo
0.06	0.83	0.05	0.004	0.003	0.57	0.08	0.73	<0.1	<0.1

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.29-98	min. 340	410-550	22	27
Typical values	AW	400	490	29	95

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		2.0
Coils 14C	6.35	X
Coils 50C	22.68	X

Innershield® NR®-203 NiC: rev. EN 15

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# Innershield® NR®-203 NiC

## Suggestions for use

For mild and higher strength steel not exceeding the yield strength range

Roundabout groove welds, especially for large diameter heavy tubular constructions

General plate fabrication, including bridge construction, hull plate and stiffener welding on ships and barges, offshore

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360
	API 5LX	X42, X46, X52
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S355
Fine grained steel	EN 10113-3	S275, S355

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed		Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
		inch/min	cm/min				
2.0	19	50	125	145	16	1.10	1.32
		90	230	235	20	1.95	1.32
		110	280	275	21	2.40	1.32

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position		PF/3G up PF/5G up	PG/5G down PG/5G down	PE/4G
		PA/1G PB/2F	PC/2G			
2.0	(cm/min.)	280	230	200	200	200
	(A)	275	235	215	215	215
	(V)	21	20	19	18	19

# Innershield® NR®-203Ni1

## Self-shielded cored wire

### Classification

AWS A5.29-98

: E71T8-Ni1

### General description

Self shielded: easiest equipment arrangement

All position welding

Easy to weld in vertical up position

All passes

Good impact and CTOD toughness

### Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PG/3G down



PE/4G



PG/5G up



PG/5G down

### Current type

DC -

### Approvals

ABS	BV	DB	DNV	FORCE	GL	LR	RINA	TÜV
3SA,3YSA	SA3YMH	+	IIIMSH10	+	3YSH10	3S,3YSH15	3S,3YS	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Cr	Al
0.08	1.1	0.27	0.008	0.003	0.9	0.04	0.85

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.29-98	min. 400	480-620	20	27
Typical values	AW	465	540	26	115

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)	
		2.0	2.4
Coils 14C	6.35	X	
Coils 50C	22.68	X	X

Innershield® NR®-203Ni1: rev. EN 15

# Innershield® NR®-203Ni1

## Suggestions for use

For mild and higher strength steel, not exceeding the yield strength range of the electrode weld deposit  
General plate fabrication, including bridge construction, hull plate and stiffener welding on ships and barges, off shore

For semi- and full automatic welding

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360
	API 5LX	X42, X46, X52
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355
	EN 10113-3	S275, S355

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	50	125	145	16	1.10	1.30
		90	230	235	20	1.95	1.30
		140	355	310	23	3.15	1.30
2.4	19	50	125	215	18	1.60	1.20
		95	240	315	21	3.25	1.20
		130	330	385	24	4.30	1.20

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position		PC/2G	PF/3G up	PF/5G up	PG/3G down PG/5G down	PE/4G
		PA/1G	PB/2F					
2.0	(cm/min.)	280	330	230	200	200	200	180
	(A)	255	300	235	215	215	215	195
	(V)	21	22	20	19	19	18	19
2.4	(cm/min.)	280	280	215	180			
	(A)	345	345	290	250			
	(V)	22	22	19.5	19			

# Innershield® NR®-211MP

## Self-shielded cored wire

### Classification

AWS A5.20-95 : E71T-11

### General description

Self shielding: easiest equipment arrangement

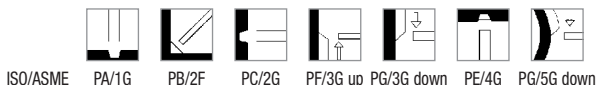
General purpose welding

Easy handling and welding versatility

Recommended for sheets from 2.5 to 12mm

With electrode diameter 0.9mm: excellent for sheets from 1.2mm

### Welding positions



### Current type

DC -

### Approvals

BV	DB	FORCE	LR
+	+	+	AWS

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.21	0.60	0.18	0.008	0.007	1.50

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20-95	min. 400	480	20	not required
Typical values	AW	450	580	23	

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)			
		0.9	1.2	1.7	2.0
Coils 14C	4.54	X	X		
Coils 14C	6.35			X	X
Coils 25RR	11.34	X	X		
Coils 50C	22.68			X	X

Innershield® NR®-211MP: rev. EN 15



# Innershield® NR®-211MP

## Suggestions for use

Fabricating and repair of machinery parts, truck bodies, saddles, tanks, hoppers, etc.  
Racks, scaffolding, light angle structurals, joints, small roundabouts, etc.  
Short assembly welds on brackets, dips, etc.  
Galvanized steel

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360
	API 5LX	X42, X46, X52
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S355
Fine grained steel	EN 10113-3	S275, S355

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
0.9	10	50	125	30	14	0.3	1.22
		90	230	90	16	0.6	1.22
		110	280	120	16.5	0.8	1.22
1.1	14	70	180	120	15	0.5	1.22
		110	280	160	17	1.0	1.22
		130	330	170	18	1.2	1.22
1.7	19	40	100	120	15	0.8	1.22
		75	190	190	18	1.5	1.22
		175	440	320	23	3.5	1.22
2.0	19	50	130	180	16	1.4	1.09
		75	190	250	18	2.2	1.09
		150	380	350	22	4.3	1.09
2.4	19	50	130	235	16	2.0	1.10
		55	140	250	18	2.3	1.10
		100	250	370	20	4.2	1.10

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position		PF/3G up	PG/3G down PG/5G down	PE/4G
		PA/1G PB/2F	PC/2G			
0.9	(cm/min.)	180	180	150	230	230
	(A)	65	65	50	85	85
	(V)	15	15	14.5	16	16
1.1	(cm/min.)	230	230	200	280	280
	(A)	140	140	130	160	160
	(V)	16	16	16	17	17
1.7	(cm/min.)	440	250	190	300	300
	(A)	320	230	190	280	280
	(V)	23	19.5	18	21	21
2.0	(cm/min.)	330	190		230	190
	(A)	320	250		320	250
	(V)	21	18		19.5	18
2.4	(cm/min.)	230	180		230	140
	(A)	350	275		350	250
	(V)	19.5	19		19.5	18

# Innershield® NR®-232

## Self-shielded cored wire

### Classification

AWS A5.20-95 : E71T-8

### General description

Self shielded: easiest equipment arrangement

Deposit rate up to 3 kg/h, out of position

Excellent low temperature impact toughness

Ideal for fillet welding and filling

For single and multi-pass welds

Size diam. 1.7mm suitable for contaminated or primed plate

### Welding positions



### Current type

DC -

### Approvals

ABS	BV	DB	DNV	LR	RINA	TÜV	NKK
3SA,3YSAH15	SA3YMH	+	IIYMSH15	3S,3YSH15	3YS	+	KSW53NH10

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.18	0.65	0.27	0.006	0.004	0.55

### Mechanical properties, all weld metal

		Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -20°C	-29°C
Required:	AWS A5.20-95		min. 400	480	22		27
Typical values		AW	490	590	26	65	35

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)		
		1.7	1.8	2.0
Coils 14C	6.12	X	X	X
Coils 50C	22.68	X	X	X

Innershield® NR®-232: rev. EN 15

# Innershield® NR®-232

## Suggestions for use

Designed for the semi-automatic welding of 5mm and thicker steel

Recommended for single and multi-pass welds

Size diam. 1.7mm, is recommended for welds where it is necessary to produce wider passes (weave technique) and for welding plate with contaminations such as oil, rust, paint or primer

Size diam. 1.8mm is recommended to obtain the fastest travel speed on single pass fillet weld

Size diam. 2.0mm is recommended for overhead position

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36.
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure Vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.7	12-25	110	280	170	19	1.7	1.33
		170	430	250	21	2.7	1.33
		320	810	400	26	5.1	1.33
1.8	12-25	80	200	130	17	1.5	1.22
		170	430	250	21	2.9	1.22
		285	730	350	24	5.0	1.22
2.0	12-25	60	150	130	16	1.3	1.22
		130	330	250	21	2.8	1.22
		220	550	350	25	4.6	1.22

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position			PF/3G up	PE/4G
		PA/1G	PB/2F	PC/2G		
1.7	(cm/min.)	635	495		380	380
	(A)	310	275		225	225
	(V)	23	23		19.5	19.5
1.8	(cm/min.)	635	510	430	390	430
	(A)	355	290	255	240	255
	(V)	11	21	21	20	21
2.0	(cm/min.)	460	380		330	380
	(A)	315	285		250	285
	(V)	23	22		21	22

# Innershield® NR®-233

## Self-shielded cored wire

### Classification

AWS A5.20-95

E71T-8

### General description

Self shielded: easiest equipment arrangement

Due to new production technology and formulation: welder friendly wire with wide range of parameter settings

Forgiving arc, with increased penetration gives better quality welds with great bead appearance

High deposition rate, even in out of position welding

Good impact properties

NR-233 has been developed to minimize gas marking, even after the electrode has been exposed to the atmosphere

### Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

### Current type

DC -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.16	0.65	0.21	0.010	0.003	0.60

### Mechanical properties, all weld metal

		Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.20-95		min. 400	480	22	27
Typical values	AW		440	570	26	40

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)	
		1.6	1.8
Plastic spool	5.7	X	
Plastic spool Foil Bag	11.3	X	X

Innershield® NR®-233: rev. EN 15

**LINCOLN**  
ELECTRIC

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

[www.lincolnelectriceurope.com](http://www.lincolnelectriceurope.com)

# Innershield® NR®-233

## Suggestions for use

Vertical up fillet and groove welds  
Overhead fillet and groove welds  
Seismic structural steel erection  
General structural steel erection  
Ship and barge fabrication

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360
	API 5LX	X42, X46, X52
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S355
Fine grained steel	EN 10113-3	S275, S355

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed		Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.6	13-32	inch/min	cm/min				
		150	380	220	17-19	1.9	1.26
		200	510	245	19-21	2.5	1.31
		250	640	270	21-23	3.0	1.35
		300	760	295	23-25	3.5	1.35
1.8	19-25	350	890	315	25-27	4.3	1.31
		100	250	185	17-18	1.6	1.25
		150	380	250	18-19	2.5	1.24
		200	510	295	20-21	3.2	1.25
		250	640	330	22-23	4.0	1.26
		300	760	355	23-24	4.8	1.26

# Innershield NR<sup>®</sup>-204-H

## Self-shielded cored wire

### Classification

AWS A5.20-95 : E71T-GS

### General description

Self shielded: easiest equipment arrangement  
NR 204 recommended for vertical down root pass pipe welding  
NR 207 recommended for filling in vertical down position pipe welding  
High quality construction welding in all positions  
Good impact and CTOD toughness  
Low hydrogen weld metal H<sub>DM</sub> 5-7ml/100g)

### Welding positions



ISO/ASME PA/1G PC/2G PG/3G down PG/5G down

### Current type

DC -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.15	0.75	0.20	0.008	0.013	0.65

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20-95	not required	min. 480	not required	not required
Typical values	AW		510*	24	

\* Flat tensile test specimen

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
Coils 14C	6.35	X

Innershield NR<sup>®</sup>-204-H: rev. EN 15

# Innershield NR®-204-H

## Suggestions for use

Where low hydrogen weld metal is required

High productivity welding

Where arctic mechanical properties are required in general construction welding

Semi-automatic pipe welding

Drag angle 30°, electrical stick out 15-20mm

## Materials to be welded

Steel	Code	Type
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360
	API 5LX	X42, X46, X52
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.7	19	80	200	170	13.5	1.8	
		95	240	185	14.5	2.1	
		110	280	210	15.6	2.4	

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position		
		PA/1G	PC/2G	PG/3G down PG/5G down
1.7	(cm/min.)	280	230	230
	(A)	240	220	220
	(V)	21	19	19

# Innershield® NR®-207

## Self-shielded cored wire

### Classification

AWS A5.29-98

: E71T8-K6

### General description

Self shielded: easiest equipment arrangement

Vertical down filling semi-automatic pipe welding

High quality construction welding in all positions

Good impact and CTOD toughness

### Welding positions



ISO/ASME

PA/1G

PB/2F

PC/2G

PG/3G down

PE/4G

PG/5G down

### Current type

DC -

### Approvals

BV	DNV	GL	TÜV
SA3YMH	IIYMSH15	3YH15S	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.07	0.9	0.20	0.005	0.003	0.85	1.0

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.29-98	min. 400	490-620	20	27
Typical values	AW	420	535	25	110

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)	
		1.7	2.0
Coils 14C	6.35	X	X
Coils 50C	22.68		X

Innershield® NR®-207: rev. EN 15



# Innershield® NR®-207

## Suggestions for use

High productivity welding

Where arctic mechanical properties are required in general construction welding

Semi-automatic pipe welding

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Fine grained steel	EN 10113-2	S275, S355
	EN 10113-3	S275, S355

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	70	180	175	17.5	1.4	1.27
		90	230	220	18.5	1.7	1.27
		130	250	260	19.5	2.5	1.27

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position			
		PA/1G PB/2F	PC/2G	PG/3G down PG/5G down	PE/4G
2.0	(cm/min.)	280	230	230	190
	(A)	240	220	220	185
	(V)	21	19	19	19

# Innershield® NR®-207-H

## Self-shielded cored wire

### Classification

AWS A5.29-98

: E71T8-K6

### General description

Self shielded: easiest equipment arrangement

Vertical down semi-automatic pipe welding

High quality construction welding in all positions

Good impact and CTOD toughness

Low hydrogen weld metal H

### Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G



PG/3G down



PE/4G



PG/5G down

### Current type

DC -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.07	0.9	0.20	0.005	0.003	0.85	1.0

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.29-98	min. 400	480-620	20	27
Typical values	AW	420	535	25	110

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm) 1.7
Coils 14C	6.35	X

Innershield® NR®-207-H: rev. EN 15

# Innershield® NR®-207-H

## Suggestions for use

Where low hydrogen weld metal is required

High productivity welding

Where arctic mechanical properties are required in general construction welding

Semi-automatic pipe welding

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36.
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10113-2 EN 10113-3	S275, S355 S275, S355

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed		Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
		inch/min	cm/min				
1.7	19	90	230	205	17.5	1.5	-
		105	270	220	18.5	1.8	-
		115	300	245	19.5	2.0	-

FCAW

# Innershield® NR®-208-H

## Self-shielded cored wire

### Classification

AWS A5.29-98 : E91T8-G

### General description

Self shielded: easiest equipment arrangement

Semi-automatic fill and cap pass welding of X-80 pipe steel in vertical down position

Excellent low temperature toughness

Low hydrogen (max. 8 ml/100 gr.)

### Welding positions



ISO/ASME PG/5G down

### Current type

DC -

### Approvals

TÜV

+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al	Ni
0.05	1.65	0.25	0.007	<0.003	0.85	0.8

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -30°C
Required:	AWS A5.29-98	min. 540	620-760	17	
Typical values	AW (1G)	585	650	26	115

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		1.7 2.0
Coils 14C	6.35	X X

Innershield® NR®-208-H: rev. EN 15

# Innershield® NR®-208-H

## Suggestions for use

Preheat and interpass temperature depending on steel quality

For root pass welding of X-60 to X-80 the Innershield NR-204-H electrode is recommended

## Materials to be welded

Steel	Code	Type
Pipe material	API5LX	X-60 tot X-80
	EN 10208-2	L 415, L445, L480, L550

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.7	19	60	150	145	15.5	1.0	-
		80	205	180	17.5	1.3	-
		105	270	215	18.5	1.8	-
		145	370	255	20.5	2.4	-

# Innershield® NR®-305

## Self-shielded cored wire

### Classification

AWS A5.20-95 : E70T-6

### General description

NR-305 is a self-shielded flux cored wire

Not intended for out-of-position welding, but can be used on 15° max. downhill and 5° max. uphill applications

High deposit rates and fast travel speed

Easy handling

Recommended for maximum productivity, downhand welding

### Welding positions



ISO/ASME

PA/1G

PB/2F

### Current type

DC +

### Approvals

ABS	BV	DB	DNV
2SA,2YSA	SA2YMH	+	IYMS

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.09	0.9	0.20	0.007	0.008	0.80

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -29°C
Required:	AWS A5.20-95	min. 400	480	22	27
Typical values	AW	470	550	25	40

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)		
		1.7	2.0	2.4
Coils 50C	22.68	X	X	X

Innershield® NR®-305: rev. EN 15

# Innershield® NR®-305

## Suggestions for use

Typical applications include bridge, ship, barge or offshore drilling rig construction and machinery, structural and general fabrication.

NR-305 can be used for single and multiple pass fillet and lap welds and for deep groove butt welds in the flat position.

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355
	EN 10113-3	S275, S355

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
1.7	12-25	510	275	24	3.75	1.22
		635	325	25	4.60	1.22
		890	390	27	6.35	1.22
2.0	19-25	510	360	22.5	4.50	1.22
		635	410	25	5.90	1.22
		1140	545	32.5	11.10	1.22
2.4	38-65	405	330	21	5.00	1.23
		610	425	24	7.55	1.23
		1015	525	33	12.70	1.23

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position	
		PA/1G	PB/2F
1.7	(cm/min.)	635	635
	(V)	25	25
2.0	(cm/min.)	890	635
	(V)	25	24
2.4	(cm/min.)	710	610
	(V)	27	24

# Innershield® NR®-311

## Self-shielded cored wire

### Classification

AWS A5.20-95 : E70T-7

### General description

**Self shielded:** easiest equipment arrangement

**Good penetration,** as in column butt welds and narrow gap welds

**Fast travel speed**

**High deposition rates**

### Welding positions



PA/1G



PB/2F



PC/2G



PG/3G down

ISO/ASME

### Current type

DC -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.27	0.40	0.08	0.007	0.005	1.5

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20-95	min. 400	480	22	not required
Typical values	AW	430	590	24	

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)	
		2.0	2.4
Coils 14C	6.35	X	
Coils 50C	22.68		X

Innershield® NR®-311: rev. EN 15



# Innershield® NR®-311

## Suggestions for use

Horizontal butt welds such as column structural connections

Fillet and lap welds in the flat horizontal and downhill positions

Deep groove welds. The penetration and extremely easy slag removal permit using a narrow gap and small bevel angle to minimize the total amount of weld metal needed to fill the joint.

