phoenix union thermanit



Welding filler metals

Welding filler metals

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Page	Brand name	EN		AWS		Page
for the welding of unalloyed steels						
12	Phoenix Blau	499	E 42 0 RC 11	A 5.1	E6013	12
19	Phoenix Grün (Sheet metal)	499	E 42 0 R 12	A 5.1	E6012	19
20	Phoenix Grün M	499	E 42 0 RR 12	A 5.1	E6013	20
21	Phoenix Grün T	499	E 42 0 RR 12	A 5.1	E6013	21
22	Phoenix K 50	499	E 42 4 B 42	A 5.1	E7015	22
23	Phoenix K 50 R	499	E 42 3 B 32	A 5.1	E7016	23
24	Phoenix K 90 S	499	E 46 4 B 32 H5	A 5.1	E7016	24
28	Phoenix Rot AR 160	499	E 42 2 RA 53	A 5.1	E7024-1	28
29	Phoenix Rot BR 160	499	E 42 2 RB 53	A 5.1	E7028	29
30	Phoenix Rot R 160	499	E 42 0 RR 53	A 5.1	E7024-1	30
31	Phoenix Rot R 160 S	499	E 42 0 RR 53	A 5.1	E7024	31
32	Phoenix SH Blau	499	E 42 0 RR 11	A 5.1	E6013	32
34	Phoenix SH Gelb	499	E 35 0 A 12	A 5.1	E6020	34
35	Phoenix SH Gelb B	499	E 38 2 RB 12	A 5.1	E6013	35
36	Phoenix SH Gelb R	499	E 38 2 RB 12	A 5.1	E6013	36
37	Phoenix SH Gelb S	499	E 38 0 RA 12	A 5.1	E6013	37
38	Phoenix SH Gelb T	499	E 38 0 RA 12	A 5.1	E6013	38
39	Phoenix SH Grün K 50 W	499	E 42 5 B 32 H5	A 5.1	E7018-1	39
40	Phoenix SH Grün K 52 W	499	E 42 5 B 12 H5	A 5.1	E7016-1	40
41	Phoenix SH Grün K 70	499	E 46 4 B 42 H5	A 5.5	E8018-G	41
42	Phoenix SH Grün K 70 W	499	E 46 4 B 32 H5	A 5.5	E8018-G	42
43	Phoenix SH Grün TB	499	E 42 0 RR 12	A 5.1	E6013	43
45	Phoenix SH Lila R	499	E 42 2 RB 12	A 5.1	E6013	45
46	Phoenix SH Multifer 130	499	E 42 0 RR 53	A 5.1	E7014	46
47	Phoenix SH Multifer 180	499	E 42 0 RR 73	A 5.1	E7024	47
59	Phoenix Spezial D	499	E 42 3 B 12 H10	A 5.1	E7016	59
60-61	Phoenix 120 K	499	E 42 5 B 32 H5	A 5.1	E7018-1	60-61
62	Phoenix 6013	499	E 42 0 RC 11	A 5.1	E6013	62
63	Phoenix 7018	499	E 42 5 B 32 H5	A 5.1	E7018-1	63
for the welding of creep resistant steels						
13	Phoenix Blau Mo	1599	E Mo R 1 1	A 5.5	E7011-A1	13
18	Phoenix Chromo 1	1599	E CrMo1 B 4 2 H5	A 5.5	E8018-B2	18
25	Phoenix NiMo 100	757	E 62 4 Mn 1 NiMo B 42 H5	A 5.5	E10018-G (E10018-D2 mod.)	25
33	Phoenix SH Chromo 2 KS	1599	E CrMo2 B 4 2 H5	A 5.5	E9015-B3	33
44	Phoenix SH Kupfer 3 KC	1599	E ZCrMoV1 B 4 2 H5	A 5.5	E9015-G	44
53	Phoenix SH Schwarz 3 K	499/1599	E 50 4 Mo B 42 / E Mo B 4 2 H5	A 5.5	E7015-G (E7015-A1 mod.)	53
54	Phoenix SH Schwarz 3 K Ni	499	E 50 4 1 NiMo B 42 H5	A 5.5	E9018-G	54
55	Phoenix SH Schwarz 3 MK	499/1599	E 50 4 Mo B 42 / E Mo B 4 2 H5	A 5.5	E7018-G (E7018-A1 mod.)	55
56	Phoenix SH Schwarz 3 TR	1599	E Mo R 1 2	A 5.5	E8013-G	56

Summary
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64	Thermanit Chromo 9 V	1599	E CrMo91 B 4 2 H5	A 5.5	E9015-B9	64
65	Thermanit Chromo T 91	1599	E CrMo91 B 4 2 H5	A 5.5	E9018-B9	65
66	Thermanit MTS 4	1599	E CrMoWV12 B 4 2 H5	–	–	66
67	Thermanit MTS 616	1599	E ZCrMoWVNb9 0,5 2 B 4 2 H5	A 5.5	E9015-G (E9015-B9 mod.)	67
68	Thermanit MTS 911	1599	E ZCrMoWVNb9 1 1 B 4 2 H5	A 5.5	E9015-G (E9015-B9 mod.)	68
69	Thermanit P23	1599	E ZCr2WV B 42 H5	A 5.5	E9015-G	69
70	Thermanit P24	1599	E ZCrMo2WVNb B 42 H5	A 5.5	E9015-G	70
	for the welding of fine grained structural steels					
41	Phoenix SH Grün K 70	499	E 46 4 B 42 H5	A 5.5	E8018-G	41
48	Phoenix SH Ni 2 K 70	499	E 46 6 2 Ni B 42 H5	A 5.5	E8018-C1	48
49	Phoenix SH Ni 2 K 90	757	E 55 5 2 NiMo B 42 H5	A 5.5	E10018-M	49
50	Phoenix SH Ni 2 K 100	757	E 69 5 Mn 2 NiCrMo B 42 H5	A 5.5	E11018-G (E11018-M mod.)	50
51	Phoenix SH Ni 2 K 130	757	E 89 4 Mn 2 Ni 1 CrMo B 42 H5	A 5.5	E12018-G (E12018-M mod.)	51
53	Phoenix SH Schwarz 3 K	499/1599	E 50 4 Mo B 42 / E Mo B 4 2 H5	A 5.5	E7015-G (E7015-A1 mod.)	53
54	Phoenix SH Schwarz 3 K Ni	499	E 50 4 1 NiMo B 42 H5	A 5.5	E9018-G	54
55	Phoenix SH Schwarz 3 MK	499/1599	E 50 4 Mo B 42 / E Mo B 4 2 H5	A 5.5	E7018-G (E7018-A1 mod.)	55
57	Phoenix SH V 1	499	E 50 6 Mn 1 Ni B 42 H5	A 5.5	E8018-G (E8018-C3 mod.)	57
58	Phoenix SH V 370	499	E 46 6 1 Ni B 42 H5	A 5.5	E8018-C3	58
60-61	Phoenix 120 K	499	E 42 5 B 32 H5	A 5.1	E7018-1	60-61
	for vertical down welding of pipelines					
14	Phoenix Cel 70	499	E 42 2 C 25	A 5.1	E6010	14
15	Phoenix Cel 75	499	E 42 2 C 25	A 5.5	E7010-P1	15
16	Phoenix Cel 80	499	E 46 3 C 25	A 5.5	E8010-P1	16
17	Phoenix Cel 90	499	E 50 3 1 Ni C 25	A 5.5	E9010-G	17
	for the welding of weatherproof steels					
52	Phoenix SH Patinax Kb	499	E 38 3 Z 1 NiCu B 42	A 5.5	E7015-G	52
	for gauging, chamfering and cutting					
26	Phoenix Nut K	–	–	–	–	26
27	Phoenix Nut S	–	–	–	–	27

Phoenix electrodes are not sold under this product designation in North America

Phoenix Blau

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RC 11	E6013

Characteristics and field of use

Rutile cellulose covered electrode.
General purpose; useable in all positions; excellent gap-bridging and arc-striking ability; for tack-welding and bad fit-ups.
Well suited for welding rusty and primered plates (roughly 40 µm); excellent vertical down characteristics. Useable on small transformers (42 V, open circuit).

Materials

S235JRG2 - S355J2; GS-38; GS-45;
boiler steels P235GH, P265GH, P295GH; shipbuilding steels corresp. to app.-grade 2; fine grained structural steels up to P355N; weldable ribbed reinforcing steel bars.
ASTM A36 and A53 Gr. all; A106 Gr. A, B, C; A135 Gr. A, B; A283 Gr. A, B, C, D; A366; A285 Gr. A, B, C; A500 Gr. A, B, C; A570 Gr. 30, 33, 36, 40, 45; A607 Gr. 45; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50;
API 5 L Gr. B, X42-X52

Typical analysis in %

C	Si	Mn
0.09	0.35	0.50

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	510	22	50

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 0425)
ABS (2, 2Y)
RS (2Y)
GL (2Y)
Controlas (0527)
ÖBB
DB (Reg. form No. 10.132.19)
BV (2Y)
LR (2/2Y)
DNV (2)
FT (E 51 2 R)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 250	400	3.4	50- 60
2.5 x 250	275	3.5	60- 90
2.5 x 350	275	4.9	60- 90
3.2 x 350	160	5.0	90-140
4.0 x 350	100	4.7	150-190
4.0 x 450	100	6.0	150-190
5.0 x 350	70	5.0	190-240
5.0 x 450	70	6.5	190-240

Phoenix Blau Mo

Covered electrode

Classifications

EN 1599	AWS A 5.5
E Mo R 1 1	E7011-A1

Characteristics and field of use

Rutile cellulose covered Mo alloyed electrode. Finely riped and smooth weld surfaces; easy slag removal; excellent weldability in the vertical down position on Mo- and unalloyed steels.

Materials

P235GH, P265GH, StE 255, P295GH, P355GH, 16 Mo 3

Typical analysis in %

C	Si	Mn	Mo
0.10	0.35	0.50	0.45

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
U	420	510	22	55

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 6542)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	275	4.9	60- 90
3.2 x 350	160	5.0	90-140

Phoenix Cel 70

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 2 C 25	E6010

Characteristics and field of use

Cellulose covered electrode for vertical down circumferential welds in pipeline constructions. Excellent weldability in root, hot, fill and cap pass welding. Easy slag removal.
Particularly suitable for root pass welding (DC ±); also in the vertical up position. CTOD, HIC and HSCC tested.
Do not redry!

Materials

API5L: Grade A, B, X 42 - X 56 and root pass welding up to X 70;
EN 10208-2: L290MB-, L360MB- and root pass welding up to L485MB- and NB qualities;
EN 10113-3: S275ML, S355ML, S275NL, S355NL

Typical analysis in %

C	Si	Mn
0.14	0.18	0.55

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –20 °C	–40 °C
AW	420	510	22	80	50	28
SR	380	510	22	90	55	28

Welding position



Polarity for root pass = + / = –

Approvals

TÜV (Certificate No. 0247)
ABS (AWS E6010)
GL (3)
Controlas (0420)
DB (Reg. form No. 10.132.44)
LR (3/3Y)
DNV (3)
VNIIST

Packaging, weights and amperages

Dimensions (mm)	pcs./can	kg/can	Amperage A
2.5 x 300	530	7.3	50- 80
3.2 x 350	330	8.8	80-130
4.0 x 350	220	9.0	120-180
5.0 x 350	150	9.2	160-220

Phoenix Cel 75

Covered electrode

Classifications

EN 499	AWS A 5.5
E 42 2 C 25	E7010-P1

Characteristics and field of use

Cellulose covered electrode for vertical down circumferential welds in pipeline constructions. Excellent weldability in root, hot, fill and cap pass welding. Easy slag removal.
Particularly suitable for root pass welding (DC ±); also in the vertical up position.
CTOD, HIC and HSCC tested. Do not redry!

Materials

API5L: Grade B, X 42 - X 60 and root pass up to X 70;
EN 10208-2: L290MB-, L360MB- and root pass L485MB- and NB-qualities;
EN 10113-3: S275ML, S355ML, S275NL, S355NL

Typical analysis in %

C	Si	Mn
0.15	0.20	0.60

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –20 °C	–30 °C
AW	420	530	22	80	55	28

Welding position



Polarity for root pass = + / = –

Approvals

TÜV (Certificate No. 3199)
Controlas (0334)
LR (3/3Y)

Packaging, weights and amperages

Dimensions (mm)	pcs./can	kg/can	Amperage A
3.2 x 350	330	8.8	80-130
4.0 x 350	220	9.0	120-180
5.0 x 350	150	9.2	160-220

Phoenix Cel 80

Covered electrode

Classifications

EN 499	AWS A 5.5
E 46 3 C 25	E8010-P1

Characteristics and field of use

Cellulose covered electrode for vertical down circumferential welds; for field welding of higher strength pipeline steels; excellent weldability in root, hot, fill and cap pass welding. Easy slag removal. Particularly suitable for root pass welding (DC ±), also in the vertical up position. Good bend and radiographic test results. High ductility of the welded joint and great safety against root pass cracking.
Do not redry!

Materials

API5L: X 42, X 46, X 52, X 56, X 60, X 65, X 70
and root pass up to X 80
EN 10208-2: L290MB-, L485MB- and root pass up to L555MB- and NB-Qualitäten
EN 10113-3: S355ML, S420ML, S460ML

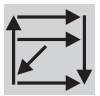
Typical analysis in %

C	Si	Mn	Ni
0.16	0.20	0.85	0.20

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –20 °C	–30 °C
AW	460	550	19	70	60	47

Welding position



Polarity = +
for root pass = –

Approvals

TÜV (Certificate No. 0536)
LR (3/3Y)
N.V. Nederlandse Gasunie
ABS (AWS E8010-P1)
Controlas (0316)

Packaging, weights and amperages

Dimensions (mm)	pcs./can	kg/can	Amperage A
3.2 x 350	330	9.0	80-130
4.0 x 350	220	9.0	140-190
5.0 x 350	150	9.3	160-220

Phoenix Cel 90

Covered electrode

Classifications

EN 499	AWS A 5.5
E 50 3 1 Ni C 25	E9010-G

Characteristics and field of use

Cellulose covered electrode for circumferential welds; developed for field welding of higher strength pipeline steels in the vertical down position.
Excellent weldability in root, hot, fill and cap pass welding. Easy slag removal. Good bend and radiographic test results. High ductility of the welded joint.
Do not redry!

Materials

API5L: X 60, X 65, X 70, (X 80)
EN 10208-2: L415MB-, L450MB-, L485MB-, (L555MB-) and NB-qualities
Phoenix Cel 90 is overmatching the X 60 and X 65 steels

Typical analysis in %

C	Si	Mn	Ni
0.18	0.20	0.85	0.75

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –20 °C	–40 °C
AW	530	630	18	70	55	47

Welding position



Polarity = +
for root pass = –

Approvals

TÜV (Certificate No. 0105)
Controlas (1068)

Packaging, weights and amperages

Dimensions (mm)	pcs./can	kg/can	Amperage A
3.2 x 350	330	8.9	80-140
4.0 x 350	220	9.0	140-190
5.0 x 350	150	9.4	160-220

Phoenix Chromo 1

Covered electrode

Classifications

EN 1599	AWS A 5.5
E CrMo1 B 4 2 H5	E8018-B2

Characteristics and field of use

Basic covered CrMo alloyed electrode.
Cryogenic, crack-free, suitable for quenching and tempering; resistant to caustic cracking; creep resistant in short time range up to 500 °C (932 °F) and in long time range up to 570 °C (1058 °F). Electrode for heavy-duty steam boiler and superheater tube fabrication; for quenched and tempered steels.
Redry for 2 h at 300 up to 350 °C (572 up to 662 °F).

Materials

13 CrMo 4-5, GS-22 CrMo 54, 42 CrMo 4

Typical analysis in %

C	Si	Mn	Cr	Mo	P	As	Sb	Sn
0.06	0.25	0.85	1.20	0.50	<0.012	<0.010	<0.005	<0.005

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –20 °C	–40 °C
SR (690 °C/10 h)	450	540	22	120	100	60
SR + SC	450	540	22	120	100	50

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 6535) Controlas (1073)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	195	4.2	80-100
3.2 x 350	125	4.3	110-145
4.0 x 350	90	4.6	130-190
5.0 x 450	60	6.1	160-230

Phoenix Grün (Sheet metal)

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 R 12	E6012

Characteristics and field of use

Rutile covered electrode for general tank construction and structural engineering. Particularly suitable for welding sheets in all positions (2.0/2.5 mm Ø also in f-position).
Soft arc; little spatter; excellent striking and restriking ability.
For use on small transformers (42 V, open circuit).

Materials

S235JRG2 - S355J2, weldable sheets

Typical analysis in %

C	Si	Mn
0.08	0.35	0.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	510	22	50

Welding position



Polarity = – / ~

Approvals

DB (Reg. form No. 10.132.10)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 250	350	3.2	50- 75
2.5 x 350	250	4.7	65-100
3.2 x 350	160	5.0	80-140

Phoenix Grün M

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RR 12	E6013

Characteristics and field of use

Rutile covered electrode.
Outstanding striking and restriking ability; soft arc; smooth weld appearance; easy slag release and low spatter losses; also useable in the vertical down position in diam. 2.0 + 2.5 mm.
For use in structural engineering, vehicle manufacture and tank construction.
For use on small transformers (42 V, open circuit).

Materials

S235JRG2 - S355J2, weldable sheet metal, primed metal (e.g. zinc-coated, primer-coated, roughly 40 µm)

Typical analysis in %

C	Si	Mn
0.09	0.30	0.50

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	510	22	50

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 3714)
DB (Reg. form No. 10.132.41)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	225	4.6	65-100
3.2 x 350	140	4.7	80-140
4.0 x 450	90	5.9	130-190
5.0 x 450	60	5.9	220-290

Phoenix Grün T

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RR 12	E6013

Characteristics and field of use

Rutile covered electrode. Very little spatter, self releasing slag; finely rippled, smooth welds with notch-free weld metal / parent metal interface. Unproblematical welding of general-purpose structural steels; also suitable for vertical down welding in diam. up to 2.0 mm. Outstanding striking and restriking ability.
For use on small transformers (42 V, open circuit).

Materials

S235JRG2 - S355J2; St 35; St 45; St 35.8; St 45.8;
boiler steels P235GH, P265GH, P295GH; shipbuilding steels;
fine grained structural steels up to P355N- and M-grades.
ASTM A36 and A53 Gr. all; A106 Gr. A, B, C; A135 Gr. A, B;
A283 Gr. A, B, C, D; A366; A285 Gr. A, B, C; A500 Gr. A, B, C;
A570 Gr. 30, 33, 36, 40, 45; A607 Gr. 45; A668 Gr. A, B;
A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50;
API 5 L Gr. B, X42-X56

Typical analysis in %

C	Si	Mn
0.08	0.35	0.55

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	510	22	60

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 0350)
RS (2)
BV (2Y)
GL (2)
Controlas (0113)
ÖBB
DB (Reg. form No. 80.132.01)
ABS (2 and as E 6013)
LR (2)
DNV (2)
FT (E 43 0 RR)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 250	325	3.1	45- 65
2.0 x 350	325	4.2	45- 65
2.5 x 250	200	3.0	60-100
2.5 x 350	200	4.3	60-100
3.2 x 350	125	4.5	85-140
3.2 x 450	125	5.6	85-140
4.0 x 350	80	4.4	130-200
4.0 x 450	80	5.6	130-200
5.0 x 450	50	5.3	230-300
6.0 x 450	35	5.4	280-370

Phoenix K 50

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 4 B 42	E7015

Characteristics and field of use

Basic covered electrode.
Good welding characteristics; smooth stable arc; cold toughness at temperatures as low as –40 °C (–40 °F); crack-free welding of steels with C contents up to 0.4 %; 115 % weld metal recovery. Suitable for use in tank construction, boiler making, apparatus engineering, vehicle manufacture and shipbuilding.
For welding high grade joints on fine grained strucural steels.
Redry for 2 h at 250 - 350 °C (482 - 662 °F).

Materials

S235JRG2 - S355J2, E335, C 35; boiler steels P235GH, P265GH, P295GH, P355GH; fine grained structural steels up to S420N; shipbuilding steels A, B, D, E; pipe steels P235, P265; X 42 - X 60; cast steel GS-38, GS-45, GS-52.

Typical analysis in %

C	Si	Mn
0.06	0.50	1.2

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–40 °C
AW	420	510	22	120	47
SR	380	490	27	130	47
N	295	440	28	130	

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1586)
ABS (3H10)
GL (3YHH)
DNV (3YH10)
DB (Reg. form No. 10.132.05)
BV (4Y40H10)
LR (3/3YH15)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	225	4.5	65- 95
3.2 x 350	125	4.3	90-130
3.2 x 450	125	5.7	90-130
4.0 x 350	80	4.3	140-180
4.0 x 450	80	5.5	140-180
5.0 x 450	55	6.0	190-250
6.0 x 450	40	6.0	220-315

Auch in Vakuumverpackung als “Extra Dry” lieferbar

Phoenix K 50 R

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 3 B 32	E7016

Characteristics and field of use

Basic covered electrode.
Very good welding characteristics for pipe root welding; fine droplet transfer; very pure weld metal; 110 % weld metal recovery; cold toughness at temperatures as low as –30 °C (–22 °F). Good weldability in out of position welding.
Specially intended for pipeline constructions; optimal for on site work; for pipe steels, boiler plates, pipeline steels and fine grained structural steels.
Redry for 2 h at 250 - 350 °C (482 - 662 °F).

Materials

Pipe steels P235, P265, X 42, X 46;
boiler steels P235GH, P265GH, P295GH;
fine grained structural steel up to S355N

Typical analysis in %

C	Si	Mn
0.06	0.55	0.95

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–30 °C
AW	420	510	22	120	47
SR	360	490	26	120	47
N	290	420	30	130	

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 1587)
ABS (3H10/3Y)
LR (3H15)
DB (Reg. form No. 10.132.18)
GL (3YHH)
DNV (3YH10)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	225	3.2	60-110
2.5 x 350	225	4.5	60-110
3.2 x 350	125	4.2	80-130
4.0 x 350	90	4.5	120-180

Also available in “Extra dry” vacuum packaging.

Phoenix K 90 S

Covered electrode

Classifications

EN 499	AWS A 5.1
E 46 4 B 32 H5	E7016

Characteristics and field of use

Basic covered electrode.
Good welding characteristics; clean weld metal with good toughness characteristics.
Prefered for rail joints and crossing frogs in railway and tramway trackage; suitable for rail grades with a tensile strength up to 1080 N/mm²; for mechanical engineering and tank construction.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

E295, E335, E360, C 45, C 60, GS-45, GS-52, GS-60, P295GH, P355GH
fine grained structural steels up to S355N;
rail steels with up to 1080 N/mm² tensile strength

Typical analysis in %

C	Si	Mn
0.07	0.40	1.35

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	470	540	22	120
SR	450	520	25	130
N	300	450	28	140

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 1807) DB (Reg. form No. 10.132.39)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 450	125	5.5	100-140
4.0 x 450	80	5.5	140-190
5.0 x 450	60	5.7	170-240
6.0 x 450	40	5.5	220-300

Phoenix NiMo 100

Basic covered electrode

Classifications

EN 757	AWS A 5.5
E 62 4 Mn 1 NiMo B 42 H5	E10018-G (E10018-D2 mod.)

Characteristics and field of use

Basic covered MnNiMo alloyed electrode.
Very low H_2-content ≤ 5 ml/100 g; extremely high resistance to cracking and high toughness at temperatures as low as –40 °C (–40 °F).
For creep resistant steels and cast steel grades, valves and oil tools according to sour gas specification; postweld heat treatment: stress relieving according to parent metal.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

GS-30CrMoV64, steels acc. ASTM A 487-4Q; AISI 4130

Typical analysis in %

C	Si	Mn	Mo	Ni
0.11	0.25	1.85	0.40	0.95

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
				–20 °C	–40 °C
SR	600	690	18	100	50	47

Welding position



Polarity = +

Packaging, weights and amperages

Dimensions (mm)	pcs./can	kg/can	Amperage A
3.2 x 350	220	7.8	100-150
4.0 x 350	160	8.2	140-200
4.0 x 450	160	10.5	140-200
5.0 x 450	90	9.8	180-250

Phoenix Nut K

Copper-coated graphite electrode

Characteristics and field of use

Phoenix Nut K is a copper coated graphite electrode; for preparing and gouging out weld grooves, and also for deburring and cutting of castings. This electrode can be used on metals of all types. It requires a special electrode holder with a combined current and compressed air supply and a heavy-duty converter or rectifier.
The compressor should be designed to provide a compressed air pressure of 6 to 8 bar. The electrode is guided forwards at high amperage at an angle of 25° to 45°.
High alloy steels are gouged with reverse polarity, depending on the alloy composition.

Welding position



Polarity = +

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
4.0 x 305	100	0.9	150-250
5.0 x 305	50	0.6	200-300
6.3 x 305	50	0.9	250-400
8.0 x 305	50	1.35	350-500
10.0 x 305	50	2.15	450-600

Phoenix Nut S

Covered electrode

Characteristics and field of use

Phoenix Nut S is a special electrode for gouging out grooves and slots and for fusion-cutting unalloyed steels, grey cast iron, light metals and non-ferrous metals.
This electrode is guided forwards at high amperage at an acute angle with a slight oscillating motion.

Welding position



Polarity = – / ~

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	100	3.7	130-180
4.0 x 350	60	3.5	170-230

Phoenix Rot AR 160

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 2 RA 53	E7024-1

Characteristics and field of use

Rutile acid covered high performance electrode with roughly 160 % weld metal recovery. Particularly high deposition rate; outstanding welding characteristics on alternating current; the weld metal exhibits good runout qualities also in tight corners. High radiographic soundness. Useable for gravity and autocontact welding; unproblematical for welding rusty and primer-coated plates.

Materials

S235JRG2 - S355J2;
boiler steels P235GH/P265GH/P295GH/P355GH;
fine grained structural steels up to P355N- and M-grades;
shipbuilding steels acc. A - E-grades, AH 32 - DH 36

Typical analysis in %

C	Si	Mn
0.08	0.28	0.75

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–20 °C
AW	420	510	22	75	50
SR	410	470	27	75	
N	295	390	27	80	

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 0535)
ABS (2, 2Y)
GL (3Y)
DNV (3)
FT (E 51 3 AR)
DB (Reg. form No. 10.132.29)
BV (3Y40)
LR (3, 3Y)
Controlas (0938)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 450	80	5.0	120-160
4.0 x 450	60	5.7	160-240
5.0 x 450	40	5.9	250-350
6.0 x 450	25	5.3	280-450
4.5 x 700	100	18.1	200-260
5.0 x 700	90	21.5	230-300
6.0 x 700	60	20.5	290-380

Phoenix Rot BR 160

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 2 RB 53	E7028

Characteristics and field of use

Rutil basic covered high performance electrode with 160 % weld metal recovery. Easy slag removal; fine rippled smooth welds; particularly good welding characteristics on primer-coated plates. Among other applications useable for gravity and autocontact welding.