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355, S420

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	32	100	255	190	21	2.2	1.28
		160	405	275	25	3.6	1.28
		300	760	4100	28	7.1	1.28

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/	Welding position			
	Current/ Voltage	PA/1G	PB/2F	PC/2G	PG/3G down
2.0	(cm/min.)	610	510	410	380
	(A)	355	320	280	260
	(V)	26	26	25	25

# Innershield® NR®-400

## Self-shielded cored wire

### Classification

AWS A5.29-98

: E71T8-K6

### General description

Self shielding: easiest equipment arrangement

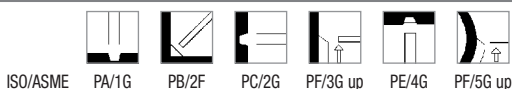
Higher strength level, overmatching StE 355

Excellent impact toughness at -40°C

CTOD tested, offshore constructions

All positions, all passes

### Welding positions



### Current type

DC -

### Approvals

BV	DB	FORCE	LR	TÜV
SA3YMH	+	+	3S,3YSH15	+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Cr	Al
0.06	0.74	0.17	0.004	0.002	0.75	0.13	0.74

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -60°C
Required:	AWS A5.29-98	min. 400	480-620	20	27
Typical values	AW	435	525	26	100

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm) 2.0
Coils 14C	6.35	X
Coils 50C	22.68	X

Innershield® NR®-400: rev. EN 15

# Innershield® NR®-400

## Suggestions for use

Off-shore oil equipment, piping, storage tanks  
General plate fabrication including bridge construction on ships and barges  
Circumferential groove welds for heavy wall, large diameter tubular construction

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36.
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360
	API 5LX	X42, X46, X52
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355
	EN 10113-3	S275, S355

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	60	150	16.5	1.20	1.37
		90	225	19.5	1.85	1.37
		110	265	20.5	2.35	1.37

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position			
		PA/1G PB/2F	PC/2G	PF/3G(up) PF/5G(up)	PE/4G
2.0	(cm/min.)	280	230	200	200
	(A)	265	225	190	190
	(V)	20	19	18	18

# Innershield® NR®-450-H

## Self-shielded cored wire

### Classification

AWS A5.29-98 : E71T8-Ni2 (also meets: E81T8-Ni2)

### General description

Self shielding: easiest equipment

Higher strength level, yield strength up to 450 N/mm

Excellent impact toughness at -40°C

CTOD tested, offshore constructions

### Welding positions



ISO/ASME PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

### Current type

DC -

### Approvals

ABS	GL	LR
3SA,3YSAH10	3YSH10	3S,3YSH10

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.07	0.26	0.06	0.004	0.002	2.44	0.88

### Mechanical properties, all weld metal

		Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -29°C	-40°C
Required:	AWS A5.29-98		min. 400	480-620	20	27	
Typical values			500	570	28	88	84

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm) 2.0
Coils 14C	6.35	X

Innershield® NR®-450-H: rev. EN 15

# Innershield® NR®-450-H

## Suggestions for use

Off-shore oil equipment, piping, storage tanks  
General plate fabrication including bridge construction on ships and barges  
Circumferential groove welds for heavy wall, large diameter tubular construction

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 t/m EH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360, L415, L445
	EN 10208-2	L240, L290, L360
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Boiler & pressure vessel steel	EN 10113-2	S275, S355, S420
Fine grained steel	EN 10113-3	S275, S355, S420

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed		Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	60	150	140	16.5	1.18	1.44
		90	230	200	19.5	1.90	1.51
		110	280	225	20.5	2.35	1.33

# Innershield® NR®-550-H

## Self-shielded cored wire

### Classification

AWS A5.29-98

: E81T8-Ni2 H8

### General description

Self shielding: easiest equipment

Higher strength level, yield strength up to 450 N/mm<sup>2</sup>

Excellent impact toughness at -40°C

CTOD tested, offshore constructions

### Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PF/3G up



PE/4G



PF/5G up

### Current type

DC -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.05	1.14	0.07	0.010	0.003	2.35	0.7

### Mechanical properties, all weld metal

		Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -18°C	-29°C
Required:	AWS A5.29-98		min. 400	480-620	20		27
Typical values			490	585	25	113	100

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		2.0
Coils 14C	6.35	X

Innershield® NR®-550-H: rev. EN 15

# Innershield® NR®-550-H

## Suggestions for use

Off-shore oil equipment, piping, storage tanks  
General plate fabrication including bridge construction on ships and barges  
Circumferential groove welds for heavy wall, large diameter tubular construction

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 t/m EH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360, L415, L445
	EN 10208-2	L240, L290, L360
	API 5LX	X42, X46, X52, X60
	EN 10216-1/	P235T1, P235T2, P275T1
	EN 10217-1	P275T2, P355N
Boiler & pressure vessel steel	EN 10028-2	P235GH, P265GH, P295GH, P355GH
Fine grained steel	EN 10113-2	S275, S355, S420
	EN 10113-3	S275, S355, S420

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	19	60	150	140	16.5	1.18	1.44
		90	230	200	19.5	1.90	1.51
		110	280	225	20.5	2.35	1.33

## Welding parameters, optimum fill passes

## Self-shielded cored wire

### Classification

AWS A5.20-95 : E70T-4

### General description

NS-3M is a self shielded wire for high deposition rate flat and horizontal welding where impact properties are not required

Recommended for heavy sections or crack-sensitive applications

Can be used for rail joint welding

### Welding positions



ISO/ASME PA/1G PB/2F

### Current type

DC +

### Approvals

DB

+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Al
0.23	0.45	0.26	0.006	0.006	1.40

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)
Required:	AWS A5.20-95	min. 400	480	22	not required
Typical values	AW	450	570	26	

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)		
		2.0	2.4	3.0
Coils 14C	6.35	X		
Spool 25RR	12.5	X		
Coils 50C	22.68	X	X	X

Innershield® NS®-3M: rev. EN 15



## Suggestions for use

Multi-pass fillet and lap welds

Single passes 4.5 to 9mm fillet and lap welds (1F)

Crack resistant fillets on higher strength steels where required joint strength can be obtained by using the proper fillet size

Joint welding of rail steel profiles with placed copperbacking.

## Materials to be welded

Steel	Code	Type
General structural steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36
Cast steel	EN 10213-2	GP240R
Pipe material	EN 10208-1	L210, L240, L290, L360
	EN 10208-2	L240, L290, L360, L415
	API 5LX	X42, X46, X52, X60
	EN 10216-1/ EN 10217-1	P235T1, P235T2, P275T1 P275T2, P355N
	EN 10113-2 EN 10113-3	S275, S355, S420 S275, S355, S420
Fine grained steel		
Railway		

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed inch/min	cm/min	Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
2.0	50	200	500	250	29	5.0	1.18
		250	635	290	30	6.3	1.18
		300	760	320	31	7.6	1.18
2.4	70	110	280	250	28	3.8	1.16
		230	580	400	31	8.1	1.16
		275	700	450	32	10.0	1.16
3.0	70	150	380	400	28	7.7	1.23
		175	450	450	29	9.0	1.23
		225	570	550	31	12.0	1.23
2.0	95	210	530	450	35	11.3	1.23
		355	900	600	38	17.9	1.23

## Welding parameters, optimum fill passes

Diameter (mm)	Wire feed speed/ Current/ Voltage	Welding position	
		PA/1G	PB/2F
2.0	(cm/min.)	635	635
	(A)	290	290
	(V)	30	30
2.4	(cm/min.)	580	580
	(A)	400	400
	(V)	31	31
3.0*	(cm/min.)	440	440
	(A)	445	445
	(V)	29	29
3.0**	(cm/min.)	760	
	(A)	550	
	(V)	37	

\* Stick-out 70mm

\*\* Stick-out 95mm

v wire feed speed

# Innershield® NR®-431

## Self-shielded cored wire

### Classification

AWS A5.26/26M-97 : EG72T-1

### General description

NR-431 is an Innershield consumable used for electrogas welding (EGW).

Vertishield is the Lincoln Electric name for its vertical-up, self-shielded, single pass electrogas arc welding process.

This process does not use an external shielding gas.

Vertishield welds are made by two methods: the consumable guide and the moving shoe process.

### Welding positions



ISO/ASME PF/3G up

### Current type

DC +

### Approvals

### Chemical composition (w%), typical, all weld metal

Chemistries of the welds will change with different heats of steel.

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -27°C	
Required:	AWS A5.26/26M-97		min. 345	483-655	22	20
Typical values						

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		2.4
Coils 50C	22.68	X

Innershield® NR®-431: rev. EN 15

# Innershield® NR®-431

## Suggestions for use

The moving shoe (dam) welding can be used with either a gapped V-groove or square butt plate.

Material from 9.5 to 100 mm plate thickness and unlimited length can be welded.

The consumable guide process is intended tot weld joints less than three feet long.

Copper retaining dams extend the full length of the joint.

## Materials to be welded

Steel	Code	Type
General structaral steel	EN 10025	S185, S235, S275, S355
Ship plates	ASTM A131	Grade A, B, D, AH32 to DH36

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed		Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
		inch/min	cm/min				
2.4	38	250	635	390-430	34	9	
		300	760	435-465	36	11	
		350	890	480-520	37	13	
		400	1020	530-570	39	15	

## Stainless rutile cored wire

### Classification

AWS A5.22-95 : E308LT0-1/-4  
EN 12073-99 : T 19 9 L R C/M 3

### General description

Gas shielded flux cored stainless steel wire electrode for welding in downhand position  
Stable arc, low spatter and good slag removal  
Excellent wire feeding and operator appeal  
Bright appearance of weld metal

### Welding positions



ISO/ASME PA/1G PB/2F

### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
100% CO<sub>2</sub> (EN 439: C1)  
15-25 l/min

### Approvals

Shielding gas	DNV	GL	LR	TÜV
M21	308LMS	4550S		+
C1	308LMS		304L	+

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	FN
M21/C1	0.03	1.5	0.6	20	10	8

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 320	min. 520 min. 510	min. 35 min. 30	
Typical values	M21/C1	AW	400	580	38	55

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
		1.2 1.6
Wire reel B202	5	X
Plastic spool S300	12.5	X X

Cor-A-Rosta 304L: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

# Cor-A-Rosta 304L

## Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNi 19 11		1.4306	(TP)304L CF-3	S30403 J92500
	X2 CrNiN 18 10		1.4311	(TP)304LN 302.304	S30453 S30400
Medium carbon C >0.03%	X4 CrNi 18 10		1.4301	(TP)304	S30409
		GX5 CrNi 19 10	1.4308	CF 8	J92600
Ti-, Nb- stabilized	X6 CrNiTi 18 10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6 CrNiNb 18 10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G
1.2	100-250	100-250	100-200
1.6	140-300	140-300	140-200

## Remarks/ Application advice

Use for positional welding: Cor-A-Rosta P304L

## Stainless rutile cored wire

### Classification

AWS A5.22-95 : E308LT-1/-4  
EN 12073-99 : T 19 9 L P C/M 2

### General description

Gas shielded flux cored stainless steel wire electrode  
Stable arc, low spatter and good slag removal  
Excellent wire feeding and operator appeal  
Bright appearance of weld metal

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
100% CO<sub>2</sub> (EN 439: C1)  
15-25 l/min

### Approvals

Shielding gas GL  
M21 4550S

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	FN
M21/C1	0.03	1.6	0.6	19.5	10	8

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 320	min. 520 min. 510	min. 35 min. 30	
Typical values	M21/C1	AW	390	570	45	50

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
Plastic spool S300	12.5	X

Cor-A-Rosta P304L: rev. EN 15

# Cor-A-Rosta P304L

## Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNi 19 11		1.4306	(TP)304L CF-3	S30403 J92500
	X2 CrNiN 18 10		1.4311	(TP)304LN 302.304	S30453 S30400
Medium carbon C >0.03%	X4 CrNi 18 10		1.4301	(TP)304	S30409
		GX5 CrNi 19 10	1.4308	CF 8	J92600
Ti-, Nb- stabilized	X6 CrNiTi 18 10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6 CrNiNb 18 10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5 CrNiNb 19 10	1.4552	CF-8C	J92710

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position	PA/1G	PB/2F	PC/2G	PF/3G up
Diameter (mm)	Current (A)			
1.2	100-250	100-250	100-200	100-180

## Remarks/ Application advice

Use for downhand welding: Cor-A-Rosta 304L

## Stainless rutile cored wire

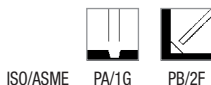
### Classification

AWS A5.22-95 : E347LT0-4  
EN 12073-99 : T 19 9 Nb R M 3

### General description

Rutile gas shielded stainless steel wire electrode for downhand welding  
For Ti or Nb stabilized 304 or equivalent steels  
Excellent resistance in oxidizing environments such as nitric acid  
High resistance to intergranular corrosion  
Easy slag release and smooth bead appearance

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Nb
M21	0.03	1.6	0.45	19.1	10.4	0.65

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 350	min. 520 min. 550	min. 30 min. 25	
Typical values	M21	AW	460	610	39	65

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
Plastic spool S300	12.5	X

Cor-A-Rosta 347: rev. EN 15



# Cor-A-Rosta 347

## Materials to be welded

Steel grades	EN 10088-1/-2	EN 10213-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Ti-, Nb- stabilized	X6 CrNiTi 18 10		1.4541	(TP)321 (TP)321H	S32100 S32109
	X6 CrNiNb 18 10		1.4550	(TP)347 (TP)347H	S34700 S34709
		GX5 CrNiNb 19-10	1.4552	CF-8C 302	J92710
	X4CrNi 18-10		1.4301	(TP)304	S30400
Non stabilized	X2CrNi 19-11		1.4306	(TP)304L	S30403
		GX5 CrNi 19-10	1.4308	CF-8	J92600
			1.4312		
				(TP)304H	S30409

## Welding parameters, optimum fill passes in shielding gas M21

Welding position	PA/1G	PB/2F	PC/2G
Diameter (mm)	Current (A)		
1.2	100-250	100-250	100-200

## Stainless rutile cored wire

### Classification

AWS A5.22-95 : E316LT0-1/ -4  
EN 12073-99 : T 19 12 3 L R C/M 3

### General description

Gas shielded flux cored stainless steel wire electrode  
Stable arc, low spatter and good slag removal  
Excellent wire feeding and operator appeal  
Bright appearance of weld metal

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
100% CO<sub>2</sub> (EN 439: C1)  
15-25 l/min

### Approvals

Shielding gas	BV	DNV	LR	TÜV
M21	316L	316LMS	316L	+
C1	316L	316LMS	316L	

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	FN
M21/C1	0.03	1.6	0.6	18.8	12.2	2.7	9

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 320	min. 485 min. 510	min. 30 min. 25	
Typical values	M21/C1	AW	410	560	39	44

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
		1.2 1.6
Plastic spool S300	12.5	X X

Cor-A-Rosta 316L: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

# Cor-A-Rosta 316L

## Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C<0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon C >0.03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
		GX5 CrNiMo 19-11	1.4408	CF 8M	J92900
Ti-, Nb- stabilized	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
		GX5 CrNiNb 19-10	1.4552	CF-8C	J92710

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position	PA/1G	PB/2F
Diameter (mm)	Current (A)	
1.2	100-250	100-250
1.6	140-300	140-300

## Remarks/ Application advice

Use for positional welding: Cor-A-Rosta P316L

## Stainless rutile cored wire

### Classification

AWS A5.22-95 : E316LT1-1/-4  
EN 12073-99 : T 19 12 3 L P C/M 2

### General description

Gas shielded flux cored stainless steel wire electrode  
Stable arc, low spatter and good slag removal  
Excellent wire feeding and operator appeal  
Bright appearance of weld metal

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
100% CO<sub>2</sub> (EN 439: C1)  
15-25 l/min

### Approvals

Shielding gas	DNV	GL	LR
M21	316LMS	4571S	316L
C1	316LMS		

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	FN
M21/C1	0.03	1.3	0.6	18.3	12.5	2.8	9

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 320	min. 485 min. 510	min. 30 min. 25	
Typical values	M21/C1	AW	415	560	41	45

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
		1.2
Plastic spool S200	5	X
Plastic spool S300	12.5	X

Cor-A-Rosta P316L: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

# Cor-A-Rosta P316L

## Materials to be welded

Steel grades	EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Extra low carbon C <0.03%	X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
	X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
	X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
	X2 CrNiMoN 17-13-3		1.4429		
Medium carbon C >0.03%	X4 CrNiMo 17-12-2		1.4401	(TP)316	S31600
	X4 CrNiMo 17-13-3		1.4436		
	X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
	X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640
Ti-, Nb- stabilized	X6 CrNiNb 18-10		1.4550	(TP)347	S34700
			1.4552	CF-8C	J92710
		GX5 CrNiNb 19-10			

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position	PA/1G	PB/2F	PC/2G	PF/3G up
Diameter (mm)	Current (A)			
1.2	100-250	100-250	100-200	100-200

## Remarks/ Application advice

Use for downhand welding: Cor-A-Rosta 316L

## Stainless rutile cored wire

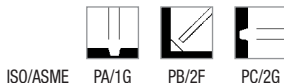
### Classification

AWS A5.22-95 : E309LT0-1/-4  
EN 12073-99 : T 23 12 L R C/M 3

### General description

Gas shielded flux cored high CrNi alloyed wire electrode for downhand welding  
For welding stainless to mild steel and buffer layers in clad steel  
Excellent weldability and slag release  
High resistance to embrittlement

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
100% CO<sub>2</sub> (EN 439: C1)  
15-25 l/min

### Approvals

Shielding gas	BV	DNV	GL	LR	TÜV
M21	309L	309LMS	4332S	SS/CMn	+
C1	309L	309LMS		SS/CMn	+

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	FN
M21/C1	0.03	1.4	0.6	24	12.6	15

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 320	min. 520 min. 510	min. 30 min. 25	
Typical values	M21/C1	AW	450	580	36	40

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
		1.2 1.6
Wire reel B202	5	X
Plastic spool S300	12.5	X X

Cor-A-Rosta 309L: rev. EN 15

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# Cor-A-Rosta 309L

## Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resisting	X2 CrNiN 18-10	1.4311	(TP)304LN	S30453
Cladsteel	X2 CrNi 19-11	1.4306	(TP)304L	S30403
			CF-3	J92500
	X4 CrNi 18-10	1.4301	(TP)304	S30400

- Dissimilar metals (mild and low alloyed steel to CrNi or CrNiMo stainless steel)
- Build-up welding on mild and low alloyed steel

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position Diameter (mm)	PA/1G Current (A)	PB/2F	PC/2G
1.2	100-250	100-250	100-200
1.6	140-300	140-300	140-200

## Remarks/ Application advice

Use for positional welding: Cor-A-Rosta P309L

## Stainless rutile cored wire

### Classification

AWS A5.22-95 : E309LT1-1/-4  
EN 12073-99 : T 23 12 L P C/M 2

### General description

Gasshielded flux cored high CrNi alloyed wire electrode for positional welding  
For welding stainless to mild steel and buffer layers in clad steel  
Excellent weldability and slag release  
High resistance to embrittlement

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
100% CO<sub>2</sub> (EN 439: C1)  
15-25 l/min

### Approvals

Shielding gas	DNV	GL	LR
M21	309L	4332S	SS/CMn
C1	309LMS		

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	FN
M21/C1	0.03	1.2	0.6	23.3	12.6	15

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 320	min. 520 min. 510	min. 30 min. 25	
Typical values	M21/C1	AW	430	565	38	45

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
		1.2
Plastic spool S200	5	X
Plastic spool S300	12.5	X

Cor-A-Rosta P309L: rev. EN 15



# Cor-A-Rosta P309L

## Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM/ACI A240/A312/A351	UNS
Corrosion resisting	X2 CrNiN 18-10	1.4311	(TP)304LN	S30453
Cladsteel	X2 CrNi 19-11	1.4306	(TP)304L CF-3	S30403 J92500
	X4 CrNi 18-10	1.4301	(TP)304	S30400

- Dissimilar metals (mild and low alloyed steel to CrNi or CrNiMo stainless steel)
- Build-up welding on mild and low alloyed steel

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position	PA/1G	PB/2F	PC/2G	PF/3G up
Diameter (mm)	Current (A)			
1.2	100-250	100-250	100-200	100-200

## Remarks/ Application advice

Use for downhand welding: Cor-A-Rosta 309L

# Cor-A-Rosta 309MoL

## Stainless rutile cored wire

### Classification

AWS A5.22-95 : E309LMoT0-1/-4  
EN 12073-99 : T 23 12 2 L R C/M 3

### General description

Gas shielded flux cored high CrNiMo alloyed wire electrode for downhand welding

High Corrosion resistant deposit

Specially developed for welding stainless steel to mild steel and buffer layers in cladding

max. plate thickness in butt welds ~ 12 mm

Suitable for repair welding in dissimilar joints and steels difficult to weld

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
100% CO<sub>2</sub> (EN 439: C1)  
15-25 l/min

### Approvals

Shielding gas	BV	DNV	LR	TÜV
M21		309MoLMS		+
C1	UP	309MoLMS	SS/CMn	+

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	FN
M21/C1	0.03	1.3	0.6	23.4	12.8	2.2	23

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 350	min. 520 min. 550	min. 25 min. 25	
Typical values	M21/C1	AW	545	695	29	40

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
		1.2 1.6
Plastic spool S300	12.5	X X

Cor-A-Rosta 309MoL: rev. EN 15

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# Cor-A-Rosta 309MoL

## Materials to be welded

EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
X2 CrNiMoN 17-13-3		1.4429		
X4 CrNiMo 17-13-3		1.4436		
X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
X10 CrNiMoTi 17-3		1.4573	316Ti	S31635
X6 CrNiMoNb 17-12-21.4580		316Cb		S31640

- Welding dissimilar metals: mild steel or low alloyed steel to stainless CrNi or CrNiMo-steel up to max. thickness of 12 mm.
- Build-up welding on mild or low alloyed steel

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position	PA/1G	PB/2F	PC/2G
Diameter (mm)	Current (A)		
1.2	100-250	100-250	100-200

## Remarks/ Application advice

Use for positional welding Cor-A-Rosta P309MoL

# Cor-A-Rosta P309MoL

## Stainless rutile cored wire

### Classification

AWS A5.22-95 : E309LMoT1-1/-4  
EN 12073-99 : T 23 12 2 L P C/M 2

### General description

Gas shielded flux cored high CrNi alloyed wire electrode for welding in position

High corrosion resistant deposit

Specially developed for welding stainless steel to mild steel and buffer layers in cladding  
max. plate thickness in butt welds ~ 12 mm.