Materials

S235JRG2 - S355J2;
boiler steels P235GH/P265GH/P295GH;
fine grained structural steels up to P355N- and M-grades;
shipbuilding steels acc. A - E-grades, AH 32 to NVE 36

Typical analysis in %

C	Si	Mn
0.08	0.30	0.85

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–20 °C
AW	430	510	22	90	47
SR	400	470	27	85	47

Welding position



Polarity = + / – / ~

Approvals

TÜV (Certificate No. 1700)
ABS (3, 3Y)
GL (3Y)
Controlas (0760)
RS (3, 3Y)
DNV (Gr. 3. up to and incl. NVE36)
DB (Reg. form No. 10.132.36)
BV (3Y40)
LR (3, 3Y)
FT (E 51 3 B)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 450	80	5.3	120-170
4.0 x 450	55	5.4	180-230
5.0 x 450	35	5.4	240-300
5.0 x 700	85	21.3	200-240
6.0 x 450	25	5.5	290-390

Also available in “Extra dry” vacuum packaging.

Phoenix Rot R 160

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RR 53	E7024-1

Characteristics and field of use

Rutile covered high performance electrode with 160 % weld metal recovery. Little spatter; fine rippled weld pattern; good striking and restriking ability; self releasing slag. Well suited for thin fillet welds.

Materials

S235JRG2 - S355J2;
boiler steels P235GH/P265GH/P295GH/P355GH
fine grained structural steels up to P355N- and M-grades;
shipbuilding steels acc. A - E-grades, AH 32 - DH 36; ASTM A36 Gr. all; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A366; A570 Gr. 30, 33, 36, 40, 45; A607 Gr. 45; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50

Typical analysis in %

C	Si	Mn
0.07	0.35	0.65

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN 0 °C
AW	420	510	22	80 47
SR	410	470	26	85
N	295	390	27	70

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 0349)
ABS (2 and as E 7024)
BV (3Y)
LR (2)
FT (E 51 2 RR)
ÖBB
DB (Reg. form No. 10.132.09)
GL (2Y)
DNV (2)
Controlas (0499)
RS (2)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 450	80	5.3	120-160
4.0 x 450	55	5.6	160-230
5.0 x 450	40	5.9	250-340
6.0 x 450	25	5.6	300-400

Phoenix Rot R 160 S

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RR 53	E7024

Characteristics and field of use

Rutile covered high performance electrode with 160 % weld metal recovery. Low spatter; fine rippled weld pattern; good striking and restriking ability; self releasing slag. The weld metal is outstandingly compressible. The covered electrode can be used in the vertical down position on inclines as great as 15°.

Materials

S235JRG2 - S355J2;
boiler steels P235GH/P265GH/P295GH/P355GH;
fine grained structural steels up to P355N- and M-grades;
shipbuilding steels acc. A - E-grades, AH 32 - DH 36

Typical analysis in %

C	Si	Mn
0.07	0.35	0.60

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN 0 °C
AW	420	510	22	70 47
SR	410	470	26	70
N	295	390	27	65

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1495)
BV (2Y)
LR (2, 2Y)
Controlas (0200)
ABS (2)
GL (2Y)
DNV (2)
RS (2 Y)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 450	80	5.4	120-160
4.0 x 450	55	5.6	160-240
5.0 x 450	40	6.0	250-350
6.0 x 450	25	5.5	280-450

Phoenix SH Blau

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RR 11	E6013

Characteristics and field of use

Rutile cellulose covered electrode.
Easy striking and restriking; preferred for tack-welding; good gap-bridging capability. For use in general structural engineering and steel, tank and apparatus construction; all purpose.
Also weldable in the vertical down position in diameters up to 3.2 mm.

Materials

S235JRG2 - S355J2; boiler steels P235GH, P265GH; pipe steels P235, P265; ASTM A36 and A53 Gr. all;
A106 Gr. A, B, C; A135 Gr. A, B; A283 Gr. A, B, C, D; A366;
A285 Gr. A, B, C; A500 Gr. A, B, C; A570 Gr. 30, 33, 36, 40, 45;
A607 Gr. 45; A668 Gr. A, B;
A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50;
API 5 L Gr. B, X42-X52

Typical analysis in %

C	Si	Mn
0.08	0.40	0.60

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	510	22	55

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 0342)
GL (2Y)
DB (Reg. form No. 80.132.03)
LR (2)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 250	375	3.3	45- 70
2.5 x 350	250	4.7	60- 95
3.2 x 350	150	4.7	90-135
4.0 x 350	100	4.7	140-180
5.0 x 450	70	6.6	190-230

Phoenix SH Chromo 2 KS

Covered electrode

Classifications

EN 1599	AWS A 5.5
E CrMo2 B 4 2 H5	E9015-B3

Characteristics and field of use

Basic covered CrMo alloyed electrode.
Extra low content of trace elements; step-cooling tested; not sensitive to long term embrittlement. Manufacture of chemical apparatus, hydrocrackers; for welding work on heavy-duty boilers, superheaters, superheater lines; for welding of CrMo and CrMoV alloyed steels for the petrochemical industry.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

10 CrMo 9-10, 12 CrMo 9-10, 10 CrSiMoV 7, 15 CrMoV 5-10;
ASTM A335 Gr. P22, A217 Gr. WC9

Typical analysis in %

C	Si	Mn	Cr	Mo	P	As	Sb	Sn
0.07	0.25	0.70	2.20	0.90	≤0.012	≤0.010	≤0.005	≤0.005

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –30 °C	–40 °C
SR	440	550	22	130	90	80
V	310	460	24	130	–	–
SR+step-cooling	440	550	22	130	80	60

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1823)
FT (EV19H)
Controlas (0492)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	225	3.2	70-100
3.2 x 350	125	4.2	100-145
4.0 x 350	90	4.5	140-190
5.0 x 450	60	5.9	160-240

Auch in Vakuumverpackungen als “Extra Dry” lieferbar

Phoenix SH Gelb

Covered electrode

Classifications

EN 499	AWS A 5.1
E 35 0 A 12	E6020

Characteristics and field of use

Iron oxide covered electrode.
Very easy slag release; fine droplet metaltransfer; easy handling when making concave fillet welds.
Also suitable for cutting applications; the C-content of the materials to be welded should not exceed 0.22 %.

Materials

S235JRG2 - S355J2; boiler steels P235GH, P265GH; GS-38, GS-45, St 35, St 45

Typical analysis in %

C	Si	Mn
0.09	0.15	0.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	360	460	22	60

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1589) DB (Reg. form No. 10.132.01)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 450	150	6.2	110-160
4.0 x 450	90	5.9	140-200
5.0 x 450	60	6.0	170-280
6.0 x 450	40	5.8	250-330

Phoenix SH Gelb B

Covered electrode

Classifications

EN 499	AWS A 5.1
E 38 2 RB 12	E6013

Characteristics and field of use

Rutile basic electrode.
Good weldability for root, fill and cap pass welding; excellent vertical up characteristics. Particularly suitable for radiographically sound welding in pipeline, boiler and tank construction.
Application prefered with thin diameters.
Suitable for use on primer-coated plates (up to 40 µm).

Materials

S235JRG2 - S355J2, P265, P295;
shipbuilding steels appr.-grade 3H;
boiler steels P235GH, P265GH, P295GH

Typical analysis in %

C	Si	Mn
0.08	0.20	0.55

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	460	22	75
SR	360	430	24	55

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1590)	DB (Reg. form No. 10.132.08)
ABS (3H 15)	GL (3H)
LR (3)	DNV (3)
Controlas (1441)	ÖBB

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	225	3.0	60-100
2.5 x 350	225	4.5	60-100
3.2 x 350	125	4.1	90-135
3.2 x 450	125	5.4	90-135
4.0 x 450	90	5.8	140-190
5.0 x 450	60	6.0	180-250
6.0 x 450	40	5.7	250-290

Phoenix SH Gelb R

Covered electrode

Classifications

EN 499	AWS A 5.1
E 38 2 RB 12	E6013

Characteristics and field of use

Rutile basic electrode.
Excellent vertical up welding characteristics; easy handling in out of position work; particularly suitable for fabricating radiographically sound circumferential pipe welds;
good porosity-free root weld fusion, also in tight air gaps.
Useable in pipeline, boiler and tank construction, structural steel work and shipbuilding.

Materials

S235JRG2 - S355J2, P295, P265;
shipbuilding steels appr.-grade 3;
boiler steels P235GH, P265GH, P295GH;
ASTM A36 and A53 Gr. all; A106 Gr. A, B, C; A135 Gr. A, B;
A283 Gr. A, B, C, D; A366; A285 Gr. A, B, C; A500 Gr. A, B, C;
A570 Gr. 30, 33, 36, 40, 45; A607 Gr. 45; A668 Gr. A, B;
A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50;
API 5 L Gr. B, X42-X52

Typical analysis in %

C	Si	Mn
0.08	0.20	0.55

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation ($L_0=5d_0$) %	Impact values in J CVN
AW	380	460	22	75

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1591)
ABS (3, 3Y)
GL (3Y)
DNV (3)
DB (Reg. form No. 10.132.20)
BV (3Y)
LR (3, 3Y)
Controlas (0533)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 250	375	3.3	30- 75
2.5 x 250	225	3.1	40- 90
2.5 x 350	225	4.4	40- 90
3.2 x 350	125	4.3	90-130
4.0 x 350	90	4.6	140-190
4.0 x 450	90	5.8	140-190
5.0 x 450	60	6.2	190-250

Phoenix SH Gelb S

Covered electrode

Classifications

EN 499	AWS A 5.1
E 38 0 RA 12	E6013

Characteristics and field of use

Rutile acid type mixed electrode.
High current carrying capacity and deposition rate; easy removable, porous slag; high depositing-speed. Useable in general purpose structural steel work, machine- and shipbuilding, and boiler and tank constructions; particularly suitable for fillet welds, narrow “V”angles and rusty workpieces.

Materials

S235JRG2 - S355J2; GS-38, GS-45, GS-52;
shipbuilding steels appr.-grade 3;
boiler steels P235GH, P265GH, P295GH

Typical analysis in %

C	Si	Mn
0.09	0.20	0.55

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation ($L_0=5d_0$) %	Impact values in J CVN
AW	380	460	22	60

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1592)
GL (2)
DNV (3)
DB (Reg. form No. 10.132.25)
LR (2)
Controlas (0279)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 450	125	5.5	100-145
4.0 x 450	90	5.9	140-200
5.0 x 450	55	5.8	180-280
6.0 x 450	40	5.9	250-330

Phoenix SH Gelb T

Covered electrode

Classifications

EN 499	AWS A 5.1
E 38 0 RA 12	E6013

Characteristics and field of use

Rutile acid type mixed electrode.
High current carrying capacity and deposition rate; high depositiong speed; also useable for semi machine spring loaded and gravity arc welding (dimensions upon request). Good vertical-up welding characteristics. Useable for welding joints in general purpose structural steel work, machine and ship building, and boiler and tank constructions.

Materials

S235JRG2 - S355J2; GS-38, GS-45, GS-52;
shipbuilding steels appr.-grade 3;
boiler steels P235GH, P265GH, P295GH

Typical analysis in %

C	Si	Mn
0.08	0.25	0.60

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	460	22	60

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1593)
ABS (3)
GL (3)
DNV (3)
DB (Reg. form No. 10.132.03)
BV (3Y)
LR (3)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	125	4.3	100-135
3.2 x 450	125	5.6	100-135
4.0 x 450	90	5.9	140-200

Phoenix SH Grün K 50 W

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 5 B 32 H5	E7018-1

Characteristics and field of use

Basic covered electrode.
Very good welding characteristics in out of position work; calm depositing on AC (70 V, open circuit); H_2-content ≤ 5 ml/100 g; high toughness at subzero temperatures as low as –50 °C (–58 °F); high temperature resistant up to 350 °C (662 °F). CTOD-tested to temperatures as low as –10 °C (14 °F). Suitable for use in offshore engineering, shipbuilding, steel-framed structures, for boiler, container, vehicle and apparatus applications. Redry for 2 h at 250 - 350 °C (482 - 662 °F).

Materials

S235JRG2 - S355J2, E295, E335, C 35, P265, P295, GS-38, GS-45; shipbuilding steels A - E, AH - EH, offshore steels; boiler steels P235GH, P265GH, P295GH; fine grained structural steels up to S355N

Typical analysis in %

C	Si	Mn
0.08	0.50	1.2

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
					–50 °C
AW	420	510	22	120	47
SR	360	490	26	120	47

Welding position



Polarity ~ / = +

Approvals

TÜV (Certificate No. 1824)
ABS (3H10/3Y)
LR (3/3YH15)
Controlas (0040)
DB (Reg. form No. 10.132.12)
BV (4Y40H5)
DNV (3YH10)
GL (3YH10)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	200	4.1	65- 90
3.2 x 350	110	4.1	100-140
4.0 x 450	90	5.8	140-190
5.0 x 450	60	5.9	180-260

Also available in “Extra dry” vacuum packaging.

Phoenix SH Grün K 52 W

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 5 B 12 H5	E7016-1

Characteristics and field of use

Basic covered electrode.
Very good welding characteristics on AC (70 V, open circuit) and DC with straight and reverse polarity; good root welding ability; high toughness at subzero temperatures as low as –50 °C (–58 °F); H_2-content ≤ 5 ml/100 g.
Suitable for use in steel framed structures, shipbuilding, apparatus engineering and pipeline fabrication.
Redry for 2 h at 250 - 350 °C (482 - 662 °F).

Materials

S235JRG2 - S355J2, E295, E355, C 35;
boiler steels P235GH, P265GH, P295GH, P355GH;
shipbuilding steels A - E, AH - EH, pipe steels P265, P295;
fine grained structural steels up to S355N,
API 5L: X 42, X 46, X 53, X 56, X 60; ASTM A27 and A36 Gr. all, A53 Gr. A-B, A106 Gr. A-C, A179, A192, A210 Gr. A-1, A214, A242 Gr. 1-5, A266 Gr. 1, 2, 4, A283 Gr. A, B, C, D, A285 Gr. A, B, C,
A299 Gr. A, B, A328, A366, A515 Gr. 60, 65, 70, A516 Gr. 55, A570 Gr. 30, 33, 36, 40, 45, A572 Gr. 42, 50, A606 Gr. all, A607 Gr. 45, A656 Gr. 50, 60, A668 Gr. A, B, A907 Gr. 30, 33, 36, 40, A841, A851 Gr. 1, 2, A935 Gr. 45, A936 Gr. 50

Typical analysis in %

C	Si	Mn
0.07	0.40	1.15

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –50 °C
AW	420	510	22	120 47
SR	400	500	26	130 47

Welding position



Polarity ~ / = + / –

Approvals

ABS (3H10/3Y)
LR (3/3YH15)
DNV (3YH10)
GL (3YHH)
Controlas (0614)
FT (E 51 3 B(H))

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	200	4.4	60-100
3.2 x 350	125	4.2	80-130
4.0 x 450	100	5.9	130-180
5.0 x 450	60	5.7	170-250

Also available in “Extra dry” vacuum packaging.

Phoenix SH Grün K 70

Basic covered electrode

Classifications

EN 499	AWS A 5.5
E 46 4 B 42 H5	E8018-G

Characteristics and field of use

Basic covered electrode.
Outstanding good welding characteristics for the welding of low alloy steels with high strength; very pure weld metal; high toughness also at low temperatures; weld metal recovery around 115 %; suited for out of position work. Useable in mechanical engineering, tank construction and permanent way applications. Good weldability of free cutting steels. Suited for steels with high C-content.
Redry for 2 h at 250 - 350 °C (482 - 662 °F).

Materials

E295, E335, E360, GS-45 - GS-60, P295GH, P355GH, fine grained structural steels up to S420N; ASTM A27 and A36 Gr. all, A214, A225 Gr. C, A242 Gr. 1-5, A266 Gr. 1, 2, 4, A283 Gr. A, B, C, D, A285 Gr. A, B, C, A299 Gr. A, B, A328, A366, A515 Gr. 16, 65, 70, A516 Gr. 55, A517 Gr. A, B, C, E, F, H, J, K, M, P, A570 Gr. 30, 33, 36, 40, 45, A572 Gr. 42, 50, A606 Gr. all, A607 Gr. 45, A656 Gr. 50, 60, A668 Gr. A, B, A907 Gr. 30, 33, 36, 40, A841, A851 Gr. 1, 2, A935 Gr. 45, A936 Gr. 50; API 5 L Gr. B, X42-X60

Typical analysis in %

C	Si	Mn
0.07	0.35	1.60

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –40 °C
AW	470	540	22	120 47
SR	450	520	25	130 47
N	300	450	28	140

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 1751)
ABS (3H10/3Y)
LR (3/3YH15)
DB (Reg. form No. 10.132.06)
GL (3Y38HH)
DNV (3YH10)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	190	4.4	75-100
3.2 x 350	125	4.7	115-150
3.2 x 450	125	6.2	115-150
4.0 x 450	90	6.2	130-200
5.0 x 450	60	6.3	190-270
6.0 x 450	40	5.9	220-330

Phoenix SH Grün K 70 W

Covered electrode

Classifications

EN 499	AWS A 5.5
E 46 4 B 32 H5	E8018-G

Characteristics and field of use

Basic covered electrode.
Very good welding characteristics on AC (70 V, open circuit); resistant to temperatures as low as –40 °C (–40 °F);
115 % weld metal recovery. Suitable for use on unalloyed and low alloy steels in mechanical engineering, tank construction and railway applications; crack-free weld metal when welding carbon steels with high C content.
Redry for 2 h at 250 - 350 °C (482 - 662 °F).

Materials

E295, E335, E360, C 45, C 60, GS-45, GS-52, GS-60, P295GH, P355GH, fine grained structural steels up to S420N

Typical analysis in %

C	Si	Mn
0.07	0.40	1.40

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
					–40 °C
AW	470	540	22	120	47
SR	450	520	25	130	47
N	300	450	28	140	

Welding position



Polarity ~ / = +

Approvals

DB (Reg. form No. 10.132.13)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	200	4.3	65-110
3.2 x 450	125	5.6	100-140
4.0 x 450	80	5.4	125-190
5.0 x 450	55	5.7	180-260

Phoenix SH Grün TB

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RR 12	E6013

Characteristics and field of use

Rutile covered universal electrode.
Good striking and re-striking ability; easy slag detachability and low spatter loss. Finely ripped, smooth welds with notch-free metal/parent metal interface. Easy welding of general purpose structural steel within the approvals which are mentioned below. Weldmetal shows more ductility than RR6 types.

Materials

S235JRG2 - S355J2, P265, P295;
boiler steels P235GH, P265GH, P295GH

Typical analysis in %

C	Si	Mn
0.08	0.35	0.70

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	510	22	65

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1496) DB (Reg. form No. 10.132.23)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 250	350	3.3	45- 65
2.5 x 350	200	4.3	60-100
3.2 x 350	125	4.5	85-140
3.2 x 450	125	5.8	85-140
4.0 x 450	70	5.0	130-195
5.0 x 450	50	5.5	200-290
6.0 x 450	35	5.3	280-370

Phoenix SH Kupfer 3 KC

Covered electrode

Classifications

EN 1599	AWS A 5.5
E ZCrMoV1 B 4 2 H5	E9015-G

Characteristics and field of use

Basic covered CrMoV alloyed electrode.
Good welding characteristics; uniform weld pattern; easy slag removal. Useable on low alloy creep resistant cast steel of the same composition.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

GS-17 CrMoV 511, GS-17 CrMo 55; creep resistant and similar cast steel; G17CrMoV5-10 (1.7706)

Typical analysis in %

C	Si	Mn	Cr	Mo	V
0.13	0.40	1.0	1.4	1.05	0.25

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
SR	520	630	18	40
V	450	610	18	40

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 3187)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 450	125	5.7	90-140
4.0 x 450	90	5.8	140-190
5.0 x 450	60	6.0	180-240

Phoenix SH Lila R

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 2 RB 12	E6013

Characteristics and field of use

Rutile basic electrode.
Outstanding vertical-up welding characteristics; easy handling in out-of-position; even in small gaps or overhead position good, pore-free welding is possible. Particularly suitable for radiographically sound welding of circumferential welds on conduit pipes. Suitable for pipeline, boiler, tank, ship construction and general structural engineering.

Materials

S235JRG2 - S355J2, P265, P295, L360,
fine grained structural steels up to P355N;
shipbuilding steels corresp. to app.-grade 3, boiler steels P235GH, P265GH, P295GH;
ASTM A36 and A53 Gr. all; A106 Gr. A, B, C; A135 Gr. A, B; A283 Gr. A, B, C, D; A366; A285 Gr. A, B, C; A500 Gr. A, B, C; A570 Gr. 30, 33, 36, 40, 45; A607 Gr. 45; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50;
API 5 L Gr. B, X42-X52

Typical analysis in %

C	Si	Mn
0.09	0.20	0.65

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	510	22	25

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1596)
GL (2)
DNV (2)
DB (Reg. form No. 10.132.22)
LR (2)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 250	400	3.4	50- 70
2.5 x 250	250	3.5	60- 90
2.5 x 350	250	4.9	60- 90
3.2 x 350	125	4.2	90-130
4.0 x 350	90	4.5	140-190
5.0 x 450	60	6.2	190-250

Phoenix SH Multifer 130

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RR 53	E7014

Characteristics and field of use

Rutile covered high performance electrode with 140 % weld metal recovery. Little spatter; self releasing slag; useable in diameters up to 4 mm for welding in the overhead and horizontal position; outstanding striking and restriking ability. Well suited for thin fillet welds.

Materials

S235JRG2 - S355J2;
boiler steels P235GH/P265GH/P295GH/P355GH;
fine grained structural steels up to P355N- and M-grades;
shipbuilding steels acc. A - E-grades, AH 32 - DH 36

Typical analysis in %

C	Si	Mn
0.07	0.40	0.60

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	0 °C
AW	420	510	22	70	47
SR	410	470	27	70	
N	295	390	27	60	

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 0583)
ABS (2)
DNV (2)
Controlas (26696)
GL (2Y)
DB (Reg. form No. 10.132.28)
BV (2Y)
LR (2)
ÖBB

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
4.0 x 450	65	6.1	180-220
5.0 x 450	45	6.1	240-320

Phoenix SH Multifer 180

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RR 73	E7024

Characteristics and field of use

Rutile covered high performance electrode with 180 % weld metal recovery.
High deposition rate; good strike and restrike ability; low spatter; partly self releasing slag; finely rippled weld pattern.
Preferred for fillet welds. Useable for shipbuilding, mechanical and structural engineering.

Materials

S235JRG2 - S355J2;
boiler steels P235GH/P265GH/P295GH/P355GH;
fine grained structural steels up to P355N- and M-grades;
shipbuilding steels acc. A - E-grades, AH 32 - DH 36;
ASTM A36 Gr. all; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A366;
A570 Gr. 30, 33, 36, 40, 45; A607 Gr. 45; A668 Gr. A, B;
A907 Gr. 30, 33, 36, 40; A935 Gr. 45; A936 Gr. 50

Typical analysis in %

C	Si	Mn
0.07	0.33	0.70

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	0 °C
AW	420	510	22	70	47

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1598)
ABS (2)
GL (2Y)
DNV (2)
FT (E 51 2 RR)
DB (Reg. form No. 10.132.07)
BV (2Y)
LR (2, 2Y)
Controlas (1009)
RS (2, 2Y)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 450	80	5.4	120-180
4.0 x 450	55	5.8	180-220
5.0 x 450	30	5.0	250-330
6.0 x 450	25	5.9	280-450

Phoenix SH Ni 2 K 70

Covered electrode

Classifications

EN 499	AWS A 5.5
E 46 6 2 Ni B 42 H5	E8018-C1

Characteristics and field of use

Basic covered MnNi alloyed electrode for cryogenic steels.
Cold tough at subzero temperatures as low as –80 °C (–112 °F); NDT-tested. Useable in tank construction (LPG-tanks).
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

fine grained structural steels S275N - S420N;
low temperature grades S275NL - S420NL;
low temperature special grades P275NL2 - P355NL2, S420NL, 12 Ni14 G 1, X 12 Ni 5; 11 MnNi 5-3; 13 MnNi 6-3;
ASTM A633 Gr. E; A572 Gr. 65; A203 Gr. D,
A333 and A334 Gr. 3, A350 Gr. LF3

Typical analysis in %

C	Si	Mn	Ni
0.06	0.30	1.15	2.10

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
					–80 °C
AW	470	560	26	140	47
SR	450	540	28	140	47

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1599)
BV (5Y40)
LR (3/3YH15)
ABS (2 Ni [-60])
GL (7Y42HH)
DNV (5YH10)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	225	3.3	70-110
3.2 x 350	125	4.5	100-150
4.0 x 350	90	4.7	140-200
5.0 x 450	55	6.0	170-250

Phoenix SH Ni 2 K 90

Covered electrode

Classifications

EN 757	AWS A 5.5
E 55 5 2 NiMo B 42 H5	E10018-M

Characteristics and field of use

Basic covered NiMo alloyed electrode.
For cryogenic, high strength, fine grained structural steels.
H_2-content ≤ 5 ml/100 g (HD); not sensitive to cold cracking.
For use in structural steel and tank construction; naval shipbuilding.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

High strength, quenched and tempered fine grained structural steels such as S550QL, HY 80, 12 MnNiMo 55 (Welmonil 35), 11 NiMoV 53 (Welmonil 43);
ASTM A225 Gr. C, A514 and A517 Gr. A, B, C, E, F, H, J, K, M, P, A656, A678 Gr. C

Typical analysis in %

C	Si	Mn	Mo	Ni
0.06	0.25	1.40	0.45	1.80

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
					–50 °C
AW	580	690	20	130	47
SR	570	650	21	130	47

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 0547)
GL (6Y55HH)
DB (Reg. form No. 10.132.34)
WIWEB (for HY 80 acc. AWS A 5.5)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	225	4.4	70-100
3.2 x 350	125	4.5	90-140
4.0 x 350	90	4.6	140-190
4.0 x 450	90	5.9	140-190
5.0 x 450	55	5.9	180-250

Also available in “Extra dry” vacuum packaging.

Phoenix SH Ni 2 K 100

Covered electrode

Classifications

EN 757	AWS A 5.5
E 69 5 Mn 2 NiCrMo B 42 H5	E11018-G (E11018-M mod.)