Suitable for repair welding in dissimilar joints and steels difficult to weld

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
100% CO<sub>2</sub> (EN 439: C1)  
15-25 l/min

### Approvals

Shielding gas	BV	DNV	LR
M21	309LMo	309MoLMS	SS/CMn

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	FN
M21/C1	0.03	0.8	0.6	22.7	12.5	2.3	20

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 350	min. 520 min. 550	min. 25 min. 25	
Typical values	M21/C1	AW	525	675	34	45

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
Plastic spool S300	12.5	X

Cor-A-Rosta P309MoL: rev. EN 15

# Cor-A-Rosta P309MoL

## Materials to be welded

EN 10088-11-2	EN 102 13-4	W.Nr.	ASTM/ACI A240/A312/A351	UNS
X2 CrNiMo 17-12-2		1.4404	(TP)316L CF-3M	S31603 J92800
X2 CrNiMo 18-14-3		1.4435	(TP)316L	S31603
X2 CrNiMoN 17-11-2		1.4406	(TP)316LN	S31653
X2 CrNiMoN 17-13-3		1.4429		
X4 CrNiMo 17-13-3		1.4436		
X6 CrNiMoTi 17-12-2		1.4571	316Ti	S31635
X10 CrNiMoTi 17-3		1.4573	316Ti	S31635
X6 CrNiMoNb 17-12-2		1.4580	316Cb	S31640

- Welding dissimilar metals: mild steel or low alloyed steel to stainless CrNi or CrNiMo-steel up to max. thickness of 12 mm.
- Build-up welding on mild or low alloyed steel

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position	PA/1G	PB/2F	PC/2G	PF/3G up
Diameter (mm)	Current (A)			
1.2	100-250	100-250	100-200	100-200

## Remarks/ Application advice

Use for downhand welding Cor-A-Rosta 309MoL

## Stainless rutile cored wire

### Classification

AWS A5.22-95 : E2209T0-4  
EN 12073-99 : T 22 9 3 N L R M 3

### General description

Gas shielded flux cored wire electrode for duplex stainless steel welding in downhand position

Excellent weldability

Applicable up to a service temperature of 280°C

High resistance to general corrosion, pitting and stress corrosion conditions

High yield strength >500N/mm<sup>2</sup>

### Welding positions



ISO/ASME



PA/1G



PB/2F



PC/2G

### Current type/Shielding gas

Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

Shielding gas	DNV	TÜV
M21	+	+

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	N	FN
M21	0.03	0.9	0.6	22.9	9.3	3.4	0.14	40

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:	AWS A5.22-95 EN 12073-99		not required min. 450	min. 690 min. 550	min. 20 min. 20	
Typical values	M21	AW	665	825	29	38

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
Plastic spool S300	12.5	X

Cor-A-Rosta 4462: rev. EN 15

# Cor-A-Rosta 4462

## Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM / ACI A240	UNS
Duplex- stainless steels	X2 CrNiMoN 22 -5-3	1.4462		S31803
		1.4417		S31500
	X3 CrNiMoN 27-5-2	1.4460		S31200
	X2 CrNiN 23-4	1.4362		S32304

Dissimilar joints such as un- and low alloyed steel to duplex stainless steel

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position	PA/1G	PB/2F	PC/2G
Diameter (mm)	Current (A)		
1.2	100-250	100-250	100-200

## Remarks/ Application advice

Use for positional welding Cor-A-Rosta P4462

## Stainless rutile cored wire

### Classification

AWS A5.22-95 : E2209T1-4  
EN 12073-99 : T 22 9 3 N L P M 2

### General description

Gas shielded flux cored wire electrode for positional welding of duplex stainless steel

Excellent weldability

Applicable up to a service temperature of 280°C

High resistance to general corrosion, pitting and stress corrosion conditions

High yield strength >500N/mm<sup>2</sup>

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
15-25 l/min

### Approvals

Shielding gas DNV  
M21 +

### Chemical composition (w%) and Ferrite Number (FN), typical, all weld metal

Shielding gas	C	Mn	Si	Cr	Ni	Mo	N	FN
M21	0.03	0.7	0.6	22.9	9.2	3.4	0.14	40

### Mechanical properties, typical, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -20°C
Required:			not required	min. 690	min. 20	
	AWS A5.22-95		min. 450	min. 550	min. 20	
Typical values	EN 12073-99 M21	AW	660	830	29	40

### Packaging and available sizes

Unit	Net weight (kg)	Size (mm)
		1.2
Plastic spool S300	12.5	X

Cor-A-Rosta P4462: rev. EN 15

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# Cor-A-Rosta P4462

## Materials to be welded

Steel grades	EN 10088-11-2	W.Nr.	ASTM / ACI A240	UNS
Duplex- stainless steels	X2 CrNiMoN 22 -5-3	1.4462		S31803
		1.4417		S31500
	X3 CrNiMoN 27-5-2	1.4460		S31200
	X2 CrNiN 23-4	1.4362		S32304

Dissimilar joints such as un- and low alloyed steel to duplex stainless steel

## Welding parameters, optimum fill passes in shielding gas M21/C1

Welding position	PA/1G	PB/2F	PC/2G	PF/3G up
Diameter (mm)	Current (A)			
1.2	100-250	100-250	100-200	130-180

## Remarks/ Application advice

Use for downhand welding Cor-A-Rosta 4462

## Hardfacing cored wire

### Classification

DIN 8555-83 : MF1-GF-350-GPS

### General description

Lincore 33 is a self shielded, open arc, flux cored tubular electrode designed primarily for the build-up of steel parts or as a buttering layer prior to hardfacing. Arc characteristics are excellent producing a soft low penetration arc (ideal for build-up) that exhibits low spatter levels and excellent slag removal. Although, Lincore 33 is primarily designed for the open arc operation, it may be used under a neutral flux for conditions requiring spatter elimination and removal of arc glare

### Application

Lincore 33 produces a crack-free wear resistant deposit with a hardness range of 25-35 HRC depending on material dilution and number of layers. Designed primarily as a final overlay on steel parts which need to be machined or as a build-up layer of other hardfacing materials. It is particularly suitable of conditions of moderate abrasion and friction, coupled with resistance to impact such as applications involving rolling, sliding and metal to metal wear.

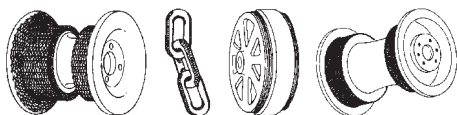
Typical applications include:

#### BUILD-UP:

Shovel and bucket lips  
Pump impellers and housings  
Dredge and shovel bucket teeth  
Mill and crushing hammers

#### HARDFACING:

Crane and mine car wheels  
Tractor rolls, idlers, links and sprockets  
Cable drums  
Shafts  
Roller guides



### Mechanical properties, all weld metal

#### Typical hardness values

Layer 1	21-30 HRC (230-290HB)
Layer 2	26-32 HRC (260-300HB)
Layer 3	25-35 HRC (250-330HB)

Welded on Mild Steel Plate (12mm)

### Packaging, available sizes and identification

Unit type	Net weight/unit (kg)	Diameter (mm)			
		1.1	1.6	2.0	2.8
Spool 14C	6.35			X	
Spool 22RR	10	X	X	X	
Spool 50C	22.68			X	X

Lincore® 33: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Additional information

All work-hardened base material should be removed prior to applying Lincore 33 to prevent embrittlement and cracking.

Preheat and postweld heat treatment is not generally necessary on C/Mn steels, however, preheat up to 260°C may be necessary on high carbon steels or large complex or restrained components.

The weld metal can be machined to exact dimensions using high speed or carbide cutting tools.

There is no limit to the deposit build-up with this electrode.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

## Chemical composition (w%) typical, all weld metal

C	Mn	Si	Cr	Al
0.14	2.2	0.55	1.3	1.8

## Structure

In the as welded condition the microstructure consists mainly of a mixture of ferrite and bainite

## Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (Amps)	Arc Voltage (volts)	Deposition Rate (kg/h)	Efficiency (%)
1.1	5.1 to 12.7	80-150	25-31	1.5-3.9	80-85
1.6	3.8 to 8.9	125-225	26-32	2.1-5.0	79-84
2.0	3.2 to 6.4	200-325	23-29	3.1-6.1	87-86

## Complementary products

Complementary products include Wearshield® BU30

## Hardfacing cored wire

### Classification

DIN 8555-83 : MF1-GF-400-GPS

### General description

Lincore 40-O is a self shielded, open arc, flux cored tubular electrode that produces a martensitic deposit. The arc characteristics are excellent producing minimal spatter and good slag removal. Although, Lincore 40-O is primarily designed for the open arc operation, it may be used with a neutral flux for conditions requiring spatter elimination and removal of arc glare.

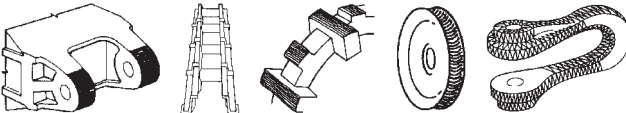
### Application

This electrode provides an overlay hardfacing deposit on carbon and low alloy steels that resists rolling, sliding and metal-to-metal wear under heavy impact conditions. The deposit has a hardness of about 40 HRC which fills in the rather large hardness gap between the ferritic bainite buildup deposit of Lincore 33 and the martensitic deposit from Lincore 55 designed for metal-to-metal wear. Although the electrode is designed to provide a hardfacing deposit by itself, it could be used as a build-up electrode to provide a base on which harder deposits could be overlaid.

Typical applications include:

Bucket links  
Bucket bases  
Guide rollers  
Tractor rollers

Actuating cams  
Steel shafts  
Crane wheels  
Mine car wheels



### Mechanical properties, all weld metal

Typical hardness values

Layer 1	ca. 36 HRC (340HB)
Layer 2	ca. 41 HRC (380HB)

### Packaging, available sizes and identification

Unit type	Net weight/unit (kg)	Diameter (mm)	
		2.0	2.8
Spool 22RR	10	X	
Spool 50C	22.68		X

Lincore® 40-O: rev. EN 15

## Additional information

The area to be hardfaced should be clean and free of rust, scale, oil, grease or dirt of any kind. Any previous hardfacing deposit that has been embrittled by severe work hardening should also be removed. Irregularities such as cracks, low spots etc. should be properly repaired before hardfacing. Cold parts should be preheated to at least 40°C. Larger parts, and those made of higher alloy or higher carbon steel, should be preheated to the 100-150°C range.

Lincore 40-O deposits normally have good resistance to cross-checking. Special precautions, however, should be taken with any buildup or hardfacing product on applications that are inherently crack sensitive. These applications include the facing of high carbon or alloy steels, previously faced parts and highly stressed parts. The facing of heavy cylinders, massive parts and parts having complex shapes are all examples of applications producing high internal stresses that may result in delayed cracking.

These applications may require one or more of the following:

1. Higher preheat temperature (150-260°C).
2. Higher interpass temperatures.
3. Controlled slow cooling between passes and/or layers

Interpass temperatures in the range of 150-200°C will not significantly affect the hardness of weld deposits produced by Lincore 40-O.

The weld deposited, can be machined with carbide tools or can be finished by grinding.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

## Chemical composition (w%) typical, all weld metal

C	Mn	Si	Cr	Mo	Al
0.2	1.5	0.7	3.5	0.4	1.8

## Structure

Martensitic

## Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (Amps)	Arc Voltage (volts)	Deposition Rate(kg/h)	Efficiency (%)
2.0	3.2 to 6.4	200-325	23-29	3.1-6.1	87-86

## Complementary products

Complementary products include Wearshield® MM40

## Hardfacing cored wire

### Classification

DIN 8555-83 : MF6-GF-50-GP

### General description

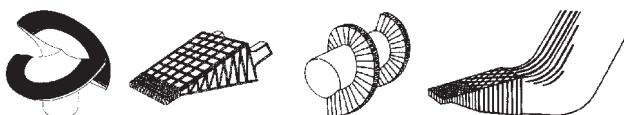
Lincore 50-O is a self shielded, open arc, flux cored tubular electrode that produces a primary austenite and austenite-carbide eutectic weld deposit. The arc characteristics are excellent producing minimal spatter and good slag removal. Although, Lincore 50 is primarily designed for the open arc operation, it may be used with a neutral flux for conditions requiring spatter elimination and removal of arc glare. The as welded deposit usually check cracks.

### Application

Lincore 50 produces an abrasion and impact resistant deposit with a hardness range of 34-56HRC depending on base metal chemistry, material dilution and number of layers. The combination of abrasion and impact resistance coupled with hot forging properties makes Lincore 50 particularly suitable for applications involving transportation of abrasive media under heavy variable loading.

Typical applications include:

- Dipper and dredge cutter teeth
- Rock crusher hammers and mill hammers
- Rock crushers and crusher mantles
- Screw flights
- Coal mining cutters
- Conveyor buckets and rolls
- Plough shares, scraper blades and cultivator sweeps
- Truck chain and gears
- Dragline buckets, links and chains



### Mechanical properties, all weld metal

	Typical hardness values
Layer 1	34-41 HRC (320-380HB)
Layer 2	44-53 HRC (415-530HB)
Layer 3	48-56 HRC (460-584HB)

Welded on Mild Steel Plate (12mm)

### Packaging, available sizes and identification

Unit type	Net weight/unit (kg)	Diameter (mm)			
		1.1	1.6	2.0	2.8
Wire reel 22RR	10			X	
Wire reel 22RR	11.34	X	X		
Wire reel 50C	22.68	X	X	X	X

Lincore® 50: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Additional information

All work-hardened base material and previously deposited hardfacing material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking. Areas that contain irregularities such as cracks and deep gouges can be repaired locally using Wearshield BU30 or Wearshield 15CrMn prior to hardfacing with Lincore 50.

Preheat is not necessary when surfacing austenitic substrates such as stainless steels and manganese steels, although the interpass temperature should be limited to about 260°C for manganese steels.

For low alloy and carbon carbon steels a preheat of 200°C is usually sufficient, but is dependent on material thickness and chemistry.

The weld metal is not machinable by conventional methods although the deposit can be shaped by grinding. Lincore 50 cannot be cut by the oxy-fuel processes. Plasma arc and air-carbon arc processes can be used to both cut an gouge the weld deposit. Preheat temperatures similar to those for welding may be necessary to prevent cracking along the cut edge.

Lincore 50 may also be used in corrosive, cavitation and erosion situations such as the chemical, paper mill, food processing industry, glass manufacturing, power generation and tool manufacturing.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

## Chemical composition (w%) typical, all weld metal

C	Mn	Si	Cr	Mo	Al
2.2	1.2	1.0	11.0	0.5	0.6

## Structure

In the as welded condition the microstructure consists mainly of primary austenite with an austenite-carbide eutectic

## Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (Amps)	Arc Voltage (volts)	Deposition Rate (kg/h)
1.1	5.1 to 15.2	120 - 250	20 - 28	1.9 - 5.8
1.6	3.8 to 8.9	175 - 365	23 - 33	2.7 - 7.9
2.0	3.2 to 6.4	210 - 380	27 - 23	3.4 - 6.8
2.8	2.0 to 3.3	315 - 450	26 - 29	3.9 - 6.4

## Complementary products

There is no direct equivalent to Lincore 50 although Wearshield® ABR and Wearshield® 44 are the nearest.

## Hardfacing cored wire

### Classification

DIN 8555-83 : MF2-GF-55-GP

### General description

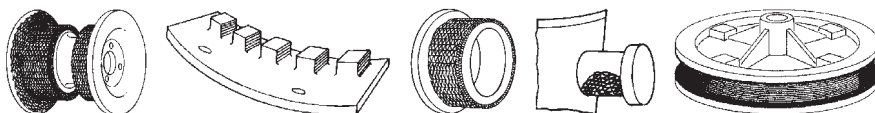
Lincore 55 is a self shielded, open arc, flux cored tubular electrode designed to provide a hardfacing overlay on new or old steel components. Although, Lincore 55 is primarily designed for the open arc operation, it may be used under a neutral flux for conditions requiring spatter elimination and removal of arc glare. A long stickout for maximum efficiency and minimum penetration.

### Application

Lincore 55 produces a martensitic and some retained austenite deposit with a hardness range of 50-59HRC. This microstructure makes Lincore 55 particularly suitable for applications involving sliding, rolling and metal to metal wear, coupled with resistance to mild abrasion. Typical applications include:

Typical applications include:

- Crane and mine car wheels
- Sprockets and gear teeth
- Skip guides
- Dredger buckets
- Scraper blades
- Transfer tables
- Cable sheaves



### Mechanical properties, all weld metal

#### Typical hardness values

Layer 1	50 - 59 HRC
Layer 2	50 - 59 HRC

Welded on Mild Steel Plate (12mm)

### Packaging, available sizes and identification

Unit type	Net weight/unit (KG)	Diameter (mm)		
		1.1	1.6	2.0
Wire reel 14C	6.35			X
Wire reel 22RR	10			X
Wire reel 22RR	11.34	X		
Wire reel 50C	22.68			X

Lincore® 55: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request



## Additional information

All work-hardened base material and previously deposited hardfacing material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking.

A preheat of up to 250°C is necessary to prevent cracking in situations of high restraint and/or heavy thicknesses. Interpass temperatures between 150 - 300°C do not adversely effect deposit hardness.

The deposit thickness is usually limited to 2 layers on high carbon or alloy steels and/or situations of high restraint and heavy sections due to the risk of cracking. Higher preheat and interpass temperatures coupled with slow cooling will minimise the risk of cracking.