Characteristics and field of use

Basic covered NiCrMo alloyed electrode.
Low H_2-content ≤ 5 ml/100 g (HD) in the weld metal;
very low moisture pickup during long term storage.
For high strength fine grained structural steels, for cast steel qualities; weld metal insensitive to cold cracking.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

Quenched and tempered fine grained structural steels up to 720 N/mm² yield point.
High strength fine grained structural steels S620QL - S690QL, S620QL1, S690QU, HY 100, Suprafort 700, N-AXTRA 56, 63, 70

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.06	0.20	1.60	0.38	0.40	1.85

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–50 °C
AW	700	750	18	120	47
SR	690	740	19	120	47

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 0548)
GL (6Y69HH)
BV (4Y69H5)
DB (Reg. form No. 10.132.35)
WIWEB (for HY100 + Suprafort700)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	225	4.7	70-100
3.2 x 350	125	4.3	90-140
4.0 x 450	90	6.0	140-190
5.0 x 450	55	5.8	180-250

Also available in “Extra dry” vacuum packaging.

Phoenix SH Ni 2 K 130

Covered electrode

Classifications

EN 757	AWS A 5.5
E 89 4 Mn 2 Ni 1 CrMo B 42 H5	E12018-G (E12018-M mod.)

Characteristics and field of use

Basic covered NiCrMo alloyed electrode.
Low H_2-content ≤ 5 ml/100 g (HD) in the weld metal.
For high strength fine grained structural steels.
Suitable for bridge building, steel and crane construction; the weld metal is insensitive to cold cracking.
Redry for 2 h at 300 up to 350 °C (572 - 662 °F)

Materials

Quenched and tempered high strength fine grained structural steels, such as X-ABO 90 (S890QL)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.08	0.40	1.45	0.80	0.50	2.20

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–45 °C
AW	880	920	18	90	47

Welding position



Polarity = +

Approvals

DB (Reg. form No. 10.132.46)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	125	4.4	90-140
4.0 x 450	90	6.0	140-190
5.0 x 450	60	6.0	170-240

Also available in “Extra dry” vacuum packaging.

Phoenix SH Patinax Kb

Covered electrode

Classifications

EN 499	AWS A 5.5
E 38 3 Z 1 NiCu B 42	E7015-G

Characteristics and field of use

Basic covered NiCu alloyed special electrode.
For the welding of weathering and fine grained structural steels.
Store dry. Redry for 2 h at 250 - 350 °C (482 - 662 °F).

Materials

S235J0W, S235J2W, S355J2G1W, such as for example COR-TEN A, COR-TEN B, Patinax 37 etc.;
ASTM A36, A283 Gr. B, C

Typical analysis in %

C	Si	Mn	Ni	Cu
0.05	0.30	0.65	0.60	0.40

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	390	480	22	150
SR	370	450	27	160
N	300	410	30	190

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1600) DB (Reg. form No. 10.132.24)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	125	4.4	90-140
3.2 x 450	125	5.7	90-140
4.0 x 450	80	5.6	140-190
5.0 x 450	60	6.1	170-240

Phoenix SH Schwarz 3 K

Covered electrode

Classifications

EN 1599	EN 499	AWS A 5.5
E Mo B 4 2 H5	E 50 4 Mo B 42	E7015-G (E7015-A1 mod.)

Characteristics and field of use

Basic covered electrode for welding high strength and creep resistant joints.
High temperature resistant up to 500 °C (932 °F) and creep resistant up to 550 °C (1022 °F); high strength and cracking resistance; very low H_2-content ≤5 ml/100 g.
For welding creep resistant joints in boilers, tanks and pipeline constructions, especially suited for boiler steel 16 Mo 3.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

boiler steels P235GH, P265GH, P295GH, P355GH, 16 Mo 3, 15 NiCuMoNb 5, 17 MnMoV 64, 13 MnNiMo 54, 20 MnMoNi 45;
FK-steels S355N - S460N, P355NH - P460NH, P355NL1 - P460NL1;
pipe steels L360NB - L415NB, L360MB - L485MB

Typical analysis in %

C	Si	Mn	Mo
0.08	0.30	1.20	0.45

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
					–40 °C
AW	490	570	20	120	47
SR	480	550	21	120	47
N	295	470	24	130	

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1829)
DB (Reg. form No. 10.132.14 and 20.132.15)
ABS (3H15) GL (3Y46HH)
DNV (3YH10) Controlas (0432)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	225	4.4	70-100
3.2 x 350	125	4.2	110-140
4.0 x 350	90	4.4	130-190
5.0 x 450	55	5.6	160-230
6.0 x 450	40	5.7	220-310

Auch in Vakuumverpackungen als “Extra Dry” lieferbar

Phoenix SH Schwarz 3 K Ni

Covered electrode

Classifications

EN 499	AWS A 5.5
E 50 4 1 NiMo B 42 H5	E9018-G

Characteristics and field of use

Basic covered NiMo alloyed electrode with a weld metal of special metallurgical purity for nuclear reactor construction. Quality controlled according to KTA 1408.2; very low H_2-content ≤ 5 ml/100 g; NDT-tested. Used preferably for the welding of steels in the construction of nuclear reactors, boiler and pressure vessels; for fine grained structural steels up to S500Q.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

20 MnMoNi 55, 22 NiMoCr 37, ASTM A 508 Cl 2,
ASTM A 533 Cl 1 Gr. B, 15 NiCuMoNb 5 S 1 (WB 36),
GS-18 NiMoCr 37, 11 NiMoV 53 (Welmonil 43),
12 MnNiMo 55 (Welmonil 35), S420N - S500Q, P460NH;
ASTM A302 Gr. A-D; A517 Gr. A, B, C, E, F, H, J, K, M, P;
A225 Gr. C; A572 Gr. 65

Typical analysis in %

C	Si	Mn	Mo	Ni	Cu	P	S
0.06	0.30	1.25	0.40	0.95	≤0.08	≤0.01	≤0.01

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
					−40 °C
AW	540	620	20	140	50
SR	500	590	21	140	47

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 0512+8100) Controlas (1491)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	200	4.3	70-110
3.2 x 350	125	4.4	100-150
4.0 x 350	90	4.6	140-200
5.0 x 450	50	5.5	170-250

Phoenix SH Schwarz 3 MK

Covered electrode

Classifications

EN 1599	EN 499	AWS A 5.5
E Mo B 4 2 H5	E 50 4 Mo B 42	E7018-G (E7018-A1 mod.)

Characteristics and field of use

Basic covered electrode.
Very good welding characteristics in out of position work; easy slag removal; cold toughness at temperatures as low as −40 °C (−40 °F). High temperature resistant up to 500 °C (932 °F) and creep resistant up to 550 °C (1022 °F).
Particularly suitable for circumferential welds in conduit pipes as well as boiler, pressure vessel, header and nuclear reactor fabrication.
Redry for 2 h at 250 - 350 °C (482 - 662 °F).

Materials

Boiler steels P235GH, P265GH, P295GH,16 Mo 3,
20 MnMo 45, 16 Mo 5, 15 NiCuMoNb 5, 17 MnMoV 64;
fine grained structural steels S355N - S460N, P355NH - P460NH, P355NL1 - P460NL1;
pipe steels L360NB - L415NB, L360MB - L485MB, X 52 - X 70;
ASTM A 355 Gr. P1; A161-94 Gr. T1; A217 Gr. WC1;
A182M Gr. F1; A204M Gr. A, B, C; A250M Gr. T1

Typical analysis in %

C	Si	Mn	Mo
0.06	0.35	1.20	0.45

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
					−40 °C
AW	490	570	20	120	47
SR	480	550	21	120	47
N	295	470	24	130	

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 0902) DB (Reg. form No. 10.132.31)
ABS (3H15) LR (3/3Y)
DNV (3YH15) FT (EV 17 H)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	200	3.2	70-110
3.2 x 350	125	4.3	100-140
4.0 x 350	90	4.6	140-190
4.0 x 450	90	6.0	140-190
5.0 x 450	60	6.2	180-250

Phoenix SH Schwarz 3 TR

Covered electrode

Classifications

EN 1599	AWS A 5.5
E Mo R 1 2	E8013-G

Characteristics and field of use

Rutile covered Mo alloyed electrode with basic additions. Very good root welding ability; creep resitant to temperatures as high as 500 °C (932 °F); non-porous weld metal and easy handling in out of position work.
Useable on unalloyed and Mo-alloyed pipe and boiler steels. Suitable in boiler constructions.

Materials

P295GH, P355GH, 16 Mo 3, P265,
X 46, X 52, X 60
ASTM A355 Gr. P1; A161-94 Gr. T1; A182M Gr. F1;
A204M Gr. A, B, C; A250M Gr. T1

Typical analysis in %

C	Si	Mn	Mo
0.08	0.25	0.55	0.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	530	22	50
SR	430	520	22	55
N	330	460	24	60

Welding position



Polarity = – / ~

Approvals

TÜV (Certificate No. 1603)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	225	3.2	60- 90
2.5 x 350	225	4.5	60- 90
3.2 x 350	125	4.1	90-130
4.0 x 350	90	4.6	130-180

Phoenix SH V 1

Covered electrode

Classifications

EN 499	AWS A 5.5
E 50 6 Mn 1 Ni B 42 H5	E8018-G (E8018-C3 mod.)

Characteristics and field of use

Basic covered MnNi alloyed electrode. High toughness at temperatures as low as –60 °C (–76 °F). High radiographical soundness; H_2-content ≤ 5 ml/100 g (HD). CTOD-tested at temperatures as low as –10 °C (14 °F), NDT tested. Particularly suitable for welding fine grained structural steels, for steel construction and bridge building applications, gas storage spheres, conduit pipes.

Materials

fine grained structural steels S355N - S500Q;
low temperature fine grained structural steels P355NL1 - S500QL; low temperature special grades P355NL2 - S500QL1;
general purpose structural steels;
pipe steels L360NB - L415NB, L360MB - L485MB, X 52 - X 70;
ASTM A516 Gr. 65; A572 Gr. 55, 60, 65; A633 Gr. E; A612;
A718 Gr. I; A537 Gr. 1-3

Typical analysis in %

C	Si	Mn	Ni
0.07	0.25	1.50	0.95

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–60 °C
AW	500	580	23	140	50
SR	470	560	25	140	50
N	295	440	27	140	

Welding position



Stromart = +

Approvals

TÜV (Certificate No. 0531)
GL (6Y46HH)
DNV (5Y42H10)
DB (Reg. form No. 10.132.37)
LR (5Y40H15)
Controlas (0439)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	200	4.4	70-110
3.2 x 350	115	4.4	100-150
4.0 x 350	90	4.6	140-200
4.0 x 450	85	5.4	140-200
5.0 x 450	60	6.3	170-250
6.0 x 450	40	6.0	220-310

Also available in “Extra dry” vacuum packaging.

Phoenix SH V 370

Covered electrode

Classifications

EN 499	AWS A 5.5
E 46 6 1 Ni B 42 H5	E8018-C3

Characteristics and field of use

Basic covered Ni alloyed electrode.
Very pure weld metal quality controlled to KTA 1408.2; H_2-content of weld metal ≤ 5 ml/100 g; high toughness values at low temperatures, NDT-tested; CTOD-tested to temperatures as low as –10 °C (–14 °F). Preferred for welding nuclear reactor fabrication steels such as 15 MnNi 63;
for fine grained steels up to S420N (S420NL and P355NL2).
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

15 MnNi 63 (TSB 370), C 22.8 S1, GS-C 25; fine grained structural steels S275N - S420N; low temperature fine grained structural steels S275NL - S420NL;
low temperature special grades P275NL2 - P355NL2;
general purpose structural steels, boiler plates and pipe steels

Typical analysis in %

C	Si	Mn	Ni
0.06	0.25	1.15	0.95

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–60 °C
AW	470	550	25	160	50
SR	420	510	26	160	50

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 2199+8011)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	200	4.4	70-110
3.2 x 350	125	4.4	100-150
4.0 x 350	90	4.6	140-200
5.0 x 450	55	6.0	180-250

Phoenix Spezial D

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 3 B 12 H10	E7016

Characteristics and field of use

Double covered basic electrode. Outstanding welding characteristics on AC and DC in all positions except the vertical down; stable arc, good radiographic soundness.
Useable in handicraft and industry for field and workshop applications.
Redry for 2 h at 250 - 300 °C (482 - 572 °F).

Materials

S235JRG2 - S355J2, boiler steels P235GH, P265GH, P295GH, P355GH; fine grained structural steels up to S355N;
pipe steels St 35, St 35.8, L210 - L360NB, GS-52, L290MB - L360MB; ASTM A27 and A36 Gr. all, A214, A242 Gr. 1-5, A266 Gr. 1, 2, 4, A283 Gr. A, B, C, D, A285 Gr. A, B, C, A299 Gr. A, B, A328, A366, A515 Gr. 60, 65, 70, A516 Gr. 55, A570 Gr. 30, 33, 36, 40, 45, A572 Gr. 42, 50, A606 Gr. all, A607 Gr. 45, A656 Gr. 50, 60, A668 Gr. A, B, A907 Gr. 30, 33, 36, 40, A841, A851 Gr. 1, 2, A935 Gr. 45, A936 Gr. 50;
API 5 L Gr. B, X42-X56

Typical analysis in %

C	Si	Mn
0.06	0.65	1.05

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–30 °C
AW	440	550	22	80	50
SR	400	520	25	80	50

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 3282)
Controlas (0088)
BV (4Y40H10)
FT (E423B12)
LR (3/3Y)
DB (Reg. form No. 10.132.42)
ABS (3H10)
DNV (3YH10)
GL (3YH10)
Rina

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	205	4.0	60- 90
3.2 x 350	125	4.1	95-150
3.2 x 450	125	5.2	95-150
4.0 x 450	80	5.1	140-190
5.0 x 450	50	5.0	190-250

Also available in “Extra dry” vacuum packaging.