The weld metal is not machinable by conventional methods although the deposit can be shaped by grinding.

The deposit can be softened by annealing at 875°C for one hour and slow cooling (air cool 22- 43HRc, furnace cool 15-17HRc). The hardness can be restored by heating at 875°C followed by water quenching (50-59HRc). The component should then be tempered at 150-200°C for one hour (54-59HRc) to retain some toughness.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

## Chemical composition (w%) typical, all weld metal

C	Mn	Si	Cr	Mo	Al
0.45	1.4	0.55	5.3	0.8	1.4

## Structure

In the as welded condition the microstructure consists mainly of martensite with some retained austenite

## Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (Amps)	Arc Voltage (volts)	Deposition Rate (kg/h)	Efficiency (%)
1.1	5.1 to 12.7	85 - 165	25 - 31	1.6 - 4.3	80 - 85
1.6	3.8 to 8.9	125 - 245	26 - 32	2.2 - 5.5	79 - 84
2.0	3.2 to 6.4	190 - 330	24 - 30	3.2 - 6.2	87 - 86

## Complementary products

Complementary products include Wearshield<sup>®</sup> MM and Wearshield<sup>®</sup> MI(e).

## Hardfacing cored wire

### Classification

DIN 8555-83 : MF10-GF-60-CG

### General description

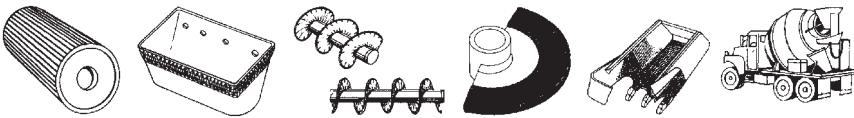
Lincore 60-O is a self shielded, open arc, flux cored tubular electrode that produces a primary carbide weld deposit. Although , designed primarily for the open arc process it can be used with a neutral flux to improve the weld shape, minimise fume and remove arc glare.

### Application

Lincore 60-O produces an primary carbide weld deposit with a hardness range of 55-60HRc. The primary carbide microstructure makes Lincore 60-O ideally suitable for applications of severe abrasion. Typical applications include:

Typical applications include:

Crusher rolls, plates and jaws  
Conveyor screws and sleeves  
Bucket and shovel lips  
Brick & coke machinery  
Cement mill parts



### Mechanical properties, all weld metal

	Typical hardness values
Layer 1	55 - 60 HRc
Layer 2	58 - 60 HRc

Welded on Mild Steel Plate (12mm)

### Packaging, available sizes and identification

Unit type	Net weight/unit (kg)	Diameter (mm)		
		1.1	1.6	2.0
Wire reel 22RR	10			X
Wire reel 22RR	11.34	X	X	
Wire reel 50C	22.68			X

Lincore® 60-O: rev. EN 15

## Additional information

When welding with Lincore 60-O stringer beads should be employed. Weaving is not advised since wide weaves generally increase the check crack spacing which can result in deposit spalling. Preheat is not necessary when surfacing austenitic substrates such as stainless steels and manganese steels, although the interpass temperature should be limited to about 260°C for manganese steels. For low alloy and high carbon steels a preheat of 200°C is necessary to prevent heat affected zone

Preheat is not necessary when surfacing austenitic substrates such as stainless steels and manganese steels, although the interpass temperature should be limited to about 260°C for manganese steels. For low alloy and high carbon steels a preheat of 200°C is necessary to prevent heat affected zone cracking.

The weld metal is not machinable or forgeable and it readily check cracks. The deposit thickness is usually limited to 2 layers, as excessive build-up will result in chipping and fragmentation.

For applications requiring build-ups in excess of 2 layers, buttering layers of Lincore 33, Wearshield BU30 or RepTec 126

Alternatively, a preheat of 650°C can be used to eliminate the formation of check cracks.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

## Chemical composition (w%) typical, all weld metal

C	Mn	Si	Cr	Al
4.2	1.6	1.3	25.4	0.6

## Structure

In the as welded condition the microstructure consists of primary carbides in an austenite - carbide eutectic matrix

## Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (Amps)	Arc Voltage (volts)	Deposition Rate (kg/h)
1.1	5.1 to 12.7	125 - 210	21 - 27	1.9 - 4.7
1.6	5.1 to 11.4	240 - 350	28 - 33	3.4 - 7.5
2.0	6.4 to 3.2	250 - 400	25 - 32	3.4 - 6.9

## Complementary products

Complementary products include Wearshield<sup>®</sup> 60

## Hardfacing cored wire

### Classification

DIN 8555-83 : MF4-GF-60-S

### General description

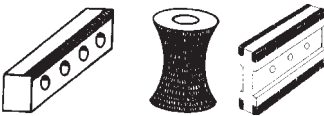
Lincore T&D is a self shielded, open arc, flux cored tubular electrode that produces a H12 type airhardening tool steel deposit. The arc characteristics are excellent producing minimal spatter and good slag removal. Although, Lincore T&D is primarily designed for the open arc operation, it may be used with a neutral flux for conditions requiring spatter elimination and removal of arc glare.

### Application

Lincore T&D produces a crack-free wear resistant tool steel deposit with a hardness range of 48- 55HRc. The hardness can be further increased to between 55-65HRc after tempering. It is particularly suitable for applications involving severe metal to metal wear coupled with elevated temperatures (up to 540°C). Ideally suited to the build up of worn steel dies, cutting tools or the application of wear resistant surfaces to carbon and low alloy steels.

Typical applications include:

Punch and forging dies  
Shear blades  
Trimmers  
Cutting tools



### Mechanical properties, all weld metal

#### Typical hardness values

As welded 48 - 55 HRc  
Tempered at 540°C 55 - 65 HRc

Welded on Mild Steel Plate (12mm)

### Packaging, available sizes and identification

Unit type	Net weight/unit (kg)	Diameter (mm)	
		1.6	2.8
Wire reel 22RR	10	X	
Wire reel 50C	22.68		X

Lincore® T&D: rev. EN 15

## Additional information

A preheat and interpass temperature of 325°C, or higher (up to 540°C), are necessary to avoid cracking. It is important to ensure that an adequate “soak” is achieved prior to the welding operation. After welding, the component should be covered and slow cooled down to room temperature. Once cooled, the weldment should be post weld heat treated to temper the martensite and toughen the deposit. Tempering at 540°C normally produces the optimum combination of hardness and toughness.

The weld metal is not machinable by conventional methods although the deposit can be shaped by grinding.

Annealing at 850°C for several hours and slow cooling will reduce the hardness to approximately 30HRC. This deposit can be readily machined. Rehardening is achieved by heating to about 1200°C for several hours to dissolve all carbides and homogenise the steel, followed by air cooling and tempering.

Lincore T&D cannot be cut by the oxy-fuel processes. Plasma arc and air-carbon arc processes can be used to both cut and gouge the weld deposit. Preheat temperatures similar to those for welding may be necessary to prevent cracking along the cut edge.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

## Chemical composition (w%) typical, all weld metal

C	Mn	Si	Cr	Mo	W	Al
0.65	1.5	0.8	7.0	1.4	1.6	1.8

## Structure

In the as welded condition the microstructure consists mainly of martensite with some carbides.

After tempering the microstructure consists of tempered martensite with secondary carbides

## Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (Amps)	Arc Voltage (volts)	Deposition Rate(kg/h)
1.6	3.8 to 8.9	170 - 300	22 - 26	2.4 - 5.4
2.8	2.5 to 5.1	340 - 500	26 - 30	4.7 - 9.1

## Complementary products

Complementary products include Wearshield® T&D

## Hardfacing cored wire

### Classification

DIN 8555-83 : MF7-GF-250-KP

### General description

Lincore 15CrMn is a self shielded, open arc, flux cored tubular electrode that exhibits excellent arc characteristics, clean slag detachability, and low spatter levels. Although, Lincore 15CrMn is primarily designed for the open arc operation, it may be used under neutral flux for conditions requiring spatter elimination and removal of arc glare.

### Application

Lincore 15CrMn produces a premium austenitic chromium-manganese deposit. The term premium is used because the weld metal has sufficient alloy content to produce a single pass austenitic deposit on ordinary carbon steel. The deposit rapidly work hardens under impact making it particularly suitable for applications of high impact and gouging coupled with moderate abrasion. In addition to surfacing, the high crack resistance of this alloy design makes Lincore 15CrMn an ideal electrode for joining manganese steel to itself or carbon steels with minimal the risk of centerline cracking. Joining by the SAW process, however, is not recommended.

Typical applications include:

Railroad frogs  
Track ends  
Crusher hammers and screens  
Earth moving equipment  
Rebuilding of austenitic manganese plates and components  
Construction equipment



### Mechanical properties, all weld metal

	Typical hardness values
As deposited	18 - 22 HRC (210-235 HB)
Work Hardened	40 - 50 HRC (375-490HB)

### Packaging, available sizes and identification

Unit type	Net weight/unit (kg)	Diameter (mm)	
		2.0	2.8
Wire reel 14C	6.35	X	
Wire reel 22RR	10	X	
Wire reel 50C	22.68	X	X

Lincore® 15CrMn: rev. EN 15

## Additional information

All work-hardened base material and previously deposited material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking. No preheat is required on austenitic manganese steels although a preheat of between 150-200°C may be necessary on carbon and low steels to prevent heat affected zone cracking.

Narrow stringer beads are preferred to avoid excessive heat build up in the base material. High heat input welds and interpass temperatures above 260°C causes manganese carbide precipitation resulting in embrittlement.

There is no definite limitation to the number of passes that may be deposited, however, it is good practise to peen each pass immediately after welding to minimise internal stresses and possible distortion and cracking.

Lincore 15CrMn deposits work harden rapidly making them difficult to machine. For best results carbide or ceramic cutting tools and rigid tooling should be used. Grinding can also be successfully employed.

For applications involving severe impact and abrasion, a build-up of Lincore 15CrMn coupled with a single pass of Wearshield 60 or Lincore 60-O should be employed.

The Lincore 15CrMn deposit can not be cut using the oxy-fuel process due to the high chromium content, however, plasma arc and air carbon arc processes are appropriate.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

## Chemical composition (w%) typical, all weld metal

C	Mn	Si	Cr
0.4	15.0	0.25	16.0

## Structure

In the as welded condition, the microstructure consists of a soft chromium manganese alloy austenite which rapidly work hardens under impact loading

## Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (Amps)	Arc Voltage (volts)	Deposition Rate (kg/h)
2.0	3.2 to 8.9	210 - 380	26 - 32	3.3 - 9.7
2.8	1.9 to 4.4	250 - 380	26 - 30	2.5 - 7.5

## Complementary products

Complementary products include Wearshield® 15CrMn

## Hardfacing cored wire

### Classification

DIN 8555-83 : MF6-GF-55-CGR

### General description

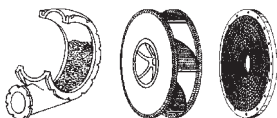
Lincore 420 is a self shielded, open arc, flux cored tubular electrode that produces a martensitic deposit similar to AISI 420 stainless steel. The arc characteristics are excellent producing minimal spatter and good slag removal.

### Application

Lincore 420 is martensitic stainless hardfacing electrode designed to provide overlay deposits that resists metal wear under corrosion.

Typical applications include:

Sand pumps  
Dredging equipment  
Fans  
Valve seats in steam and liquid pipes



### Mechanical properties, all weld metal

	Typical hardness values
Layer 1	52 HRc
Layer 2	51 HRc
Layer 3	53 HRc

Welded on Mild Steel Plate (12mm)

### Packaging, available sizes and identification

Unit type	Net weight/unit (kg)	Diameter (mm)		
		1.6	2.4	4.0
Spool S300	14	X		
Spool C435	24		X	
Speed-feed® drum	272.2			X

Lincore® 420: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request



## Additional information

All work-hardened base material and previously deposited hardfacing material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking.

Areas that contain irregularities such as cracks and deep gouges can be repaired locally using Wearshield® BU30 or Wearshield® 15CrMn prior to hardfacing with Lincore 420.

Preheat would be needed if the welding is done over either highly restrained material or martensitic stainless base metal.

A preheat and interpass temperature in the range of 200-300°C can be used depending on the nature of the material to be welded.

Under conditions of low dilution, the microstructure is similar to that of AISI 420 martensitic stainless steel. This structure provides good abrasion resistance under conditions of severe corrosion and high impact. At higher dilutions, when overlaid on mild steel or low alloy steel, the weld metal microstructure will retain its martensitic stainless structure. But the reduced chromium level might adversely affect the corrosion resistance of the deposit.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

## Chemical composition (w%) typical, all weld metal

ø1.6 mm	C	Mn	Si	Cr	ø2.0 mm	C	Mn	Si	Cr
	0.5	1.7	0.9	11		0.5	1.4	0.7	11

## Structure

Martensitic + ferritic

## Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (Amps)	Arc Voltage (volts)	Deposition Rate (kg/h)
1.1	5.1 to 15.2	120 - 250	20 - 28	1.9 - 5.8
1.6	3.8 to 8.9	175 - 365	23 - 33	2.7 - 7.9
2.0	3.2 to 6.4	210 - 380	27 - 23	3.4 - 6.8

## Complementary products

Complementary products include Wearshield® 420

Hardfacing cored wire

Classification

DIN 8555-83 : MF6-GF-45-KP

General description

Lincore M is a selfshielded, open arc, flux cored tubular electrode  
Deposition of austenitic manganese steel with 14% manganese

Application

Lincore M is designed for rebuilding and hardfacing of manganese steel, carbon steel and low alloy steel parts  
Typical applications include: Rail crossovers, frogs and switchpoints

Typical applications include:

- Rail crossovers, frogs and switchpoints

Dipper teeth and lips

Crusher hammers

Crushers screens and grizzlies

Chain hooks

Dredge parts, pump shells

Parts for safes and vaults
- Manganese bucket fronts

Crusher rolls

Dragline pins and links

Rolling mill parts

Drive sprockets

Shovel tracks

Mechanical properties, all weld metal

	Typical hardness values
As deposited	18-28 Rc
Work Hardened	30-48 Rc

Packaging, available sizes and indentification

Unit type	Net weight/unit (kg)	Diameter (mm) 2.0
Spool 22RR	10	X

Lincore® M: rev. EN 15

## Additional information

All work-hardened base material and previously deposited material should be removed prior to applying a new deposit, since such areas are prone to embrittlement and possible cracking.

No preheat is required on austenitic manganese steels although a preheat of between 150-200°C may be necessary on carbon and low steels to prevent heat affected zone cracking.

Narrow stringer beads are preferred to avoid excessive heat build up in the base material. High heat input welds and interpass temperatures above 260°C causes manganese carbide precipitation resulting in embrittlement.

There is no definite limitation to the number of passes that may be deposited, however, it is good practise to peen each pass immediately after welding to minimise internal stresses and possible distortion and cracking.

Lincore M deposits work harden rapidly making them difficult to machine. For best results carbide or ceramic cutting tools and rigid tooling should be used. Grinding can also be successfully employed.

First layers on mild and low alloy steel can be welded with RepTec 126, Lincore M can be used to complete the build up.

## Welding positions



ISO/ASME PA/1G

## Current type

DC +

## Chemical composition (w%) typical, all weld metal

C	Mn	Si	Cr	Ni
0.6	13.0	0.4	4.9	0.5

## Structure

Martensitic + ferritic

## Calculation Data

Diameter (mm)	Wire Feed Speed (m/min)	Current (Amps)	Arc Voltage (volts)	Deposition Rate (kg/h)
2.0	3.2 to 6.4	240 - 360	24 - 29	2.9 - 6.2

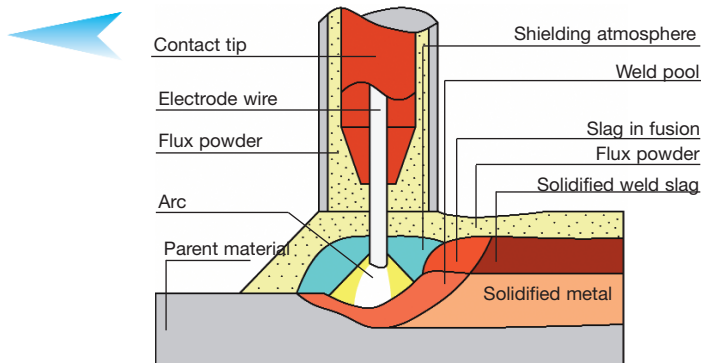
## Complementary products

Complementary products include Wearshield® Mangjet (e)

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# Subarc Process

Welding direction



*The mechanics of the Submerged Arc Welding process (SAW): Both the electrode and the base metal are melted beneath a layer of flux. This layer protects the weld metal from contamination and concentrates the heat into the joint. The molten flux rises through the pool, deoxidising and cleaning the molten metal. It then forms a protective slag covering and maintaining the newly deposited weld.*

*The range of applications can be anything from 2 mm increasing with no upper limit. Subarc is one of the most versatile of welding processes. All steel grades, from non to high alloyed, including Ni-based, can be welded with a combination of various application techniques.*

*Ranging from a single electrode-single power source to a combination of four power sources feeding two wires each, Lincoln is proud to offer an extensive range of application solutions to the market.*

*As a global supplier, including equipment and consumables, Lincoln's knowledge in the SAW process will support you in reaching the toughest productivity and quality targets.*

## Flux

### Classification

Flux 761	EN 760:	A CS/MS 1 88 AC H5	
Flux/wire	AWS A5.17 / A5.23	EN 756 : MR	EN 756 : TR
761 / L60	F7A2-EL12	S 38 2 MS S1	
761 / L61	F7A2-EM12K	S 42 2 MS S2Si	S 4T 0 MS S2Si
761 / L70 (LNS140A)	F9A0-EA1-G	S 50 0 MS S2Mo	S 4T 2 MS S2Mo

### General description

High current capacity

Active flux for limited pass welding

High restraint cracking resistant

Suitable for rusty/dirty plates (at high current)

Applicable for low quality steels

Note: Use another flux for thin plates and multi-pass welding of thick plates (without particular caution)

### Approvals

Wire grade	ABS	BV	CRS	CTL	DB	DNV	PRS	GL	LR	RINA	RMRS	TÜV	UDT
L-60					X							X	X
L-61	X		X	X		X	X	X	X	X	X	X	X
L-70 (LNS 140A)	X	X		X		X	X	X	X	X	X	X	

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	P	S	Mo
L61	0.05	1.8	0.9	<0,03	<0,025	
L70 (LNS 140A)	0.05	1.6	0.65	<0,03	<0,025	0.4

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J)	
				0°C	-20°C
L60	MR	380	500	80	50
L61	MR	440	530	100	50
	TR	>420	>520	50	
L70 (LNS 140A)	MR	480	600	80	40
	TR	>420	>520	100	50

MR : multi run

TR : two run

## Suggestions for use

Wire	Characteristics	Applications
L60	Lowest cost combination	Flat fillet, large throat
L61	Reliable properties	Butt joints in two passes, in medium and thick plates
L70	For good impact toughness as welded TR could be selected	Flux backing, modified series arc-welding
		Low quality steels

## Materials to be welded

	MR L60	L61	L70 / LNS 140A	TR L60	L61	L70 / LNS 140A
A to D, A (H) 32 to D(H) 36	x	x				x
A 32 to AH36	x	x	x	x	x	x
500 A						x
S275 to S420, N,M	x	x				x
S315 to S420, MC	x	x	x	x	x	x
S315 to S420, NC	x	x				x
S460, MC & NC						x
S185 to S355, E295 to E360, JR(G1 & G2), JO	x	x	x	x	x	x
S185 to S355, E295 to E360, J2 (G3&G4)	x	x				x
P235 to P420, GH	x	x	x	x	x	x
P235 to P420, GH N, NH, M, Q & QH	x	x				x
P235 to P460, GH, N, NH, M, Q & QH	x	x				x
P500, GH, N, NH, M, Q & QH						x
P235 S, P265 S	x	x				x
A37 to A52, CP	x	x	x	x	x	x
A37 to A52, CP, AP	x	x				x

## Flux characteristics

Max current, one wire (A)	800
Current type	DC (+, -) / AC
Basicity (Boniszewski)	1
Solidification speed	Low, slag vicious
Density (kg/dm3)	1.2
Grain	1 - 16

## Packaging

Unit	Net weight (kg)
Bag	25
Steel drum	250
Big Bag	1000

## Flux

### Classification

Flux 780	EN 760:	A AR/AB1 78 AC H5	
Flux/Wire	AWS A5.17/A5.23	EN 756 : MR	EN 756 : TR
780 / L60	F7A0-EL12	S 42 0 AR/AB S1	S 4T 0 AR/AB S1
780 / L61	F7A2-EM12K	S46 0 AR/AB S2Si	S 4T 0 AR/AB S2Si
780 / L70 (LNS140A)	F8A2-EA1-A2		S 4T 2 AR/AB S2Mo

### General description

Active flux for limited pass welding

Good general purpose flux, including semi-automatic

High speed on dirty plate

Good resistance to porosity on rust and primer

Good slag removal, good bead shape

Note: Use another flux for thick plates and multi-pass welding of thick plates (without particular caution) and for low quality steel

### Approvals

Wire grade	BV	ABS	LR	DNV	GL	CTL	RINA	RMRS	CRS	TUV	DB	DWI	UDT
L60	x	x	x	x	x	x				x	x	x	x
L61	x		x	x	x	x	x	x	x	x	x		x
L70 (LNS 140A)			x							x	x		x

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	P	S	Mo
L-60	0.07	1.5	0.6	<0,030	<0,025	
L-61	0.07	1.6	0.7	<0,030	<0,025	
L-70 (LNS140A)	0.07	1.6	0.6	<0,030	<0,025	0.4

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J)	
				0 °C	-20°C
L60	MR	400	510	50	
L61	TR	> 420	> 520	50	
L70 (LNS140A)	TR	> 420	> 520		50

MR : multi run

TR : two run



## Suggestions for use

Wire	Characteristics	Applications
L60	Lowest cost combination	Can be used in multipass: with low silicon wires on plates < 25mm with low voltage
L61	Reliable properties	
L70 (LNS140A)	For good impact toughness as welded TR could be selected	

## Materials to be welded

	MR L60	L61	L70 / LNS 140A	TR L60	L61	L70 / LNS 140A
A to D, A (H) 32 to D(H) 36	x	x				x
A 32 to AH36	x	x	x	x	x	x
500 A						x
S275 to S420 N,M	x	x				x
S315 to S420 MC	x	x	x	x	x	x
S315 to S420 NC	x	x				x
S460 MC & NC						x
S185 to S355, E295 to E360 JR(G1 & G2), JO	x	x	x	x	x	x
S185 to S355, E295 to E360 J2 (G3&G4)	x	x				x
P235 to P420 GH	x	x	x	x	x	x
P235 to P420 GH N, NH, M, Q & QH	x	x				x
P235 to P460 GH, N, NH, M, Q & QH	x	x				x
P500 GH, N, NH, M, Q & QH						x
P235 S, P265 S	x	x				x
A37 to A52 CP	x	x	x	x	x	x
A37 to A52 CP, AP	x	x				x

## Flux characteristics

Max current, one wire (A)	800
Current type	DC (+, -) / AC
Basicity (Boniszewski)	0.7
Solidification speed	high
Density (kg/dm3)	1.4
Grain	1 - 20

## Packaging

Unit	Net weight (kg)
Bag	25
Steel drum	250
Big Bag	1000

## Flux

### Classification

Flux 781	EN 760:	A ZS1 87 AC H5	
Flux/Wire	AWS A5.17 / A5.23	EN 756 : MR	EN 756 : TR
781 / L61	F7A0-EM12K		S 4T 2 ZS S2Si
781 / L50M (LNS133U)			S 4T 2 ZS S3Si
781 / L70 (LNS140A)			S 4T 2 ZS S2Mo

### General description

Active flux for limited pass welding  
High speed on sheet metal  
Good impact in two-pass technique

### Approvals

Wire grade	BV	ABS	LR	DNV	RINA	TUV	UDT
L61						x	x
L50M (LNS133U)	x	x	x	x	x		x

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	P	S	Mo
L61	0.05	1.3	0.9	0.03	0.02	
L50M (LNS133U)	0.06	1.6	1	0.03	0.02	
L70 (LNS140A)	0.06	1.3	0.9	0.03	0.02	0.4

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J) -20°C
L61	TR	> 420	> 520	50
L50M (LNS133U)	TR	> 420	> 520	50
L70 (LNS140A)	TR	> 420	> 520	50

MR : multi run  
TR : two run

## Suggestions for use

Wire	Characteristics	Applications
L61	high speed on clean plate	Mainly single pass or limited pass
L50M (LNS133U)	very high speeds	High speed on clean plate (tandem up to 12mm thickness)
L70 (LNS140A)	good impact	Good impact with single pass and two run with wire L-70

## Materials to be welded

	L61	L50M (LNS133U)	L70 (LNS140A)
A to D, AH32 to DH40	x	x	x
A to E, AH32 to EH40			x
500 & 550 A	x	x	x
500 & 550 A & AL			x
S275 to S460 N/M	x	x	x
S275 to S460 all qualities			x
S315 to S600 MC & NC	x	x	x
S185 to S360 all qualities	x	x	x
P235 to P460 (GH, N NH, M, ML1)	x	x	x
P235 to P460 all qualities			x
P235 to P275 S	x	x	x
A37 to A52 (CP, AP)	x	x	x
A37 to A52 (CP, AP, FP)			x

## Flux characteristics

Max current, one wire (A)	700
Current type	DC (+,-) / AC
Basicity (Boniszewski)	0.7
Solidification speed	fast, very fluid slag
Density (kg/dm <sup>3</sup> )	1.5
Grain	1 - 16

## Packaging

Unit	Net weight (kg)
Bag	25
Steel drum	250

## Flux

### Classification

Flux 782	EN 760 :	A AR/AB 98 AC H5	
Flux/wire	AWS A5.17 / A5.23	EN 756 : TR	EN 756 : MR
782 / LNS135	F7AZ-EM12	S 4T Z AR/AB S2	
782 / L61	F7AZ-EM12K	S 4T 0 AR/AB S2Si	S 46 0 AR/AB S2Si
782 / L60		S 4T A AR/AB S1	S 42 A AR/AB S1
782 / L50M		S 5T 2 AR/AB S3Si	S 50 0 AR/AB S3Si
782 LNS 140A		S 5T 2 AR/AB S2Mo	S 46 0 AR/AB S2Mo

### General description

Active flux for limited pass welding  
 Good bead shape with optimum wetting  
 High speed on thin plates  
 Mono & multi-electrode welding

### Approvals

Wire grade	BV	ABS	LRS	DNV	RINA
L50M (LNS133U)3YT+		4Y400T	4YT	4Y40T	3YT

### Chemical composition (w%), typical, all weld metal

Lincoln wire	C	Mn	Si	P	S	Mo
LNS135	0.07	1.15	0.7	<0.030	<0.025	-
L61	0.07	1.15	0.8	<0.030	<0.025	-
L60	0.07	1	0.6	<0.030	<0.025	-
L50M (LNS133U)	0.06	1.7	1	<0.030	<0.025	-
L70 (LNS140A)	0.07	1.2	0.7	<0.030	<0.025	0.4

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )
LNS135	TR	> 520	
L60	TR	> 520	40J to 0°C
L61	TR	> 520	50J to 0°C
L50M (LNS133U)	TR	>600	55J to -20°C
L70 (LNS140A)	TR	>600	63J to -20°C

\* TR : thickness 20, S355 plate grade

FX 782: rev. EN 15

## Suggestions for use

Wire	Characteristics :	Applications
LNS135	Lowest cost combination	Fillet weld, lap joint
L61	Excellent properties	- truck wheels
L50M	very high speeds	- gas bottles
		- Tube to fin fillet weld
		- Boiler tubes

## Materials to be welded

	LNS135	L50M (LNS133U)	L61	L70 (LNS140A)
A, AH32 to AH40		X	X	
S315 à S460 MC	X	X	X	
S185 à S355 JR quality(G1 & G2)	X	X	X	
S185 à S355 JR quality((G1 & G2), JO		X	X	
E295 à E360	X	X	X	
P235 to 275 GH		X	X	
P355 to P460 M		X	X	
A37 to A52 CP		X	X	
15Mo3,16Mo3,17Mo3,14Mo6				X

## Flux characteristics

Max current, one wire (A)	800
Current type	DC (+,-) / AC
Basicity (Boniszewski)	0.4
Solidification speed	high speed
Density (kg/dm3)	1.4
Grain	1 - 1,6

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux 8500	EN 760 :	A FB1 54 AC H5	
Flux/wire	AWS A5.17 & A5.23	EN756 MR	EN756 TR
8500 / L61	F7A6-EM12K	S 38 4 FB S2Si	S 4T 0 FB S2Si
8500 / L50M (LNS133U)	F7A6-EH12K	S 42 6 FB S3Si	S 4T 2 FB S3Si
8500 / L70 (LNS140A)	F8A6-EA1-A2	S 46 4 FB S2Mo	S 4T 4 FB S2Mo
8500 / LNS140TB			S 4T 4 FB S0

### General description

**Basic flux designed for the welding of carbon and low alloy steels**

**Excellent welding characteristics over a wide range of welding procedures**

**Superior mechanical properties**

- Readily meets impact requirements at -50°C
- Impact properties are consistent throughout the weld joint, including the cap location
- Excellent CTOD values

### Approvals

Wire grade	BV	ABS	LR	DNV	GL	RINA	UDT
L61			x				
L50M (LNS133U)	x	x	x	x			x
L70 (LNS 140A)		x			x	x	
LNS140TB	x						

### Chemical composition (w%), typical, all weld metal

Lincoln wire	C	Mn	Si	P	S	Mo	B	Ti
L61	0.07	0.9	0.2	0.03	0.025			
L50M (LNS133U)	0.07	1.4	0.3	0.03	0.025			
L70 (LNS140A)	0.07	0.9	0.1	0.03	0.025	0.4		
LNS 140TB	0.06	1.2	0.2	0.03	0.025	0.4	0.005	0.02

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J)		
				-20°C	-40°C	-60°C
L61	MR	430	510	150	100	
L50M (LNS133U)	MR	440	540		140	
	TR	> 420	> 520	100		
L70 (LNS140A)	MR	440	540		100	50
	TR	> 420	> 520		100	
LNS140TB	TR	> 420	> 520			

MR : multi run

TR : two run

FX 8500: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Suggestions for use

Characteristics :	Applications
Off-shore and on-shore applications	Suitable for semi narrow gap welding
Nuclear components	Low temp. equipment
High purity weld metal and high toughness	Highly restraint constructions
Long stick-out welding	Single- and multi-wire systems

## Materials to be welded

	MR	TR		
	L61	L50M (LNS133U)L70	(LNS140A)	LNS140TB
A to E	x	x	x	x
AH 32 to FH40	x	x	x	x
500 all qualities				x
S275 to S420 all qualities	x	x	x	x
S460 all qualities			x	x
S315 to S420 all qualities	x	x	x	x
S460 to S650 all qualities				x
S185 to S355 all qualities	x	x	x	x
E295	x	x	x	x
E335 & E360				x
P235 to P420 all qualities	x	x	x	x
P460 all qualities				x
P235 to P275 all qualities	x	x	x	x
A37 to A52 all qualities	x	x	x	x

## Flux characteristics

Max current, one wire (A)	800
Current type	DC (+, -) / AC
Basicity (Boniszewski)	2.8
Solidification speed	neutral
Density (kg/dm <sup>3</sup> )	1.3
Grain	2 - 20

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux 860	EN 760 :	A AB1 56 AC H5	
Flux/wire	AWS A5.17 & A5.23	EN756 : TR	EN756 : 2 passes
860 / L60	F6A2-EL12	S 35 2 AB S1	
860 / LNS135	F6A2-EM12	S 35 2 AB S2	S 3T 0 AB S2
860 / L61	F7A2-EM12K	S 38 2 AB S2Si	S 3T 0 AB S2Si
860 / L70 (LNS140A)	F7A2-EA1-A2	S 42 2 AB S2Mo	S 4T 2 AB S2Mo

### General description

**Multi purpose neutral agglomerated flux**  
**Good impact values in both multi-run (with L60/L61/L50M)**  
**and two-run (with wire L-70) technique**  
**High restraint cracking resistant**  
**Very good results in multi-run with flux cored wire LNS T55**

### Approvals

Wire grade	LR	BV	ABS	DNV	GL	Controlas	TUV	DB	UDT	DWI	RMRS	RINA
L60							X		X			
LNS 135	X			X	X		X	X	X			
L61	X	X	X	X	X	X	X	X	X	X	X	X
L50M (LNS133U)		X				X			X			
L70 (LNS 140A)	X	X		X	X		X		X			

### Chemical composition (w%), typical, all weld metal

Lincoln wire	C	Mn	Si	P	S	Mo
L60	0.05	1.0	0.2	<0.030	<0.020	
LNS135	0.06	1.3	0.25	<0.030	<0.020	
L61	0.07	1.3	0.4	<0.030	<0.020	
L50M (LNS133U)	0.07	1.7	0.5	<0.030	<0.020	
L70 (LNS140A)	0.07	1.3	0.25	<0.030	<0.020	0.4

### Mechanical properties, all weld metal

Wire grade	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J)	
			0°C	-20°C
L60	360	480	80	50
LNS135	390	490	100	50
L61	430	510	100	50
L50M (LNS133U)	460	530	120	80
L70 (LNS140A)	520	570	80	50

FX 860: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request



## Suggestions for use

Wire	Characteristics :
L60 & LNS135	Low yield strength steel
L61	Yield strength steel
L50M (LNS133U)	Yield strength steel < 460 N/mm <sup>2</sup> and good impact toughness at -20 °C
LNS 140A (L-70)	High yield strength steel and good impact toughness in two run applications

## Materials to be welded

	L61	L50M (LNS133U)
A to E	x	x
AH 32 to DH32	x	x
AH 36 to DH36		x
AH 40 to DH40		
S275&S355 (N & M)	x	x
S275&S355 (N & M)	x	x
S275 to S420N		
S275 to S420 M		
S275 to S460N		
S275 to S460 M		
S315 & S355 MC & NC	x	x
S315 & S355 MC & NC	x	x
S315 to S420 MC & NC		
S315 to S460 MC & NC		
S315 to S500 MC & NC		
S185 & S275 JR(G1 & G2), JO, J2 (G3&G4)	x	x
S185 to S355 JR(G1 & G2), JO, J2 (G3&G4)		
E295		x
P235 to 275 GH, NH & NH1	x	x
P235 to P355 GH, NH , NH1& M		x
P355 to P420 M		
P355 to P460 M		
P235 S & P265 S	x	x
A37 to A48 CP, AP	x	x
A37 to A52 CP, AP		

## Flux characteristics

Max current, one wire (A)	700
Current type	DC (+,-) / AC
Basicity (Boniszewski)	1.1
Solidification speed	high
Density (kg/dm3)	1.4
Grain	1 - 16

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux 888	EN760 :	S A FB 1 66 AC H5
Wire	AWS A5.17-97/A5.23-97	EN756-95:MR
888 / L61 (LNS129)	F7A8-EM12K	S 38 6 FB S2Si
888 / L50M	F7A8/F6P8-EH12K	S 42 6 FB S3Si
888 / LNS164	F10A4EF1*-EF3	S 50 4 FB S3NiMo
888 / LNS165	F8A6/F7P8-ENi5-Ni5	S 50 4 FB S0
888 / LA92	F9A4/F7P6-EB2-B2	S 50 2 FB CrMo1
888 / LA93	F8P6-EB3-B3	
888 / LA100	F10A6/F10P2-EM2-M2	S 50 4 FB S3Ni1,5Mo

### General description

Basic flux designed for the welding of carbon and low alloyed steels  
 Easier slag removal in deep groove  
 Robust mechanical properties  
 Suited for step cooling applications  
 H4 hydrogen level as per AWS A4.3-93

### Chemical composition (w%), typical, all weld metal

Wire grade	C	MN	Si	P	S	Ni	Mo	Cr	Bruscati factor
L61	0.08	1.05	0.37	<0,02	<0,015				
L50M (LNS133U)	0.07	1.46	0.54	<0,02	<0,015				
LNS164	0,08	1,7	0,5	<0,02	<0,010	0,90	0,5		
LNS165	0.06	1.47	0.49	<0,02	<0,015	0.97	0.2		
LA92	0.069	0.91	0.49	<0,02	<0,010		0.56	1.34	<1,1
LA93	0.062	0.86	0.31	<0,02	<0,010		0.93	2.15	<1,1
LA100	0.06	1.62	0.7	<0,02	<0,010	1.8	0.42	0.08	

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -30°C	-40°C	-50°C	-60°C
L61	AW	415	515	31		180		125
L50M (LNS133U)	AW	480	580	29				80
	SR	430	550	31		150		130
LS164	AW	650	750	21		65		30
	SR	630	720	23	60			
LNS165	AW	530	620	26		60		40
	SR	495	595	27				70
LA92	AW	600	700	24		47	30	
	SR	500	605	26		150	117	113
LA93	SR	530	645	23		125	70	50
LA100	AW	680	760	25		85	60	
	SR	680	750	25	52	50	30	

FX 888: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Suggestions for use

Applications  
Boiler and pressure vessel  
Offshore application  
Wind towers  
Shipbuildings  
Structural fabrication

## Materials to be welded

	L61 AW - MR60°	L50M (LNS133U) AW - MR60°	SR - MR60°	LNS164 AW - MR40°	LNS165 AW - MR60°	SR - MR60°	LA100 AW - MR40°	SR - MR20°
A to E	X	X	X					
AH 32, DH36, H(36)	X	X	X					
S185, S235S, S275	X	X	X					
S355	X	X	X	X	X	X		
GP240R	X	X	X					
L210, L240, L290	X	X	X					
L360	X	X	X	X	X	X		
L415		X		X	X	X		
L445, L480				X	X	X		
X42, X46	X	X	X					
X52	X	X	X	X	X	X		
X56, X60		X		X	X	X		
X65, X70				X	X	X		
X42	X	X	X					
X52	X	X	X	X	X	X		
X63		X		X	X	X		
P235, P275	X	X	X					
P355	X	X	X	X	X			
P235GH, P265GH	X	X	X					
P295GH	X	X	X					
S275	X	X	X					
S355	X	X	X	X	X	X		
S420		X		X	X	X		
S460				X	X	X		
16 Mo 3					X	X	X	X
S460, S500				X	X	X		
11MnNi5-3					X	X	X	X
13MnNi6-3								