Phoenix 120 K

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 5 B 32 H5	E7018-1

Characteristics and field of use

Basic covered electrode. Very good welding characteristics including out of position work; 120 % weld metal recovery; H_2-content in the weld metal ≤5 ml/100 g; very pure cryogenic weld metal at temperatures as low as –50 °C (–58 °F); CTOD tested up to –10 °C (14 °F). Suitable for use in structural steel work, boiler making, tank construction, ship and bridge building and vehicle manufacture; particularly suitable for welding fine grained structural steels. Excellent weldability on offshore steels. Redry for 2 h at 250 - 350 °C (482 - 662 °F).

Materials

S235JRG2 - S355J2, E295, E335, C 35; boiler steels P235GH, P265GH, P295GH, P355GH; fine grained structural steels up to S420N; shipbuilding steels A, B, D, E; offshore steels; pipe steels P265, P295, L290NB - L415NB, L290MB - L415MB; X 42 - X 60; cast steel GS-38, GS-45, GS-52; ageing resistant steels ASt 35 - ASt 52; ASTM A27 and A36 Gr. all, A214, A242 Gr. 1-5, A266 Gr. 1, 2, 4, A283 Gr. A, B, C, D, A285 Gr. A, B, C, A299 Gr. A, B, A328, A366, A515 Gr. 60, 65, 70, A516 Gr. 55, A570 Gr. 30, 33, 36, 40, 45, A572 Gr. 42, 50, A606 Gr. all, A607 Gr. 45, A656 Gr. 50, 60, A668 Gr. A, B, A907 Gr. 30, 33, 36, 40, A841, A851 Gr. 1, 2, A935 Gr. 45, A936 Gr. 50;

Typical analysis in %

C	Si	Mn
0.07	0.35	1.20

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–50 °C
AW	420	510	22	120	47
SR	400	500	26	130	47
N	295	440	30	140	

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 0348)	DB (Reg. form No. 10.132.17)	
ABS (3H10/3Y)	BV (4Y40H5)	GL (3YHH)
LR (3/3YH15)	DNV (3YH10)	Controlas (0172)
FT (E 51 3 B (H))	RS (3/3Y)	Inspecta

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 250	275	3.0	45- 65
2.5 x 250	200	3.3	65-110
2.5 x 350	200	4.2	65-110
3.2 x 350	115	4.5	100-145
3.2 x 450	115	5.8	100-145
4.0 x 350	90	4.8	135-200
4.0 x 450	90	6.3	135-200
5.0 x 450	60	6.3	180-280
6.0 x 450	40	6.0	240-375
8.0 x 450	26	6.3	290-420

Also available in “Extra dry” vacuum packaging.

Phoenix 6013

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 0 RC 11	E6013

Characteristics and field of use

Rutile cellulose covered electrode.
General purpose; useable in all positions; excellent gap-bridging and arc-striking ability; for tack-welding and bad fit-ups; excellent vertical down characteristics.

Materials

S235JRG2 - S355J2, GS-38, GS-45; P265
boiler steels P235GH, P265GH, P295GH; shipbuilding steels corresp. to app.-grade 2; fine grained structural steels up to P355N; weldable reinforcing steel bars

Typical analysis in %

C	Si	Mn
0.09	0.35	0.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	510	22	50

Welding position



Polarity = – / ~

Approvals

ABS (Grade 2)
LR (Grade 2/2Y)
DNV (Grade 2)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	279	5.0	70-110
3.2 x 350	173	5.0	110-160
4.0 x 350	113	5.0	140-200
5.0 x 450	80	6.9	170-280

Phoenix 7018

Covered electrode

Classifications

EN 499	AWS A 5.1
E 42 5 B 32 H5	E7018-1

Characteristics and field of use

Basic covered electrode with very good welding characteristics including out of position work; weld metal recovery about 120 %; crack-free weld metal when welding high-carbon steels. Suitable for use in tank construction, boilermaking, apparatus engineering, vehicle manufacture and shipbuilding.
Redry for 2 h at 250-350 °C (482-662 °F).

Materials

S235JRG2 - S355J2, E295, E355, C 35; boiler steels P235GH, P265GH, P295GH, P355GH; fine grained structural steels up to S420N; shipbuilding steels A, B, D, E; offshore steels; pipe steels P265, P295; L290NB - L415NB, L290MB - L415MB; X 42 - X 60; cast steel GS-38, GS-45, GS-52;

Typical analysis in %

C	Si	Mn
0.07	0.35	1.20

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–50 °C
AW	420	510	25	120	47
SR	400	500	26	130	47
N	295	440	30	140	

Welding position



Polarity = + / ~

Approvals

ABS (3H10/3Y)
DNV (3YH10)
Controlas (0484)
LR (3/3YH15)
GL

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	200	4.2	65-100
3.2 x 350	110	4.3	100-145
3.2 x 450	110	5.5	100-145
4.0 x 350	80	4.5	135-200
4.0 x 450	80	5.8	135-200
5.0 x 450	55	5.7	180-280
6.0 x 450	40	7.0	240-375

Thermanit Chromo 9 V

Covered electrode

Classifications

EN 1599	AWS A 5.5
E CrMo91 B 4 2 H5	E9015-B9

Characteristics and field of use

Basic covered CrMoVNb alloyed electrode.
Good welding characteristics in out of position work; high temperature resistant weld metal. For quenched and tempered 9 % chromium steels, in particular P 91 / T 91 according to ASTM.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

For quenched and tempered 9 % chromium steels, in particular P91 / T91 according to ASTM.
X10CrMoVNb91 (1.4903), A 213-T91, A 335-P91, A 387 Gr. 91 (plates), A 182 F91 (forgings).

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	V	Nb	N
0.09	0.2	0.6	9.0	1.1	0.8	0.2	0.05	0.04

Creep and stress rupture properties

according to base metal P91

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
760 °C/2 h	550	680	17	47
760 °C/4 h	530	620	17	47

Welding instruction

Preheating / Interpass temperature	Cooling down before PWHT	PWHT
200 - 250 °C / 200 - 300 °C	≤100 °C	760 °C/2 h

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 6173) Controlas (1353)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	225	3.2	70-100
3.2 x 350	125	4.4	100-145
4.0 x 350	90	4.5	140-190
5.0 x 450	60	5.9	160-240

Also available in “Extra dry” vacuum packaging.

Thermanit Chromo T 91

Basic covered electrode

Classifications

EN 1599	AWS A 5.5
E CrMo 91 B 42 H5	E9018-B9

Characteristics and field of use

Thermanit Chromo T 91 is a basic coated, low hydrogen electrode for vertical up welding with very good welding characteristics on AC and DC ±. Excellent weldability in root pass welding on DC.
Redry for 2 h at 300 - 350 °C (572-662 °F)

Materials

For quenched and tempered 9 % chromium steels, in particular P91 / T91 according to ASTM.
X10CrMoVNb91 (1.4903), A 213-T91, A 335-P91, A 387 Gr. 91 (plates), A 182 F91 (forgings).

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	V	Nb	N
0.09	0.3	0.6	9.0	1.0	0.6	0.2	0.05	0.04

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
760 °C* / 2 h	550	680	17	47

Welding instruction

Preheating / Interpass temperature	Cooling down before PWHT	PWHT
200 - 250 °C / 200 - 300 °C	≤100 °C	760 °C/2 h

Welding position



Polarity = + / – ; ≈

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	100	2.0	70- 90
3.2 x 350	55	1.9	90-130
4.0 x 350	35	1.8	130-170
5.0 x 450	23	2.4	170-240

Thermanit MTS 4

Basic covered electrode

Classifications

EN 1599
E CrMoWV12 B 4 2 H5

Characteristics and field of use

High temperature resistant up to 550 °C (1022 °F), resistant to scaling up to 600 °C (1112 °F). For surfacing and joining applications on matching/similar high temperature 12 % Cr steels/cast steel grades, suitable for quenching and tempering.

Materials

Base materials acc. TÜV approval
X20CrMoV12-1 (1.4922) X20CrMoWV12-1 (1.4935)
X22CrMoV12-1 (1.4923) X19CrMoVNb11-1 (1.4913)
(Turbotherm, 20MVNb), GX22CrMoV12-1 (1.431)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	W	V
0.18	0.3	0.6	11.0	1.0	0.6	0.5	0.3

Creep and stress rupture properties

In the range of matching high temperature resistant parent metal

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
760 °C / 4 h	590	700	15	35

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Parent materials	Preheating	Postweld heat treatment
High temperature martensitic steels/cast steel grades	According to wall thickness: 250-450 °C (482-842 °F)	For smaller welding jobs, cool slowly to 120 °C (248 °F) (i.e. furnace). Tempering for approx. 4h 720-760 °C (1328-1400 °F) / air or quench and temper 1050 °C (1922 °F) / air or oil + 4h 700-760 °C (1292-1400 °F) / air. For larger welding jobs: intermediate stress-relieving at first from welding temperature 2h 550 °C (1022 °F) max. 580 °C (1076 °F) cool slowly to 120 °C (248 °F), tempering or quenching and tempering as above

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1898)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	240	3.4	60- 80
3.2 x 350	140	4.9	90-120
4.0 x 350	95	4.8	110-140
5.0 x 450	60	6.2	150-180

Thermanit MTS 616

Basic covered electrode

Classifications

EN 1599	AWS A 5.5
E ZCrMoWVNb9 0,5 2 B 4 2 H5	E9015-G (E9015-B9 mod.)

Characteristics and field of use

Creep resistant.

Basic covered CrMoNiVWNb alloyed electrode.
Good welding characteristics in out of position work; high temperature resistant matching weld metal.
For the welding of high temperature martensitic steels in particular P 92 according to ASTM A 355.
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

ASTM A355 Gr. P92 (T92), A213 Gr. T 92, NF 616

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	V	W	Nb	N
0.11	0.2	0.6	8.8	0.5	0.7	0.2	1.6	0.05	0.05

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
760 °C / 2 h	560	720	15	41

Welding instruction

Preheating / Interpass temperature	Cooling down before PWHT	PWHT
200 - 250 °C / 200 - 300 °C	≤100 °C	760 °C/2 h

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 9289)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	220	3.7	70-100
3.2 x 350	135	4.7	90-140
4.0 x 350	95	4.7	130-180

Also available in “Extra dry” vacuum packaging.

Thermanit MTS 911

Basic covered electrode

Classifications

EN 1599	AWS A 5.5	Mat. No.
E ZCrMoWVNb9 1 1 B 4 2 H5	E9015-G (E9015-B9 mod.)	1.4905

Characteristics and field of use

Creep resistant.

Basic covered CrMoNiVWNb alloyed electrode.
Good welding characteristics in out of position work;
high temperature resistant matching weld metal.
For the welding of high temperature resistant martensitic steels in particular X11CrMoWVNb9-1-1 (E911).
Redry for 2 h at 300 - 350 °C (572 - 662 °F).

Materials

X11CrMoWVNb9-1-1 (1.4905); E911;
ASTM A355 Gr. P911 (T911), A213 Gr. T911

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	V	W	Nb	N
0.11	0.25	0.6	8.8	1.0	0.7	0.2	1.0	0.05	0.05

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
760 °C / 2 h	560	720	15	41

Welding instruction

Preheating / Interpass temperature	Cooling down before PWHT	PWHT
200 - 250 °C / 200 - 300 °C	≤100 °C	760 °C/2 h

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 7991)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	220	3.7	70-100
3.2 x 350	135	4.7	90-140
4.0 x 350	95	4.7	130-180

Also available in “Extra dry” vacuum packaging.

Thermanit P23

Basic covered electrode

Classifications

EN 1599	AWS A 5.5 - 96
E ZCr2WV B 42 H5	E9015-G

Characteristics and field of use

Creep resistant.

Basic covered medium alloyed electrode for the welding of similar creep resistant materials. Good welding characteristics even in out-of-postion welding.
Redry for 2h at 300 - 350 °C (572 - 662 °F).

Field of use is the welding of creep resistant steels in boiler, tank and pipeline construction and reactor fabrication.

Materials

ASM Grade P23; HCM 2S

Typical analysis in %

C	Si	Mn	Cr	W	V	Nb
0.06	0.2	0.5	2.2	1.7	0.22	0.05

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
740 °C / 2 h	540	620	19	130

Welding instruction

Preheating / Interpass temperature	Cooling down before PWHT	PWHT
180 - 220 °C / 200 - 280 °C	<200 °C	740 °C/2 h

Welding position



Polarity = +

Approvals

TÜV

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	200	3.2	70-100
3.2 x 350	125	4.4	100-145
4.0 x 350	85	4.6	140-190

Thermanit P24

Basic covered electrode

Classifications

EN 1599	AWS A 5.5 - 96
E ZCrMo2VNb B 42 H5	E9015-G

Characteristics and field of use

Creep resistant.

Basic covered medium alloyed electrode for the welding of similar creep resistant materials. Good welding characteristics even in out-of-postion welding.
Redry for 2h at 300 - 350 °C (572 - 662 °F).

Field of use is the welding of creep resistant steels in boiler, tank and pipe construction and reactor fabrication.