## Flux characteristics

Max current, one wire (A)	1000
Current type	DC (+, -) / AC
Basicity (Boniszewski)	2.6
Density (kg/dm3)	1.2
Grain	2 - 20

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux 960	EN 760 :	A AB1 66 AC H5	
Flux / wire	AWS A5.17	EN756 : MR	EN756 : TR
960 / L61	F7A2-EM12K	S 38 0 AB S2Si	S 3T 0 AB S2Si
960 / L50M (LNS133U)	F7A2-EH12K	S 38 0 AB S3Si	S 3T 0 AB S3Si

### General description

General purpose neutral flux

Attractive as the "one-flux" in the shop

Very good results in semi-automatic submerged arc welding

Very good operating characteristics (deslagging - wash in - aspect)

### Approvals

Wire grade	UDT
L61	+
L50M (LNS133U)	+

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	P	S
L61	0.07	1.3	0.4	<0.030	<0.025
L50M (LNS133U)	0.07	1.6	0.6	<0.030	<0.025

### Mechanical properties, all weld metal

Wire grade	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J) 0°C
L61	420	510	60
L50M (LNS133U)	430	530	60

FX 960: rev. EN 15

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## Suggestions for use

Wire	Characteristics :	Applications
L50M	For dirty plates	Fillet welds
L61	General purpose	Butt welds (single pass and multi-run)

## Materials to be welded

	L61	L50M (LNS 133U)
A, D	x	x
AH32 to DH36	x	x
S275 to S355 N & M	x	x
S275 to S420 N & M	x	x
S315 to S355 MC & NC	x	x
S315 to S420 MC & NC	x	x
S185 to S355 all qualities	x	x
E295 to E360	x	x
P235 to P355 GH, NH, M & Q	x	x
P235 to P420 GH, NH, M & Q	x	x
P235 S to P275 S	x	x
A37 to A52 CP & AP	x	x

## Flux characteristics

Max current, one wire (A)	800
Current type	DC (+/-) AC
Basicity (Boniszewski)	1.1
Solidification speed	high
Density (kg/dm <sup>3</sup> )	1.4
Grain	1 - 16

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux 980	EN 760 :	A AR/AB1 57 AC H5	EN756 TR
Flux / Wire	AWS A5.17	EN756 MR	S 3T 2 AR/AB S2 Si
980 / L61	F7A2-EM12K	S 38 2 AR / AB S2Si	S 4T 2 AR/AB S3 Si
980 / L50M ( LNS133U)	F7A2-EH12K	S 38 2 AR / AB S3Si	

### General description

**Neutral flux**

**Outstanding slag removal, also in narrow grooves**

**Multi purpose flux**

**Suitable for semi-automatic submerged arc welding**

**Attractive as the "one-flux" in the shop**

### Approvals

Wire grade	BV	Controlas	DB	UDT
L61		x		
L50M (LNS133U)	x	x	x	x

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	P	S
L61	0.06	1.5	0.3	<0.030	<0.020
L50M (LNS133U)	0.06	1.9	0.4	<0.030	<0.020

### Mechanical properties, all weld metal

Wire grade	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J) -20°C
L61	420	520	60
L50M (LNS133U)	460	550	60

FX 980: rev. EN 15

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## Suggestions for use

Wire	Applications
L50M	For the best operating characteristics For the best impact values in multi-pass (AW of SR)

## Materials to be welded

	L50M (LNS133U)	L61
A & D	x	x
AH32 to DH40	x	x
S275 to S420 ( N & M )	x	x
S275 to S460 ( N & M )	x	
S315 to S420 (MC & NC )	x	x
S315 to S460 (MC & NC )	x	
S185 to S355 all qualities	x	x
P235 to P420 ( GH, N, NH, ML1 )	x	x
P235 to P460 ( GH, N, NH, ML1 )	x	
P235 to P275 S	x	x
A37 to A52 CP & AP	x	x

## Flux characteristics

Max current, one wire (A)	800
Current type	DC (+/-), AC
Basicity (Boniszewski)	0.65
Solidification speed	HIGH
Density (kg/dm3)	1.4
Grain	1 - 16

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux 995N	EN 760 :	A AB1 67 AC H5
Flux / Wire	AWS A5.23	EN756 TR
995N / L70 (LNS140A)		S 4T 2 AB S2Mo
995N / LNS140TB	F9A2-EG-G	S 5T 5 AB S0

### General description

Application in arctic grade pipe steels up to 40mm wall thickness  
 Designed for longitudinal and spiral welded pipe lines with multiple  
 Outstanding welding characteristics and bead profile  
 Higher usable travel speeds (up to 3.5 m/min) in 5 wire systems  
 Superior mechanical properties due to lower N in weld metal  
 Very low hydrogen in the weld deposit  $H_{DM} < 5 \text{ ml/100g}$

### Approvals

Wire grade	UDT
L-70 (LNS140A)	x
LNS140TB	x

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	P	S	Mo	Ti	B
L70 (LNS140A)	0.07	1.5	0.3	<0.025	<0.025	0.2	-	-
LNS140TB	0.06	1.6	0.3	<0.025	<0.025	0.2	0.015	0.002

### Mechanical properties, all weld metal

Wire grade	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J) -20°C	-40°C	-60°C
L70 (LNS140A)	> 520		60	
LNS140TB	> 600		115	50

FX 995N: rev. EN 15



## Suggestions for use

One run on every side in one- or multi wire systems for high welding speed in spiral weld seams

## Materials to be welded

	L70 (LNS140A)	LNS140TB
A to E	x	x
AH32 to FH40	x	x
500 to 550 A & AL	x	x
S275 to S460 all qualities	x	x
S315 to S650 all qualities	x	x
S185 to S355 all qualities	x	x
E295 to E360	x	x
P235 to P460G all qualities	x	x
P235 to P275	x	x
A37 to A52 all qualities	x	x
PF24 to PF 36 all qualities	x	x
P265 to P460 all qualities	x	x
X42 to X80	x	x

## Flux characteristics

Max current, one wire (A)	5000
Current type	DC (+/-), AC
Basicity (Boniszewski)	1.3
Solidification speed	high
Density (kg/dm <sup>3</sup> )	1
Grain	2 - 20

## Packaging

Unit	Net weight (kg)
Bag	25
Bigbag	500
Bigbag	600

## Flux

### Classification

Flux 998N	EN 760 :	A AB1 67 AC H51
Flux / Wire	AWS A5.23	EN756 TR
998N / L70 (LNS 140A)		S 4T 2 AB S2Mo
998N / LNS 140TB	F9A2-EG-G	S 5T 5 AB S0

### General description

998N is a neutral, agglomered flux intended for the double submerged arc welding (DSW) of longitudinal seam pipe with a wall thickness greater than 7mm. It can be used with up to 5 arcs. When welded in conjunction with LNS 140TB wire, it provides excellent CVN impact toughness even at very low temperature (-60°C)

### Approvals

Wire grade	Controlas	UDT
LNS165	x	x

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	P	S	Ni	Mo
LNS160	0.07	1.0	0.1	0.02	0.015	1	
LNS162	0.08	1.0	0.1	0.02	0.015	2	
LNS165	0.07	1.3	0.2	0.02	0.015	0.9	0.2

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J)	
				-40°C	-60°C
LNS160	BS	430	510	150	50
	TT	400	510	150	50
LNS162	BS	470	560	150	100
	TT	450	530	150	100
LNS165	BS	530	600	130	50
	TT	480	580	130	50

FX 998N: rev. EN 15

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## Materials to be welded

	LN160	LNS162	LNS165
A to E, AH 32 to FH 40	x	x	x
500 A & AL			x
S275 to S420 all qualities	x	x	x
S275 to S460 all qualities		x	x
S315 to S420 MC & NC	x	x	x
S500 & S550 MC & NC			x
S185 to S355 all qualities	x	x	x
E295 & E335	x	x	x
S235 & S355	x	x	x
P235 to P355 all qualities	x	x	x
P460 all qualities			x
P235 to P275 all qualities	x	x	x
A 37 to A52 all qualities	x	x	x
PF 24 to PF36 all qualities	x	x	x
P265 to P440 all qualities	x	x	x
P285 to P420 NH & QH	x	x	x

## Flux characteristics

Max current, one wire (A)	800
Current type	DC (+/-), AC
Basicity (Boniszewski)	2.8
Solidification speed	neutral
Density (kg/dm <sup>3</sup> )	1.3
Grain	2 - 20

## Packaging

Unit	Net weight (kg)
Bag	25
Big bag	1000

## Flux

### Classification

Flux P223	EN 760 :	A AB1 67 AC H5	
Flux / Wire	AWS A5.17 & A5.23	EN756 : MR	EN756 : TR
P223 / L61	F7A4-EM12K	S 38 4 AB S2Si	S 4T 2 AB S2Si
P223 / L50M (LNS133U)	F7A5-EH12K	S 42 4 AB S3Si	S 4T 2 AB S3Si
P223 / L70 (LNS140A)	F8A4-EA1-A2	S 46 4 AB S2Mo	S 4T 4 AB S2Mo
P223 / LNS140TB			S 4T 5 AB S0

### General description

High quality basic agglomerated flux  
 Good impact toughness in two run and multi-run technique  
 Very low hydrogen content  
 Extra moisture resistant  
 Very suitable for longitudinal and spiral pipe welding

### Approvals

Wire grade	UDT
LNS135	+
L61	+
L70 / LNS 140A	+

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	P	S	Mo	Ni
L61	0.07	1.4	0.4	<0.030	<0.020		
LNS135	0.07	1.4	0.25	<0.030	<0.020		
L70 (LNS140A)	0.07	1.3	0.3	<0.030	<0.020	0.5	
L50M (LNS133U)	0.07	1.9	0.4	<0.030	<0.020		
LNS160	0.07	1.4	0.25	<0.030	<0.020		1.2

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J) -20°C	-40°C
L61	TR			60	
L50M (LNS133U)	MR	480	580		80
L50M (LNS133U)	TR			80	
L70 (LNS140A)	MR	540	620	100	
L70 (LNS140A)	TR				50
LNS140TB	TR				50

TR : two run

P223: rev. EN 15

## Suggestions for use

Single/ multi wire welding  
Longitudinal and spiral pipe welding

## Materials to be welded

	Multi-run		Two run		
	L61	L50M	L70	L70	LNS140TB
		(LNS133U)	(LNS140A)	(LNS140A)	
A to D	x	x	x		
AH32 to DH40	x	x	x		
500 A			x	x	x
S275 to 355 N & M	x	x	x		
S275 to 420 N, NL, M & ML	x	x	x		
S275 to 460 N, NL, M & ML		x	x	x	x
S315 & S355 MC & NC	x	x	x		
S315 to S420MC & NC	x	x	x		
S315 to S460MC & NC		x	x		
S315 to S500MC & NC			x	x	x
S185 to S355 All qualities	x	x	x	x	x
P235 to P355 GH, N, NH,Q & M	x	x	x		
P235 to P420 all qualities	x	x	x		
P235 to P460 all qualities		x	x	x	x
P235 to P275 S	x	x	x		
P235 to P275 S & SL		x	x	x	x
A37 to A52 CP & AP	x	x	x		
A37 to A52 CP, AP & FP	x	x	x	x	x
PF 24 to PF 36 - 4	x	x	x		
PF 24 to PF 36 all qualities	x	x	x	x	x
P265 to P400 NJ2, NGJ2	x	x	x		
P265 to P440 All qualities	x	x	x		
P265 to P460 all qualities		x	x	x	x
X 42 to X80				x	x
P285 & P355 NH	x	x	x		
P285 & P420 all qualities	x	x	x	x	x

## Flux characteristics

Max current, one wire (A)	700
Current type	DC (+,-) / AC
Basicity (Boniszewski)	1.6
Solidification speed	high
Density (kg/dm3)	1.2
Grain	1 - 16

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

## Classification

Flux P230	EN 760 :	A AB1 67 AC H5	
Flux / wire	AWS A5.17 & A5.23	EN756 MR	EN756 TR
P230 / LNS135	F7A4-EM12	S 38 4 AB S2	S 4T 2 AB S2
P230 / L61	F7A4-EM12K	S 38 4 AB S2Si	
P230 / L50M (LNS133U)	F7A5-EH12K	S 42 4 AB S3Si	
P230 / L70 (LNS140A)	F8A4-EA1-A2	S 46 4 AB S2Mo	S 4T 4 AB S2Mo
P230 / LNS160	F7A8-ENi1-Ni1	S 46 4 AB S2Ni1*	
P230 / LNS162	F7A8-ENi2-Ni2	S 46 6 AB S2Ni2*	

## General description

Neutral aluminate basic agglomerated flux

Low hydrogen content and extra moisture resistant

One flux to combine with a wide range of wire electrodes

Good impact toughness in two-run and multi-run technique

Very consistent properties

Selection of wires provides application possibilities from -40 to +400°C

## Approvals

Wire grade	LR	BV	ABS	DNV	GL	Controlas	TUV	DB	UDT	DWI	RMRS	RINA
LNS 135			x	x	x	x	x	x	x			
L61	x		x		x	x	x	x	x			x
L50M (LNS133U)	x	x		x		x	x		x			
L70 (LNS 140A)	x		x		x	x	x	x	x		x	x
LNS160	x	x	x	x		x	x		x			
LNS162		x	x	x		x	x		x			

## Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	P	S	Mo	Ni
L61	0.07	1.4	0.4	<0.030	<0.020		
LNS135	0.07	1.4	0.25	<0.030	<0.020		
L70 (LNS140A)	0.07	1.9	0.3	<0.030	<0.020	0.5	
L50M (LNS133U)	0.07	1.3	0.4	<0.030	<0.020		
LNS160	0.07	1.4	0.25	<0.030	<0.020		1.2

## Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J)	
				-20°C	-40°C
LNS135	MR	400	500	50	
L61	MR	450	520	100	
L50M (LNS133U)	MR	480	580		80
L70 (LNS140A)	MR	540	620	100	
L70 (LNS140A)	TR		620		50
LNS160	MR	490	570		120
LNS162	MR	500	590		120

TR : two run

P230: rev. EN 15

## Suggestions for use

### Application

LNS 140A is applicable in multirun and two run technique

Flux cab be used in one- and tandem wire application

## Materials to be welded

	LNS135	L61	L50M (LNS133U)L70	(LNS140A)
A to D	X	X	X	X
AH32 to DH40	X	X	X	X
500 A				X
S275 to 355 N & M	X	X	X	X
S275 to 420 N, NL, M & ML		X	X	X
S275 to 460 N, NL, M & ML			X	X
S315 & S355 MC & NC	X	X	X	X
S315 to S420MC & NC		X	X	X
S315 to S460MC & NC			X	X
S315 to S500MC & NC				X

## Flux characteristics

Max current, one wire (A)	700
Current type	DC (+,-) / AC
Basicity (Boniszewski)	1.6
Solidification speed	high
Density (kg/dm <sup>3</sup> )	1.2
Grain	1 - 16

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux P240	EN 760 :	A FB1 55 AC H5
Flux / Wire	AWS A5.17 & A5.23	EN756 : MR
P240 / L50M (LNS133U)	F7A/P8-EH12K	S 42 6 FB S3Si
P240 / L70 (LNS140A)	F7A/P4-EA1-A2	S 46 4 FB S2Mo
P240 / LNS160	F7A/P10-ENi1-Ni1	S 46 6 FB S2Ni1*
P240 / LNS162	F7A/P10-ENi2-Ni2	S 46 6 FB S2Ni2*
P240 / LNS165	F8A/P8-EG-G	S 50 6 FB S0

### General description

**Highly basic fluoride agglomerated flux**

**Reliable good impact toughness, very suitable for offshore constructions**

**Consistently good CTOD values with CMn and Ni-alloyed wires**

**Very low hydrogen content  $H_{DM} < 5\text{ml}/100\text{g}$**

**Extra moisture resistant**

**Very suitable for single/multi wire welding and long stick out welding**

### Approvals

Wire grade	LR	BV	ABS	DNV	GL	Controlas	TUV	DB	UDT
L50M (LNS133U)	x	x	x	x	x	x	x	x	x
L70 (LNS 140A)									x
LNS160	x	x	x	x	x	x	x		x
LNS162	x	x	x	x	x	x	x		x
LNS165	x			x					x

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	S	P	Ni	Mo
L50M / LNS133U	0.08	1.6	0.35	< 0.015	< 0.020		
LNS160	0.08	1	0.25	< 0.015	< 0.020	1	
LNS162	0.08	1	0.25	< 0.015	< 0.020	2.2	
LNS165	0.08	1.3	0.35	< 0.015	< 0.020	0.9	0.15

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Impact ISO-V(J) -60°C
L50M (LNS133U)	BS	460	560	40
	TT	420	540	40
LNS160	BS	470	550	80
	TT	430	490	100
LNS162	BS	480	560	100
	TT	460	530	140
LNS165	BS	520	600	60
	TT	510	580	60

P240: rev. EN 15

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## Suggestions for use

Characteristics :	Applications
Boiler and pressure vessels	Suitable for semi narrow gap welding
Off-shore applications	Low temperature applications
Nuclear components	Highly restraint constructions
High purity weld metal and high toughness	Single- and multi-wire systems
	Long stick-out welding

## Materials to be welded

		L50M (LNS133U)	LNS160	LNS162	LNS165
Ship plates	A to E, AH32 to EH40	x	x	x	x
General structural steel					
NF EN 10137 ( A 36-204)	500 A & AL				x
NF EN10113 (A35-502)	S275 to S460 all qualities	x	x	x	x
NF EN 10149 (A36-231)	S315 to S460 MC & NC	x	x	x	x
	S315 to S500 MC & NC				x
NF EN 10025 (A35-501)	S185 to E360 all qualities	x	x	x	x
Boiler & pressure vessel steel					
NF EN 10028 ( A 36-205)	P235 to P460 all qualities	x	x	x	x
NF EN 10207 ( A36-220)	P235 to P275 all qualities	x	x	x	x
NF A36-601 & NF A36-605	A37 to A52 all qualities	x	x	x	x
Steel for dangerous material transportation					
NF A 36-215	P265 to P460 all qualities	x	x	x	x
Low temperature steel					
	P285 to P420 all qualities	x	x	x	x

## Flux characteristics

Max current, one wire (A)	700
Current type	DC (+,-) / AC
Basicity (Boniszewski)	3
Density (kg/dm3)	1.1
Grain	2 - 20

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux P2000	EN 760 : A AF2 63 AC H5
Flux / wire	EN 12072
P2000 / LNS 304L	S 19 9 L
P2000 / LNS 309L	S 24 12 L
P2000 / LNS 316L	S 19 12 3 L
P2000 / LNS 4462	S 22 9 3 N L
P2000 / LNS 318	S 19 12 3 Nb
P2000 / LNS 347	S 19 9 Nb
P2000 / LNS Zeron 100X	S 25 9 4 N L

### General description

**Perfect stainless steel welding flux**  
**Excellent slag release, also in narrow gaps**  
**Low flux consumption**  
**Extra moisture resistant and low hydrogen content**  
**No residual slag on the welded seam**  
**Suitable for 3.5, 5 and 9% nickel steel**

### Approvals

Wire grade	LR	BV	ABS	DNV	GL	Controlas	TUV	DB	UDT
LNS304L					x	x	x		x
LNS309L				x					x
LNS316L	x		x	x			x		x
LNS4462	x			x	x	x	x		x
LNS318							x		x
LNS347							x		x