Materials

7CrMoVTiB10-10(1.7378); ASTM Grade T/P24

Typical analysis in %

C	Si	Mn	Cr	Mo	V	Nb/Ti
0.07	0.2	0.5	2.2	1.0	0.22	0.04

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
740 °C / 2 h	560	660	18	130

Welding instruction

Preheating / Interpass temperature	Cooling down before PWHT	PWHT
200 - 220 °C / 200 - 280 °C	<200 °C	760 °C/2 h

Welding position



Polarity = +

Approvals

TÜV

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	200	3.2	70-100
3.2 x 350	125	4.4	100-145
4.0 x 350	85	4.6	140-190

SMAW Covered electrodes (high alloyed)

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for the welding of stainless steels	80, 82, 92-99, 102-105, 108-130, 134-135, 138-142, 144-145, 148-149
for the welding of Duplex stainless steels	134-135, 138-139
for the welding of heat resistant steels	83, 84-90, 100-105, 110-113, 116-117, 131-133, 143, 146-147
for the welding of high temperature resistant steels	81, 102-105, 147-149
for the welding of cryogenic steels	97-99, 102-105, 122-123, 148-149
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for the welding of nickel and nickel base alloys	102-105, 108-109, 145, 147-149

Summary
SMAW Covered electrodes (high alloyed)

Page	Brand name	Material No.	EN / •EN ISO	AWS	Page
for the welding of stainless steels					
80	Thermanit A Spezial	1.4576	1600 E 19 12 3 Nb B 2 2	A 5.4 E318-15	80
82	Thermanit AW	1.4576	1600 E 19 12 3 Nb R 3 2	A 5.4 E318-17	82
92	Thermanit GE Spezial	1.4430	1600 E 19 12 3 L B 2 2	A 5.4 E316L-15	92
93	Thermanit GEW 316L-17	1.4430	1600 E 19 12 3 L R 3 2	A 5.4 E316L-17	93
94	Thermanit GEW/F	1.4430	1600 E 19 12 3 L R 1 5	A 5.4 E316L-16	94
95	Thermanit HE Spezial	1.4551	1600 E 19 9 Nb B 2 2	A 5.4 E347-15	95
96	Thermanit HW	1.4551	1600 E 19 9 Nb R 3 2	A 5.4 E347-17	96
97	Thermanit JE Spezial	1.4316	1600 E 19 9 L B 2 2	A 5.4 E308L-15	97
98-99	Thermanit JEW 308L-17	1.4316	1600 E 19 9 L R 3 2	A 5.4 E308L-17	98-99
102-103	Thermanit Nicro 82	2.4648	•14172 E Ni 6082 (NiCr20Mn3Nb)	A 5.11 ENiCrFe -3 (mod.)	102-103
104-105	Thermanit Nicro 182	2.4620	•14172 E Ni 6182 (NiCr15Fe6Mn)	A 5.11 ENiCrFe -3	104-105
108-109	Thermanit Nimo C 24	2.4609	•14172 E Ni 6059 (NiCr23Mo16)	A 5.11 ENiCrMo-13	108-109
110-111	Thermanit X	1.4370	1600 E 18 8 Mn B 2 2	A 5.4 E307-15 (mod.)	110-111
112-113	Thermanit XW	1.4370	1600 E 18 8 Mn R 1 2	A 5.4 E307-16 (mod.)	112-113
114	Thermanit 13/04	1.4351	1600 E 13 4 B 2 2	A 5.4 E410NiMo-15	114
115	Thermanit 14 K	1.4018	1600 E 13 1 B 2 2	A 5.4 E410-15 (mod.)	115
116-117	Thermanit 17	1.4015	1600 E 17 B 2 2	A 5.4 E430-15	116-117
118-119	Thermanit 17/06	≈ 1.4405	1600 E Z17 6 B 2 2	–	118-119
120-121	Thermanit 18/17 EW	≈ 1.4440	1600 E 18 16 5 N L R 1 2	A 5.4 E317L-17 (mod.)	120-121
122-123	Thermanit 19/15 H	1.4455	1600 E 20 16 3 Mn N L B 2 2	A 5.4 E316L-15 (mod.)	122-123
124-125	Thermanit 20/10 W	1.4431	1600 E 20 10 3 R 3 2	A 5.4 E308Mo-17 (mod.)	124-125
126-127	Thermanit 20/10 W 140 K	1.4431	1600 E 20 10 3 R 5 3	A 5.4 E308Mo-17 (mod.)	126-127
128	Thermanit 20/16	≈ 1.3954	1600 E Z20 16 3 Mn N L R 1 2	–	128
129	Thermanit 20/16 SM	≈ 1.3954	1600 E Z22 17 4 Mn N L R 1 2	–	129
130	Thermanit 20/25 CuW	1.4519	1600 E 20 25 5 Cu N L R 3 2	A 5.4 E385-16	130
134	Thermanit 22/09	≈ 1.4462	1600 E 22 9 3 N L B 2 2	A 5.4 E2209-15	134
135	Thermanit 22/09 W	≈ 1.4462	1600 E 22 9 3 N L R 3 2	A 5.4 E2209-17	135
138	Thermanit 25/09 CuT	≈ 1.4501	1600 E 25 9 4 N L B 2 2	A 5.4 E2553-15 (mod.)	138
139	Thermanit 25/09 CuW	–	1600 E Z25 9 3 Cu N L R 1 2	A 5.4 E2553-15 (mod.)	139
140-141	Thermanit 25/14 EW 309L-17	1.4332	1600 E 23 12 L R 1 2	A 5.4 E309L-17	140-141
142	Thermanit 25/22 H	≈ 1.4465	1600 E 25 22 2 L B 2 2	–	142
144	Thermanit 30/10 W	1.4337	1600 E 29 9 R 1 2	A 5.4 E312-16 (mod.)	144
145	Thermanit 30/40 EW	2.4653	•14172 E Ni 8025 (NiCr29Fe30Mo)	–	145
148-149	Thermanit 625	2.4621	•14172 E Ni 6625 (NiCr22Mo9Nb)	A 5.11 ENiCrMo-3	148-149
for the welding of Duplex stainless steels					
134	Thermanit 22/09	≈ 1.4462	1600 E 22 9 3 N L B 2 2	A 5.4 E2209-15	134
135	Thermanit 22/09 W	≈ 1.4462	1600 E 22 9 3 N L R 32	A 5.4 E2209-17	135
138	Thermanit 25/09 CuT	–	1600 E 25 9 4 N L B 2 2	A 5.4 E2553-15 (mod.)	138
139	Thermanit 25/09 CuW	–	1600 E Z25 9 3 Cu N L R 1 2	A 5.4 E2553-15 (mod.)	139

Summary
SMAW Covered electrodes (high alloyed)

Page	Brand name	Material No.	EN / •EN ISO	AWS	Page
for the welding of heat resistant steels					
83	Thermanit C	1.4842	1600	E 25 20 B 2 2	A 5.4 E310-15 (mod.) 83
84-85	Thermanit CM	≈ 1.4842	1600	E 25 20 B 2 2	A 5.4 E310-15 (mod.) 84-85
86	Thermanit CR	≈ 1.4846	1600	E 25 20 H B 2 2	A 5.4 E310H-15 (mod.) 86
87	Thermanit CW 310-16	1.4842	1600	E 25 20 R 1 2	A 5.4 E310-16 87
88-89	Thermanit D	1.4829	1600	E 22 12 B 2 2	A 5.4 E309-15 (mod.) 88-89
90	Thermanit DW	1.4829	1600	E 22 12 R 3 2	A 5.4 E309-17 90
100	Thermanit L	1.4820	1600	E 25 4 B 2 2	– 100
101	Thermanit LW	1.4820	1600	E 25 4 R 1 2	– 101
102-103	Thermanit Nicro 82	2.4648	•14172	E Ni 6082 (NiCr20Mn3Nb)	A 5.11 ENiCrFe-3 (mod.) 102-103
104-105	Thermanit Nicro 182	2.4620	•14172	E Ni 6182 (NiCr15Fe6Mn)	A 5.11 ENiCrFe-3 104-105
110-111	Thermanit X	1.4370	1600	E 18 8 Mn B 2 2	A 5.4 E307-15 (mod.) 110-111
112-113	Thermanit XW	1.4370	1600	E 18 8 Mn R 1 2	A 5.4 E307-16 (mod.) 112-113
116-117	Thermanit 17	1.4015	1600	E 17 B 2 2	A 5.4 E430-15 116-117
131	Thermanit 21/33	≈ 1.4850	1600	E Z21 33 Nb B 2 2	– 131
132-133	Thermanit 21/33 So	≈ 1.4850	1600	E Z21 33 Mn Nb B 2 2	– 132-133
143	Thermanit 25/35 R	1.4853	1600	E Z25 35 Nb B 2 2	– 143
146	Thermanit 35/45 Nb	–	•14172	E Ni Z 6152 (NiCr35Fe20Nb)	– 146
147	Thermanit 617	2.4628	•14172	E Ni 6617 (NiCr22Co12Mo)	A 5.11 ENiCrCoMo-1 (mod.) 147
for the welding of high temperature resistant steels					
81	Thermanit ATS 4	≈ 1.4948	1600	E 19 9 B H 2 2	A 5.4 E308H-15 81
65	Thermanit Chromo T91	–	1599	E CrMo 91 B 42 H5	A 5.5 E9018-B9 65
64	Thermanit Chromo 9 V	–	1599	E CrMo91 B 4 2 H5	A 5.5 E9015-B9 64
66	Thermanit MTS 4	–	1599	E CrMoWV12 B 4 2 H5	– 66
67	Thermanit MTS 616	–	1599	E ZCrMoWVNb9 0,5 2 B 4 2 H5	A 5.5 E9015-G (E9015-B9 mod.) 67
68	Thermanit MTS 911	–	1599	E ZCrMoWVNb9 1 1 B 4 2 H5	A 5.5 E9015-G (E9015-B9 mod.) 68
102-103	Thermanit Nicro 82	2.4648	•14172	E Ni 6082 (NiCr20Mn3Nb)	A 5.11 ENiCrFe-3 (mod.) 102-103
104-105	Thermanit Nicro 182	2.4620	•14172	E Ni 6182 (NiCr15Fe6Mn)	A 5.11 ENiCrFe-3 104-105
147	Thermanit 617	2.4628	•14172	E Ni 6617 (NiCr22Co12Mo)	A 5.11 ENiCrCoMo-1 (mod.) 147
148-149	Thermanit 625	2.4621	•14172	E Ni 6625 (NiCr22Mo9Nb)	A 5.11 ENiCrMo-3 148-149
for the welding of cryogenic steels					
97	Thermanit JE Spezial	1.4316	1600	E 19 9 L B 2 2	A 5.4 E308L-15 97
98-99	Thermanit JEW 308L-17	1.4316	1600	E 19 9 L R 3 2	A 5.4 E308L-17 98-99
102-103	Thermanit Nicro 82	2.4648	•14172	E Ni 6082 (NiCr20Mn3Nb)	A 5.11 ENiCrFe-3 (mod.) 102-103
104-105	Thermanit Nicro 182	2.4620	•14172	E Ni 6182 (NiCr15Fe6Mn)	A 5.11 ENiCrFe-3 104-105
122-123	Thermanit 19/15 H	1.4455	1600	E 20 16 3 Mn N L B 2 2	A 5.4 E316L-15 (mod.) 122-123
148-149	Thermanit 625	2.4621	•14172	E Ni 6625 (NiCr22Mo9Nb)	A 5.11 ENiCrMo-3 148-149

Summary
SMAW Covered electrodes (high alloyed)

Page	Brand name	Material No.	EN / •EN ISO	AWS	Page
for the welding of austenite ferrite joints					
84-85	Thermanit CM	≈ 1.4842	1600 E 25 20 B 2 2	A 5.4 E310-15 (mod.)	84-85
102-103	Thermanit Nicro 82	2.4648	•14172 E Ni 6082 (NiCr20Mn3Nb)	A 5.11 ENiCrFe-3 (mod.)	102-103
104-105	Thermanit Nicro 182	2.4620	•14172 E Ni 6182 (NiCr15Fe6Mn)	A 5.11 ENiCrFe-3	104-105
110-111	Thermanit X	1.4370	1600 E 18 8 Mn B 2 2	A 5.4 E307-15 (mod.)	110-111
112-113	Thermanit XW	1.4370	1600 E 18 8 Mn R 1 2	A 5.4 E307-16 (mod.)	112-113
124-125	Thermanit 20/10 W	1.4431	1600 E 20 10 3 R 3 2	A 5.4 E308Mo-17 (mod.)	124-125
126-127	Thermanit 20/10 W 140 K	1.4431	1600 E 20 10 3 R 5 3	A 5.4 E308Mo-17 (mod.)	126-127
136-137	Thermanit 23/11 MoZLW	1.4459	1600 E 23 12 2 L R 3 2	A 5.4 E309MoL-17	136-137
140-141	Thermanit 25/14 EW 309L-17	1.4332	1600 E 23 12 L R 1 2	A 5.4 E309L-17	140-141
144	Thermanit 30/10 W	1.4337	1600 E 29 9 R 1 2	A 5.4 E312-16 (mod.)	144
145	Thermanit 30/40 EW	2.4653	•14172 E Ni 8025 (NiCr29Fe30Mo)	–	145
148-149	Thermanit 625	2.4621	•14172 E Ni 6625 (NiCr22Mo9Nb)	A 5.11 ENiCrMo-3	148-149
for the welding of non magnetic steels					
120-121	Thermanit 18/17 EW	≈ 1.4440	1600 E 18 16 5 N L R 1 2	A 5.4 E317L-17 (mod.)	120-121
122-123	Thermanit 19/15 H	1.4455	1600 E 20 16 3 Mn N L B 2 2	A 5.4 E316L-15 (mod.)	122-123
128	Thermanit 20/16	≈ 1.3954	1600 E Z20 16 3 Mn N L R 1 2	–	128
129	Thermanit 20/16 SM	≈ 1.3954	1600 E Z22 17 4 Mn N L R 1 2	–	129
for the welding of cast materials					
91	Thermanit Fe Ni	–	•1071 E C Z NiFe-1	A 5.15 ENiFe-CI	91
106	Thermanit Ni 55	–	•1071 E C Z NiFe-1	A 5.15 ENiFe-CI	106
107	Thermanit Nickel A	–	•1071 E C Z NiCI	A 5.15 ENi-CI	107
for the welding of nickel and nickel base alloys					
102-103	Thermanit Nicro 82	2.4648	•14172 E Ni 6082 (NiCr20Mn3Nb)	A 5.11 ENiCrFe-3 (mod.)	102-103
104-105	Thermanit Nicro 182	2.4620	•14172 E Ni 6182 (NiCr15Fe6Mn)	A 5.11 ENiCrFe-3	104-105
108-109	Thermanit Nimo C 24	2.4609	•14172 E Ni 6059 (NiCr23Mo16)	A 5.11 ENiCrMo -13	108-109
145	Thermanit 30/40 EW	2.4653	•14172 E Ni 8025 (NiCr29Fe30Mo)	–	145
147	Thermanit 617	2.4628	•14172 E Ni 6617 (NiCr22Co12Mo)	A 5.11 ENiCrCoMo-1 (mod.)	147
148-149	Thermanit 625	2.4621	•14172 E Ni 6625 (NiCr22Mo9Nb)	A 5.11 ENiCrMo-3	148-149

Thermanit A Spezial

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 19 12 3 Nb B 2 2	E318-15	1.4576

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion resistant similar to matching stabilized CrNiMo steels. For joining and surfacing work with matching and similar stabilized and non stabilized austenitic CrNi(N)- and CrNiMo(N) steels and cast steel grades.