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	Cr	Ni	Mo	N	Nb	FN
LNS304L	0.015	1.5	0.5	19	10				8-10
LNS309L	0.015	1.5	0.5	23	13				10-20
LNS316L	0.015	1.5	0.5	18	12	2.5			8-10
LNS4462	0.015	1.5	0.5	22	8	3	0.1		40-60
LNS318	0.04	1.5	0.5	19	11	2.5		0.5	8-10
LNS347	0.03	1.4	0.5	19	10			0.6	8-10

### Mechanical properties, all weld metal

Wire grade	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	-20°C	Impact ISO-V(J) -40°C	-196 °C
LNS304L	380	550	35	80		
LNS309L	425	580	33		80	
LNS316L	425	560	33			50
LNS4462	550	800	27		50	

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Suggestions for use

General stainless steel welding flux

Very good applicable in the boiler and pressure vessel industry as well as pipe fabrication

Due to relative low Si-content very good impact toughness at low temperature

## Materials to be welded

ISI	Mat.nr.	EN 10088-1/2	ASTM/ACI	UNS	Wire LNS
304L	1.4306	X2 CrNi 19-11	(TP) 304L	S30403	LNS 304L
304LN	1.4311	X2 CrNiN 18-10	(TP) 304LN	S30453	LNS 304L
316LN	1.4406	X2 CrNiMoN 17-11-2	(TP) 316LN	S31653	LNS 316L
316L	1.4404	X2 CrNiMo 17-12-2	(TP) 316L	S31603	LNS 316L
316L	1.4435	X2 CrNiMo 18-14-3	(TP) 316L	S31603	LNS 316L
316LN	1.4429	X2 CrNiMoN 17-13-3			LNS 316L
304	1.4301	X4 CrNi 18-10	(TP) 304	S30409	LNS 304L
321	1.4541	X6 CrNiTi 18-10	(TP) 321	S32100	LNS 304L/347
316	1.4401	X4 CrNiMo 17-12-2	(TP) 316	S31600	LNS 316L
316	1.4436	X4 CrNiMo 17-13-3			LNS 316L
347	1.4550	X6 CrNiNb 18-10	(TP) 347	S34700	LNS 304L/347
318	1.4580	X6 CrNiMoNb 17-12-2	316Cb	S31640	LNS 316L/318
318	1.4583	X10 CrNiMoNb 18-12(DIN)			LNS 316L/318
			Zeron 100	S32760	LNS Zeron 100 X

## Flux characteristics

Max current, one wire (A)	700
Current type	DC (+,-)
Basicity (Boniszewski)	1.6
Solidification speed	high
Density (kg/dm <sup>3</sup> )	1.2
Grain	2-20

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux P2000 S :	EN 760 : A AF2 64Cr DC H5
Flux / wire	EN 12072
P2000S / LNS 309L	S 24 12 L
P2000S / LNS 4462	S 22 9 3 N L
P2000S / LNS Zeron 100X	S 25 9 4 N L

### General description

**Welding stainless steel to carbon steel**

**To be used to welding first layers in carbon steel with over-alloyed wires**

**Applicable where a higher weldmetal ferrite is needed**

**Compensates Cr-burn off and increases the Cr-content in the weldmetal**

### Approvals

Wire grade	LR	BV	ABS	DNV	GL	Controlas	TUV	UDT
LNS309L	x	x	x	x	x	x	x	x
LNS4462							x	x

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	Cr	Ni	Mo	N	other	FN
LNS309L	0.015	1.5	0.5	25	13				15-20
LNS4462	0.015	1.5	0.5	24	8	3	0.1		40-60
LNS Zeron 100X	0.02	0.5	0.4	26	9	3.7	0.2	W=0,6 Cu = 0,7	30-60

### Mechanical properties, all weld metal

Wire grade	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -40°C
LNS309L	450	600	33	80
LNS4462	700	850	27	50

P2000S: rev. EN 15

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[www.lincolnelectriceurope.com](http://www.lincolnelectriceurope.com)

## Suggestions for use

Special developed for welding stainless steel to carbon steel. Also to be used in welding root runs in clad steel as well as root runs in Nitrogen alloyed fully austenitic steels to avoid hot cracking

## Materials to be welded

AISI	Mat.nr.	EN 10088-1/2	ASTM/ACI	UNS	Wire LNS
304L	1.4306	X2 CrNi 19-11	(TP) 304L	S30403	LNS 304L
304LN	1.4311	X2 CrNiN 18-10	(TP) 304LN	S30453	LNS 304L
316LN	1.4406	X2 CrNiMoN 17-11-2	(TP) 316LN	S31653	LNS 316L
316L	1.4404	X2 CrNiMo 17-12-2	(TP) 316L	S31603	LNS 316L
316L	1.4435	X2 CrNiMo 18-14-3	(TP) 316L	S31603	LNS 316L
316LN	1.4429	X2 CrNiMoN 17-13-3			LNS 316L
304	1.4301	X4 CrNi 18-10	(TP) 304	S30409	LNS 304L
321	1.4541	X6 CrNiTi 18-10	(TP) 321	S32100	LNS 304L/347
316	1.4401	X4 CrNiMo 17-12-2	(TP) 316	S31600	LNS 316L
316	1.4436	X4 CrNiMo 17-13-3			LNS 316L
347	1.4550	X6 CrNiNb 18-10	(TP) 347	S34700	LNS 304L/347
318	1.4580	X6 CrNiMoNb 17-12-2	316Cb	S31640	LNS 316L/318
318	1.4583	X10 CrNiMoNb 18-12(DIN)			LNS 316L/318
			Zeron 100	S32760	LNS Zeron 100 X

## Flux characteristics

Max current, one wire (A)	700
Current type	DC (+, -)
Basicity (Boniszewski)	1.6
Solidification speed	high
Density (kg/dm <sup>3</sup> )	1.2
Grain	1-16

## Packaging

Unit	Net weight (kg)
Bag	25

## Flux

### Classification

Flux P7000	EN 760-96:	S A AB/AR 2 69 AC H5
Wire	AWS 5.9 / 5.14	EN 12072 /EN xx:
P7000 / LNS 4439 Mn		S-18 16 5 L
P7000 / LNS 4455		S-20 16 3 Mn L
P7000 / LNS 4465		S-25 22 2 L
P7000 / LNS 4500	ER 385 L	S-20 25 5 Cu L
P7000 / LNS NiCr 31/27		
P7000 / LNS NiCr 70/19	NiCr-3	R-NiCr 20 Nb
P7000 / LNS NiCr 60/20	NiCrMo-3	R-NiCr 21 Mo 9 Nb

### General description

- Agglomerated aluminate basic welding flux which increases the Mn content of the weld metal
- for full austenitic stainless steel grades,
  - suitable for Ni-based alloys in multi run butt welding (Alloy 625)
  - for welding low Ni-alloyed structural steels (12Ni14, 12Ni19, X8Ni9)
  - resistance to hot cracking

### Approvals

Wire grade	TUV
LNS NiCr 60/20	+

### Chemical composition (w%), typical, all weld metal

Wire grade	C	Mn	Si	Cr	Ni	Mo	N	Nb	Fe
LNS4455	0.02	7.5	0.6	19	16	2.7	0.13		bal.
LNS4465	0.02	6	0.6	25	23	2	0.12		bal.
LNS4500	0.02	3	0.6	20	25	4.5			bal.
LNS NiCr 31/27	0.02	2.7	0.4	27	31	3.5			bal.
LNS NiCr 70/19	0.025	4.8	0.45	19	bal.			2.5	1.2
LNS NiCr 60/20	0.01	2	0.3	21	bal.	8.5		4	6

### Mechanical properties, all weld metal

Wire grade	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -100 °C	-196 °C
LNS4455	AW	420	620	30		40
	SR	420	610	30		40
LNS NiCr 60/20	AW		450	740	40	90

P7000: rev. EN 15

**Liability:** All information in this data sheet is based on the best available knowledge, is subject to change without notice and can only be considered as suitable for general guidance **Fumes:** Consult information on Welding Safety Sheet, available upon request

## Suggestions for use

Good slag release

AC/DC welding and for multi wire systems

Heat input max. 12 KJ/cm

Interpass temperature max. 150°C

Redrying: 2h / ~ 375°C

## Materials to be welded

AISI	Mat.nr.	EN	UNS
317L	1.4438	X2 CrNiMo 18-15-4	
317LN	1.4439	X2 CrNiMoN 17 13 5	
	1.4455		
	1.4465		
904L	1.4539	X1 NiCrMoCu 25-20-5	N08904
	1.4563	X1 NiCrMoCu 31-27-4	N08028
Alloy 254		X4 CrNi 18-10	S31254
Alloy 625	2.4856	NiCr 22 Mo 9 Nb	N06625
Special	1.5637	12 Ni 14	
	1.5680	12 Ni 19	
	1.5662	X8 Ni 9	

## Flux characteristics

Max current, one wire (A)	700
Current type	AC, DC +
Basicity (Boniszewski)	2.5
Solidification speed	high
Density (kg/dm <sup>3</sup> )	1.1
Grain	2 - 20

## Packaging

Unit	Net weight (kg)
Drum	40

## Cellulosic electrode

### Classification

AWS A5.1-91 : E6010  
EN 499-94 : E 35 3 C 25

### General description

All-position cellulosic pipe electrode designed especially for vertical down root pass welding  
Designed for application in pipes up to and including API 5L X60  
Light slag with little slag interference for easy arc control  
Easy slag removal, smooth bead  
Deep penetration with maximum dilution  
X-ray quality welds, even out of position

### Welding positions

ISO/ASME PA/1G PB/2F PC/2G PF/3G up PG/3G down PE/4G PF/5G up PG/5G down

### Current type

DC electr. + / -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S
0.11	0.55	0.18	0.009	0.009

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -29°C -30°C
Required: AWS A5.1-91		min. 331	min. 414	min. 22	27
EN 499-94		min. 350	440-570	min. 22	47
Typical values	AW	415	510	26	85

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	5.0
	Length (mm)	350	350	350	350
Unit: metal can	Pieces / unit (nominal)	xx	xx	xx	xx
	Net weight/unit (kg)	4.5	4.5	4.5	4.5

**Identification** Imprint: 6010 PIPELINER 6P+ Tip colour: none

PIPELINER® 6P+: rev. EN 15



## Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X42, X46, X52, X56, X60

## Calculation data

Sizes Diam. x length (mm)	Current range (A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5x350	40-70	DC+ / -						
3.2x350	65-130	DC+ / -						
4.0x350	90-175	DC+ / -						
5.0x350	140-225	DC+ / -						

\* stub end = 35 mm

## Typical operating procedures

Welding position Diameter (mm)	5G up Current (A)	5G down
2.5		
3.2	90	110
4.0	130	150
5.0	150	165

## Application advice

Preheating pipe material L360 (X52) required (acc. EN 1011-1).

Pipeclamps to be removed after finishing root pass, start welding the hot pass immediately (within 5 min.) after root pass

Use electrode directly from metal cans

## High strength cellulosic electrode

### Classification

AWS A5.5-96 : E8010-P1  
EN 499-94 : E 46 4 1Ni C 25

### General description

Designed for vertical down welding of pipes up to and including API 5L X70  
Excellent resistance to porosity, X-ray quality welds  
High stacking efficiency: fill joints in fewer passes  
Exceptional mechanical properties

### Welding positions



ISO/ASME PA/1G PB/2F PC/2G PF/3G up PG/3G down PE/4G PF/5G up PG/5G down

### Current type

DC electr. +

### Approvals

ABS

+

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	Ni	Mo	P	S
0.17	0.7	0.25	0.8	0.2	0.01	0.01

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-29°C	-40°C	-46°C
Required: AWS A5.5-96		min. 460	min. 550	min. 19	27		
EN 499-94		min. 460	530-680	min. 20		min. 47	
Typical values	AW	500	620	26	75		65

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	5.0
	Length (mm)	350	350	350
Unit: metal can	Pieces / unit (nominal)	xx	xx	xx
	Net weight/unit (kg)	4.5	4.5	4.5

**Identification** Imprint: 8010-P1 PIPELINER 8P+ Tip colour: none

PIPELINER® 8P+: rev. EN 15

## Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X56, X60, X65, X70

## Calculation data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	75 - 130	DC+						
4.0 x 350	90 - 185	DC+						
5.0 x 350	140 - 225	DC+						

\* stub end = 35 mm

## Typical operating procedures

Welding position	5G up	5G down
Diameter (mm)	Current (A)	
3.2	90	110
4.0	130	150
5.0	150	165

## Application Advice

Preheating pipe material L360 t/m L480 (X56 t/m X70) required (acc. EN 1011-1).

Pipeclamps to be removed after finishing root pass, start welding the hot pass immediately (within 5 min.) after root pass

Use electrode directly from metal cans

Use PIPELINER 6P+ for lower hardness in the root pass when required

## Basic electrode

### Classification

AWS A5.1-91 : E7016 H4  
EN 499-94 : E 42 3 B 12 H5

### General description

Designed for vertical up root and fill pass welding of pipes up to and including API 5L X65  
Excellent low temperature impact properties  
Square burnoff makes welding easier, especially in critical pipe welding applications  
Open gap root pass welding with 2.5 and 3.2 mm electrodes using DC - / + polarity

### Welding positions



### Current type

DC electr. - / +, AC

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S
0.06	1.3	0.5	0.013	0.009

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-29°C	-30°C
Required: AWS A5.1-91		min. 400	min. 480	min. 22	27	
EN 499-94		min. 420	500-640	min. 20		min. 47
Typical values	AW	450	555	30	100	

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0
	Length (mm)	350	350	350
Unit: Metal can	Pieces / unit (nominal)	xx	xx	xx
	Net weight/unit (kg)	22.7	22.7	22.7

Identification Imprint: 7016 H4 PIPELINER 16P Tip colour: none

PIPELINER® 16P: rev. EN 15

## Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X42, X46, X52, X56, X60, X65

## Calculation data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	55 - 80	DC+						
3.2 x 350	75 - 120	DC+						
4.0 x 350	120 - 160	DC+						

\* stub end = 35 mm

## Typical operating procedures

Welding position	1G	2F	2G	3G	4G
Diameter (mm)	Current (A)			up	
2.5	80	85	85	85	80
3.2	120	115	115	115	110
4.0	170	180	180	180	160

## Application Advice

Preheating pipe material L360 t/m L445 (X56 t/m X65) required (acc. EN 1011-1).

## Basic electrode

### Classification

AWS A5.5-96 : E8018-G H4  
EN 499-94 : E 50 6 Mn1Ni B 32 H5

### General description

Designed for vertical up fill and cap pass welding of welding of high strength pipe up to and including API 5L X80  
Excellent low temperature impact properties down to -60°C  
Square burnoff makes welding easier, especially in critical pipe welding applications

### Welding positions



### Current type

AC / DC electr. + / -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni
0.05	1.5	0.5	0.010	0.005	0.95

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)	
					-46°C	-60°C
Required: AWS A5.1-91		min. 460	min. 550	min. 19	not required	
EN 499-94		min. 500	560-720	min. 18		min. 47
Typical values	AW	550	640	24		80

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0
	Length (mm)	350	350
Unit: Metal can	Pieces / unit (nominal)	123	75
	Net weight/unit (kg)	4.2	4.0

Identification Imprint: 8018-G H4 PIPELINER 18P Tip colour: none

PIPELINER® 18P: rev. EN 15

## Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X 56, X60, X65, X70, X80

## Calculation data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	80 - 145	DC+	66	220	1.2	37.7	48	1.79
4.0 x 350	120 - 185	DC+	77	355	1.6	54.1	29	1.59

\* stub end = 35 mm

## Typical operating procedures

Welding position: Diameter (mm)	1G Current (A)	2F	2G	3G up	4G	5G up
3.2	140	120	145	120	120	120
4.0	150	140	150	140	135	140

## Application Advice

Preheating pipe material L360 t/m L480 (X56 t/m X70) required (acc. EN 1011-1).  
Use PIPELINER 16P for lower hardness in the root if needed.

## High strength basic electrode

### Classification

AWS A5.5-96 : E8018-G  
EN 499-94 : E 46 4 B 35

### General description

Basic covered low hydrogen electrode primarily designed for vertical down pipe welding

Recommended for pipe grades up to and including API 5L Grade X70

Low temperature impact properties down to -46°C.

Unique "hot start" tip helps initiate the arc and quickly establish puddle control

Slag design allows for easy control of weld puddle

### Welding positions



### Current type

AC / DC electr. + / -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S
0.07	1.35	0.55	0.015	0.010

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-29°C	-40°C	-46°C
Required: AWS A5.5-96		min. 460	min. 550	min. 19	not required		
EN 499-94		min. 460	530 - 680	min. 20		min. 47	
Typical values	AW	535	630	26	85		48

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	4.5
	Length (mm)	350	350	350	350
Unit: Metal can	Pieces / unit (nominal)	xx	xx	xx	xx
	Net weight/unit (kg)	4.5	4.5	4.5	4.5

Identification Imprint: LH-D80 8018-G Tip colour: none

PIPELINER® LH-D80: rev. EN 15



# PIPELINER® LH-D80

## Materials to be welded

Steel	Code	Type
Pipe material	API 5 L	X60, X65, X70

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	80 - 110	DC+						
3.2 x 350	125 - 155	DC+						
4.0 x 350	170 - 215	DC+						
4.5 x 350	200 - 260	DC+						

\* stub end = 35mm

## Typical operating procedures

Welding position:	PG/5G down
Diameter (mm)	Current (A, DC+)
2.5	80-110
3.2	125-155
4.0	170-215
4.5	200-260

## High strength basic electrode

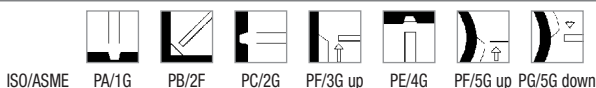
### Classification

AWS A5.5-96 : E 9018-G \* Nearest classification  
EN 757-97 : E 55 5 Mn1Ni B 35

### General description

Basic covered low hydrogen electrode primarily designed for vertical down pipe welding  
Recommended for pipe grades up to and including API 5L Grade X80  
High deposition rates and excellent low temperature impact properties down to -46°C.  
Unique "hot start" tip helps initiate the arc and quickly establish puddle control  
Slag design allows for easy control of weld puddle

### Welding positions



### Current type

AC / DC electr. + / -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni
0.07	1.55	0.50	0.015	0.010	0.70

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-29°C	-46°C	-50°C
Required: AWS A5.5-96		min. 530	min. 620	min. 17	not required		
EN 757-97		min. 550	610-780	min. 18			min. 47
Typical values	AW	585	670	26	95	69	

### Packaging, available sizes and identification

	Diameter (mm)	2.5	3.2	4.0	4.5
	Length (mm)	350	350	350	350
Unit: Metal can	Pieces / unit (nominal)	xx	xx	xx	xx
	Net weight/unit (kg)	4.5	4.5	4.5	4.5

Identification Imprint: LH-D90 9018-G Tip colour: None

PIPELINER® LH-D90: rev. EN 15

# PIPELINER® LH-D90

## Materials to be welded

Steel	Code	Type
Pipe material	API 5 L	X65, X70, X80

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
2.5 x 350	80 - 110	DC+						
3.2 x 350	125 - 155	DC+						
4.0 x 350	170 - 210	DC+						
4.5 x 350	200 - 260	DC+						

\* stub end = 35mm

## Typical operating procedures

Welding position: Diameter (mm)	PG/5G down Current (A, DC+)
2.5	80-110
3.2	125-155
4.0	170-215
4.5	200-260

## Remarks

Deviations: chemical composition

Mn = 1.30 - 1.60%

EN: Mn = 1.4 - 2.0%

## High strength basic electrode

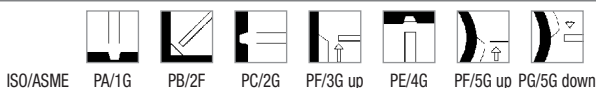
### Classification

AWS A5.5-96 : E10018-G  
EN 757-97 : E 62 5 Mn1Ni B 35

### General description

Basic covered low hydrogen electrode primarily designed for vertical down pipe welding  
Recommended for pipe grades up to and including API 5L Grade X100  
High deposition rates and excellent low temperature impact properties down to -46°C.  
Unique "hot start" tip helps initiate the arc and quickly establish puddle control  
Slag design allows for easy control of weld puddle

### Welding positions



### Current type

AC / DC electr. + / -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Mo
0.06	1.55	0.50	0.015	0.010	0.9	0.25

### Mechanical properties, all weld metal

	Condition	0.2% Proof strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J)		
					-29°C	-46°C	-50°C
Required: AWS A5.5-96		min. 600	min. 690	min. 16	not required		
EN 757-97		min. 620	690-890	min. 18			min. 47
Typical values	AW	690	750	25	88	67	

### Packaging, available sizes and identification

	Diameter (mm)	3.2	4.0	4.5
	Length (mm)	350	350	350
Unit: Metal can	Pieces / unit (nominal)	xx	xx	xx
	Net weight/unit (kg)	4.5	4.5	4.5

Identification Imprint: LH-D100 10018-G Tip colour: None

PIPELINER® LH-D100: rev. EN 15

# PIPELINER® LH-D100

## Materials to be welded

Steel	Code	Type
Pipe material	API 5 L	X70, X80, X100

## Calculation Data

Sizes Diam. x length (mm)	Current range A)	Current type	Arc time - per electrode at max. current - (s)*	Energy E(kJ)	Dep.rate H(kg/h)	Weight/ 1000 pcs. (kg)	Electrodes/ kg weldmetal B	kg Electrodes/ kg weldmetal 1/N
3.2 x 350	125 - 155	DC+						
4.0 x 350	170 - 215	DC+						
4.5 x 350	200 - 260	DC+						

\* stub end = 35mm

## Typical operating procedures

Welding position:	1G
Diameter (mm)	Current (A, DC+)
3.2	125-155
4.0	170-215
4.5	200-260

## Solid wire

### Classification

AWS A5.18 : ER70S-G  
EN 440-94 : G 38 3 M G2Si / G 38 3 C G2Si

### General description

Specially intended and packaged for the needs of semiautomatic and automatic root pass pipe welding  
Fluid puddle provides good wash-in at the weld toes and uniform bead shape  
Clean weld deposit  
Foil bag packaging guards against moisture  
Consistent X-ray quality welds  
Primarily intended for all position welding on pipe steels such as API 5L X42 through X65  
Suitable for welding root passes for up to API 5L X70

### Shielding gases (acc. EN 439)

GMAW	M21	Mixed gas Ar+ >5-25% CO <sub>2</sub>
	C1	Active gas 100% CO <sub>2</sub>

### Approvals

### Chemical composition (w%), typical range, wire

C	Mn	Si	P	S
0.07	1.25	0.55	0.010	0.020

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -29°C
Typical values	GMAW	C1	AW	420	520	26	82

### Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X42, X46, X52, X56, X60, X65

### Packaging

Sizes (mm)1.1 (0.045")1.3 (0.052")			
Process	Unit		
GMAW	4.5 kg Plastic spool Foil Bag	X	X
GMAW	11.3 Plastic spool Foil Bag	X	X

PIPELINER® 70S-G: rev. EN 15

## Solid wire

### Classification

AWS A5.18 : ER80S-G  
EN 440-94 : G 50 3 M G4Si1

### General description

Specially intended and packaged for the needs of semiautomatic and automatic root pass pipe welding  
Fluid puddle provides good wash-in at the weld toes and uniform bead shape  
Clean weld deposit  
Foil bag packaging guards against moisture  
Consistent X-ray quality welds  
Primarily intended for all position welding on pipe steels such as API 5L X65 through X80

### Shielding gases (acc. EN 439)

GMAW M21 Mixed gas Ar+ >5-25% CO

### Approvals

### Chemical composition (w%), typical, wire

C	Mn	Si	P	S	Mo
0.09	1.72	0.61	0.012	0.007	0.45

### Mechanical properties, typical, all weld metal

	Process	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V(J) -29°C
Required: ER80S-G				not required	550	not required	not required
Typical values	GMAW	M21	AW	630	710	23	120

### Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X65, X70, X80

### Packaging

		Sizes (mm) 1.1 (0.045") 1.3 (0.052")	
Process	Unit		
GMAW	4.5 kg Plastic spool Foil Bag	X	X
GMAW	11.3 Plastic spool Foil Bag	X	X

Other sizes and packaging on request

PIPELINER® 80S-G: rev. EN 15

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## Rutile cored wire

### Classification

AWS A5.20-95 : E71T-1MJ H8 / E71T-9MJ H8  
EN 758-97 : T 46 4 P M 2 H10

### General description

Gas shielded flux cored wire for semi-automatic application in pipeline welding

Smooth, spray type arc transfer and low spatter level

Slag system provides for puddle support, good wetting and bead shape in all positions

All position single and multiple pass wire designed fo join pipe up to and including X70

Reliable weld metal properties

Excellent wire feeding

In diameter 1.3 mm (0.052") the wire is called PIPELINER AUTOWELD® G70M, and is specifically designed to use with the Autoweld pipe welding system.

It has tightly controlled cast and helix to assure proper wire placement every time

### Welding positions



### Current type/Shielding gas

DC +

Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)

15-25 l/min.

### Approvals

### Chemical composition (w%), typical, all weld metal

Shielding gases	C	Mn	Si	P	S	Ni
M21	0.05	1.60	0.45	0.013	0.011	0.36

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J) -40°C
Required:	AWS A5.20-95 EN 758-97			min. 400	min. 480	min. 22 min. 27
Typical values	M21	AW	570	640	25	85

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)
		1.1 (0.045") 1.3 (0.052")
Plastic spool Foil Bag 4.5		X X
Plastic spool Foil Bag 11.3		X X

PIPELINER® G70M: rev. EN 15



# PIPELINER® G70M

## Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X42, X46, X52, X56, X60, X65, X70

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.1	19	440-1330	130-275	23-30	1.4-4.4	1.21
1.3	19	380-1140	155-315	22-31	1.6-4.9	1.22

## Rutile cored wire

### Classification

AWS A5.29-98 : E101T1-GM H8  
EN 12535-00 : T 62 3 P M 2 H10

### General description

Gas shielded flux cored wire for semi-automatic application in pipeline welding

Smooth, spray type arc transfer and low spatter level

Slag system provides for puddle support, good wetting and bead shape in all positions

All position single and multiple pass wire designed to join pipe up to and including X80

For the root pass, the use of PIPELINER 70S-G or 80S-G is recommended

Reliable weld metal properties

Excellent wire feeding

In diameter 1.3 mm (0.052") the wire is called PIPELINER AUTOWELD® G80M, and is specifically designed to use with the Autoweld pipe welding system.

It has tightly controlled cast and helix to assure proper wire placement every time

### Welding positions



### Current type/Shielding gas

DC +  
Ar+ (>5-25%) CO<sub>2</sub> (EN 439: M21)  
15-25 l/min.

### Approvals

### Chemical composition (w%), typical, all weld metal

Shielding gases	C	Mn	Si	P	S	Ni	Cr	Mo
M21	0.04	1.75	0.40	0.020	0.010	1.0	0.11	0.25

### Mechanical properties, all weld metal

	Shielding gas	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation (%)	Impact ISO-V (J)		
						-29°C	-30°C	-40°C
Required:	AWS A5.29-98 EN 758-97		620	min. 605 700-890	690-825 min. 18	min. 16	not required	min. 47
Typical values	M21	AW	720	760	21	51		42

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm)	
		1.1 (0.045")	1.3 (0.052")
Plastic spool	Foil Bag 4.5	X	X
Plastic spool	Foil Bag 11.3	X	X

PIPELINER® G80M: rev. EN 15

# PIPELINER® G80M

## Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X70, X80

## Calculation data

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed (cm/min)	Current (A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg weld metal
1.1	19	440-1330	130-275	23-30	1.4-4.4	1.21
1.3	19	380-1140	155-315	22-31	1.6-4.9	1.22

# PIPELINER® NR®-207+

## Self-shielded cored wire

### Classification

AWS A5.29-98

: E71T8-K6

### General description

Optimum performance on vertical down hot, fill and cap pass welding in pipe steels such as API 5L X42 through X70

Self-shielded, flux cored. No need for external gas or flux

Produces quality welds in moderate wind conditions with no tenting

Great arc characteristics and superior feedability

Excellent crack resistance, CTOD and Charpy-V impact properties

### Welding positions



ISO/ASME

PA/1G



PB/2F



PC/2G



PG/3G down



PE/4G



PG/5G down

### Current type

DC -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.04	1.22	0.25	0.010	0.010	0.82	1.1

### Mechanical properties, all weld metal

Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J) -29°C
Required: AWS A5.29-98	min. 400	482-613	20	27
Typical values AW	435	535	30	150

### Packaging and available sizes

Unit type	Net weight/unit (kg)	Diameter (mm) 2.0
Coils 14C	6.35	X

PIPELINER® NR®-207+: rev. EN 15

**LINCOLN®**  
**ELECTRIC**

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[www.lincolnelectriceurope.com](http://www.lincolnelectriceurope.com)

# PIPELINER® NR®-207+

## Suggestions for use

Optimum performance on vertical down hot, fill and cap passes on standard cross-country pipelines and arctic grade pipe

## Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X42, X46, X52, X56, X60, X65, X70

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed		Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
		inch/min	cm/min				
2.0	19	70-130	170-330	210-305	18-21	1.6-3.0	1.21

- Typical operating procedures

# PIPELINER® NR®-207XP

## Self-shielded cored wire

### Classification

AWS A5.29-98

: E71T8-K6

### General description

Optimum performance on vertical down hot, fill and cap pass welding in pipe steels such as API 5L X42 through X70

Self-shielded, flux cored. No need for external gas or flux

Produces quality welds in moderate wind conditions with no tenting

Great arc characteristics and superior feedability

### Welding positions



PA/1G



PB/2F



PC/2G



PG/3G down



PE/4G



PG/5G down

ISO/ASME

### Current type

DC -

### Approvals

### Chemical composition (w%), typical, all weld metal

C	Mn	Si	P	S	Ni	Al
0.04	1.15	0.07	0.010	0.010	0.68	1.0

### Mechanical properties, all weld metal

	Condition	Yield strength (N/mm <sup>2</sup> )	Tensile strength (N/mm <sup>2</sup> )	Elongation %	Impact ISO-V(J)	
					-29°C	-40°C
Required: AWS A5.29-98		min. 400	482-613	20	27	
Typical values	AW	510	580	27	295	199

### Packaging and available sizes

Unit type	Net weight/unit	Diameter (mm)
	(kg)	2.0
Coils 14C	6.35	X

PIPELINER® NR®-207XP: rev. EN 15

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**ELECTRIC**

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# PIPELINER® NR®-207XP

## Suggestions for use

Optimum performance on vertical down hot, fill and cap passes on standard cross-country pipelines and arctic grade pipe

For consistently high Charpy-V impact values

## Materials to be welded

Steel	Code	Type
Pipe material	API 5LX	X42, X46, X52, X56, X60, X65, X70

## Calculation data at normal setting

Diameter (mm)	Electrical Stick-out (mm)	Wire feed speed		Current (approx. A)	Arc Voltage (V)	Deposition Rate (kg/h)	kg Wire/ kg Weldmetal
		inch/min	cm/min				
2.0	19	70-130	170-330	210-305	18-21		

- Typical operating procedures

# Ceramic backing material

## Where are most weld defects found?

Most weld defects are found in weld roots. If access is available from only one side of the weld, the defects are usually a result of poor fusion. In two-side welds, the defects are usually slag inclusions that result from insufficient back grinding or gouging. Grinding and gouging are themselves costly and unpleasant procedures and, of course, the metal removed must be replaced by more weld metal. If defects are found, weld roots are the most difficult and expensive regions to repair.

## How can we minimise root defects ?

Since defect free fully penetrated root welds can be made only by highly qualified welders if no supporting backing is used, the Lincoln Electric LNB ceramic backing strips can be your answer. LNB products are ceramic backing strips that are attached to the back of weld roots. The ceramic is formulated to provide a molten surface contact that supports the weld root and breaks free when the metal cools. The backing is not permanent and is therefore permissible where permanent backing is not admissible, because of fatigue or corrosion.

## What are the major benefits of Lincoln Electric LNB backing materials?

- Weld roots can be made at higher currents, thereby ensuring good fusion.
- Quality of root welds is less dependent on welder skills.
- Minimised overhead welding. Deck welds can be made from above.
- Less re-positioning of work. Work pieces need not be moved to allow welding of the back of joints.
- Less defects. Better root fusion ensures lower defect levels.
- More tolerant of fit-up. The use of a bigger weld pool supported by the ceramic, allows larger and mis-matched gaps to be filled with sound weld metal.
- Purging with inert gas is not necessary to protect the back of the weld root.

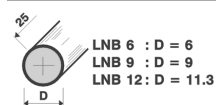
## What are the features of Lincoln Electric LNB materials?

- LNB products do not absorb moisture. They are made from high density, non-hygroscopic ceramics. In combination with Lincoln Electric low hydrogen consumables, they give maximum security when welding materials are susceptible to hydrogen induced cracking.
- LNB materials are inert and do not introduce undesirable elements into the weld pool.
- LNB products control weld back reinforcement. The weld metal that cools in contact with the ceramic is smooth, slightly convex and it usually needs no further cleaning or grinding.
- LNB products are easy to attach to the back of welds, and they will withstand normal preheat temperatures. Either aluminium adhesive tape or spring steel clips hold the ceramic in firm contact with the joint. The weld metal is not adversely effected by its contact with the ceramic strips.
- LNB strips can be used with many materials, like structural steels, low-alloy and stainless steels as well as many processes such as stick electrodes and most standard solid wires for CO<sub>2</sub> and mixed gas metal arc welding. In combination with Outershield, Cor-A-Rosta or other flux cored wires and Innershield self shielded wires, as well as submerged arc processes, they add substantially to the already high productivity.
- LNB ceramic backing strips are made in a variety of shapes and sizes that are suitable for most welds.
- No release of disagreeable gases during welding.



# Ceramic backing material

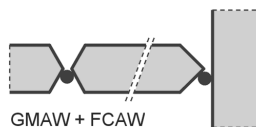
## Product range



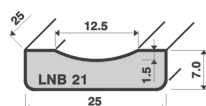
Strip length: 600 mm

Product	item	pcs/bx	mtr/bx
LNB 6	tape 640007	100	60
LNB 9	tape 640014	72	43.2
LNB 12	tape 640021	60	36

Mainly for mild steel. For general steel structures

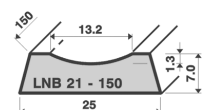
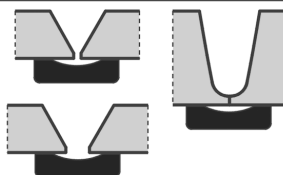


GMAW + FCAW



Strip length: 600 mm

Product	item	pcs/bx	mtr/bx
LNB 21	tape 640083	56	33.6

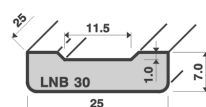


Strip length: 600 mm

Product	item	pcs/bx	mtr/bx
LNB 21 - 150	tape 640090	56	33.6
LNB 21 - 150	rail 640106	63	37.8

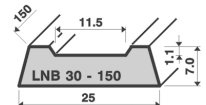
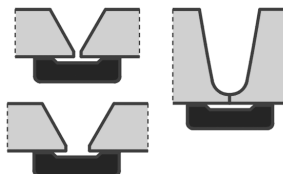
Strips can be used in metal rail.  
For fastening use magnetic clamps

To be used with LNM solid wires  
and metal cored wires like  
Outersield MC 710-H and MC 715-H



Strip length: 600 mm

Product	item	pcs/bx	mtr/bx
LNB 30	tape 640151	56	33.6

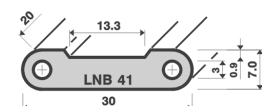


Strip length: 600 mm

Product	item	pcs/bx	mtr/bx
LNB 30 - 150	tape 640168	56	33.6
LNB 30 - 150	rail 640175	63	37.8

Strips can be used in metal rail.  
For fastening use magnetic clamps.

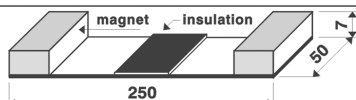
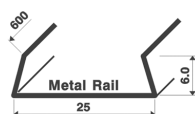
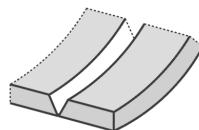
To be used with flux cored wires like  
Outersield and Cor-A-Rosta



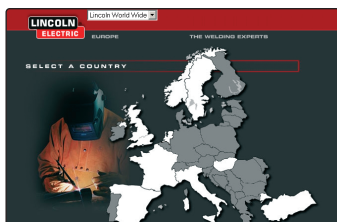
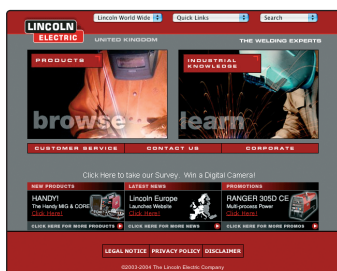
LNB 40 - strip length: 600 mm  
LNB 41 - strip length: 1000 mm

Product	item	pcs/bx	mtr/bx
LNB 40	tape 640243	48	28.8
LNB 41	wire 640229	24	24

Elements are mounted on flexible wire.  
Suitable for pipe and cylindrical parts.  
Designed to bend easily.



Magnetic Clamp, item 640236



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#### ***CUSTOMER ASSISTANCE POLICY***

The business of Lincoln Electric Europe is manufacturing and selling high quality welding equipment, consumables and cutting equipment. Our challenge is to meet the needs of the customer and to exceed their expectations. On occasion, purchasers may ask Lincoln Electric for advice or information about their use of our products. We respond to our customers based on the best information in our possession at that time. Lincoln Electric is not in a position to warrant or guarantee such advice and assumes no responsibility, with respect to such information or advice. We expressly disclaim any warranty of any kind, including any warranty of fitness for any customer's particular purpose, with respect to such information or advice. As a matter of practical consideration, we also cannot assume any responsibility for updating or correcting any such information or advice once it has been given, nor does the provision of information or advice create, expand or alter any warranty with respect to the sale of our products.

Lincoln Electric is a responsive manufacturer, but the selection and use of specific products sold by Lincoln Electric is solely within the control of, and remains the sole responsibility of the customer. Many variables beyond the control of Lincoln Electric affect the results obtained in applying these types of fabrication methods and service requirements.

Subject to change - This information is accurate to the best of our knowledge at the time of printing.



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