Materials

TÜV certified parent metal
X10CrNiMoNb18-12 (1.4583); AISI 316L, 316Ti, 316Cb

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Nb
<0.07	<0.5	1.3	19.0	2.8	12.0	>10xC

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	440	600	30	70

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to susceptibility to embrittlement

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 7663)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	240	4.2	50- 80
3.2 x 350	150	4.9	80-110
4.0 x 350	100	4.8	110-140
5.0 x 450	60	6.0	140-190

Thermanit ATS 4

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 19 9 H B 2 2	E308H-15	≈1.4948

Characteristics and field of use

High temperature resistant up to 700 °C (1292 °F); resistant to scaling up to 800 °C (1472 °F). For surfacing and joining applications on matching/similar high temperature resistant steels/cast steel grades.

Materials

TÜV certified parent metals
X6CrNi18-11 (1.4948) X12CrNiTi18-9 (1.4878)
X6CrNiNb18-10 (1.4550) AISI 304, 304H, 321H, 347H

Typical analysis in %

C	Si	Mn	Cr	Ni
0.05	0.3	1.6	18.5	9.5

Creep and stress rupture properties

In the range of matching high temperature resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	390	550	35	70

Structure

Austenite with approx. 5% ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	Up to 25 mm wall thickness: none. Over 25 mm wall thickness: max. 200 °C (392 °F) advisable	Up to 25 mm wall thickness: none. Over 25 mm wall thickness: to avoid stress corrosion cracking 1050 °C (1922 °F)/air

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1526) Controlas (0194)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	205	3.7	55- 80
3.2 x 350	145	4.7	80-105
4.0 x 350	95	4.4	90-135
5.0 x 450	65	5.9	150-190

Thermanit AW

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 19 12 3 Nb R 3 2	E318-17	1.4576

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion resistant similar to matching stabilized CrNiMo steels. For joining and surfacing work with matching and similar stabilized and non stabilized austenitic CrNi(N)- and CrNiMo(N) steels and cast steel grades.

Materials

TÜV certified parent metal
X10CrNiMoNb18-12 (1.4583); AISI 316L, 316Ti, 316Cb

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Nb
<0.03	<0.9	0.8	19.0	2.8	12.0	>10xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	440	550	30	60

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to susceptibility to embrittlement

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 0607) DB (Reg. form No. 30.132.09)
Controlas

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 300	340	3.9	40- 60
2.5 x 350	220	4.7	50- 90
3.2 x 350	130	4.5	80-120
4.0 x 350	85	4.5	110-160
5.0 x 450	60	6.0	140-200

Thermanit C

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 25 20 B 2 2	E310-15 (mod.)	1.4842

Characteristics and field of use

Resistant to scaling up to 1150 °C (2102 °F). For surfacing and joining applications on matching/similar heat resistant steels/cast steel grades. For tough fill layers beneath cap passes made with Thermanit L when welding thicker cross sections of Cr steels/cast steel grades to permit use of such steels in sulphureous atmospheres.

Atmosphere

	max. application temperature in °C (°F)	
	sulphur-free	max. 2 g S/Nm³
Air and oxidizing combustion gases	1150 (2102)	1100 (2012)
Reducing combustion gases	1080 (1976)	1040 (1904)

Materials

TÜV certified parent metal X15CrNiSi25-20 (1.4841);
AISI 305, 310, 314; ASTM A297HF, A297HJ

Typical analysis in %

C	Si	Mn	Cr	Ni
0.13	1.0	2.5	25.0	20.0

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	390	550	25	80

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/cast steel grades	According to parent metal	According to parent metal
Heat resistant matching/ similar steels/cast steel grades	None	None

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1232)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	250	4.0	55- 75
3.2 x 350	190	5.5	70-110

Thermanit CM

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 25 20 B 2 2	E310-15 (mod.)	≈1.4842

Characteristics and field of use

Resistant to scaling up to 1050 °C (1922 °F). For fabricating tough joints on heat resistant Cr and CrNi steels/cast steel grades. Suitable for austenitic ferritic joints at max. application temperature 300 °C (572 °F). Specially suited for fill and final pass welding (provided no sulphureous atmosphere is present) on plates clad with 1.4000 or 1.4002 metals.
Maximum application temperature 400 °C (752 °F).
If application temperatures are higher, use of Thermanit Nicro 82 / Thermanit Nicro 182 is advisable.

Materials

TÜV certified parent metals
X7CrAl13 (1.4002), austenitic steels to DIN 17440 and "AD-Merkblatt"/leaflet W2 combined with unalloyed steels to EN 10025 and EN 10028 as well as steels of the same strength level and similar composition

Typical analysis in %

C	Si	Mn	Cr	Ni
0.12	1.0	4.5	25.0	20.0

Creep and stress rupture properties

In the range of matching heat resistant parent materials

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation ($L_0=5d_0$) %	Impact values in J CVN
AW	380	400	550	30	80

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/ cast steel grades	According to parent metal	According to parent metal
Heat resistant CrNi steels/ cast steel grades	None	None
Joining of CrNi(MoN) austenitic with unalloyed/ low alloy steels/ cast steel grades	According to ferritic parent metal	Max. annealing temperature 300 °C (527 °F), otherwise carbide precipitation in weld fusion zone, loss of toughness (tendency to hot cracking)
Joining CrNi(MoN) austenitic and stainless and heat resistant Cr steels/cast steel grades	According to ferritic parent metal	According to parent metals. Attention must be paid to intercrystalline corrosion resistance and susceptibility of austenitic side to embrittlement
Cladded plates and cast materials with 14 % Cr metals	According to ferritic parent metal	Attention must be paid to intercrystalline corrosion resistance and susceptibility of austenitic side to embrittlement

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1314)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	245	4.0	55- 75
3.2 x 350	170	5.0	70-110
4.0 x 350	120	5.3	90-140
5.0 x 450	80	7.1	140-190

Thermanit CR

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 25 20 H B 2 2	E310H-15 (mod.)	≈1.4846

Characteristics and field of use

Resistant to scaling up to 1000 °C (1832 °F).
For surfacing and joining applications on matching heat resistant cast steel grades.

Materials

GX40CrNiSi25-20 (1.4848) GX40CrNiSi22-9 (1.4826)
GX40CrNiSi25-12 (1.4837)

Typical analysis in %

C	Si	Mn	Cr	Ni
0.40	1.0	2.5	25.5	21.5

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %
AW	400	450	600	10

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching heat resistant cast steel grades	None	None

Welding position



Polarity = +

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	145	4.8	80-105
4.0 x 350	95	4.8	90-135

Thermanit CW 310-16

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 25 20 R 1 2	E310-16	1.4842

Characteristics and field of use

Resistant to scaling up to 1150 °C (2102 °F). For surfacing and joining on matching/similar heat resistant steels/cast steel grades. For tough fill layers beneath cap passes made with Thermanit L when welding thicker cross sections of Cr steels/cast steel grades to permit use of steels in sulphureous atmospheres.

Atmosphere	max. application temperature in °C (°F) sulphur-free	max. 2 g S/Nm³
Air and oxidizing combustion gases	1150 (2102)	1100 (2012)
Reducing combustion gases	1080 (1976)	1040 (1904)

Materials

X15CrNiSi25-20 (1.4841) X12CrNi25-21 (1.4845)
X15CrNiSi20-12 (1.4828)
AISI 305, 310, 314; ASTM A297 HF; A297 HJ

Typical analysis in %

C	Si	Mn	Cr	Ni
0.1	0.5	2.0	26.0	21.0

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	410	570	35	80

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/cast steel grades	According to parent metal. Intermediate layer 100 °C (212 °F) max.	According to parent metal
Heat resistant matching/similar steels/cast steel grades	None	None

Welding position



Polarity = + / ~

Approvals

Controlas

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	220	4.0	55- 70
3.2 x 350	140	4.9	65-105
4.0 x 350	105	5.0	100-140
5.0 x 450	60	5.9	160-200

Thermanit D

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 22 12 B 2 2	E309-15 (mod.)	1.4829

Characteristics and field of use

Resistant to scaling up to 950 °C (1742 °F). For joining and surfacing applications on matching/similar heat resistant steels/ cast steel grades.

Atmosphere	max. application temperature in °C (°F) sulphur-free	max. 2 g S/Nm³	over 2 g S/Nm³
Air and oxidizing combustion gases	950 (1742)	930 (1706)	850 (1562)
Reducing combustion gases	900 (1652)	850 (1562)	

Materials

TÜV certified parent metal
X15CrNiSi20-12 (1.4828); AISI 305; ASTM A297HF

Typical analysis in %

C	Si	Mn	Cr	Ni
0.11	1.0	0.9	22.0	11.0

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	320	340	550	30	70

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/cast steel grades	According to parent metal	Annealing according to parent metal is not necessary if service temperature the same or higher
Matching austenitic steels/cast steel grades	None	None

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1249)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	280	4.2	55- 75
3.2 x 350	170	4.9	70-110
4.0 x 350	120	5.1	90-140
5.0 x 450	80	6.8	140-190

Thermanit DW

Rutile covered electrode

Classifications	EN 1600	AWS A 5.4	Mat. No.
	E 22 12 R 3 2	E309-17	1.4829

Characteristics and field of use

Resistant to scaling up to 950 °C (1742 °F). For joining and surfacing applications on matching/similar heat resistant steels/ cast steel grades.

Atmosphere	max. application temperature in °C (°F) sulphur-free	max. 2 g S/Nm³	over 2 g S/Nm³
Air and oxidizing combustion gases,	950 (1742)	930 (1706)	850 (1562)
Reducing combustion gases	900 (1652)	850 (1562)	

Materials

TÜV certified parent metal

X15CrNiSi20-12 (1.4828); AISI 305; ASTM A297HF

Typical analysis in %

C	Si	Mn	Cr	Ni
0.11	<0.9	0.8	22.5	12.5

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	320	340	550	30	55

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/cast steel grades	According to parent metal	Annealing according to parent metal is not necessary if service temperature the same or higher
Matching austenitic steels/cast steel grades	None	None

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 1315)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	220	4.5	50- 80
3.2 x 350	130	4.3	80-110
4.0 x 350	90	4.6	110-140
5.0 x 450	60	5.9	150-210

Thermanit Fe Ni

Basic covered electrode

Classifications	EN ISO 1071	AWS A 5.15
	E C Z NiFe-1	ENiFe-Cl

Characteristics and field of use

Covered electrode with iron nickel core; for joining of cast iron, nodular cast iron and special higher strength cast iron; weldmetal and interface are easily workable.
Suitable for hardfacing sealing faces; the strength of the weld metal is higher than that provided by the alloy type with a pure nickel core; for joining of steel, steel castings and cast materials as well as surfacing tougher materials; mild preheating is advisable.

Materials

GG10 up to GG40, GTS35 up to GTS65,
GTW335 up to GTW65, GGG40 up to GGG70

Typical analysis in %

C	Si	Mn	Ni	Fe
1.9	1.3	0.6	53.0	Balance

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB
				180

Welding position



Polarity = – / ~

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	265	5.0	55- 75
3.2 x 350	158	5.0	70-100
4.0 x 350	140	6.5	85-125

Thermanit GE Spezial

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 19 12 3 L B 2 2	E316L-15	1.4430

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion resistant similar to matching low carbon and stabilized austenitic 18/8 CrNiMo steels/cast steel grades.

For joining and surfacing applications with matching/similar – non stabilized and stabilized – austenitic CrNi(N) and CrNiMo(N) steels/cast steel grades. Well suited for out of position welding.

Materials

TÜV certified parent metals
X10CrNiMoNb18-12 (1.4583) X2CrNiMoN17-13-3 (1.4429)
S31653; AISI 316L, 316Ti, 316Cb

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
<0.04	0.2	1.3	18.5	2.8	11.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	320	350	550	35	70 (+20 °C) 40 (–105 °C)

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar non stabilized and stabilized steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to susceptibility to embrittlement

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 6521) DNV (316)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	240	4.0	50- 80
3.2 x 350	150	4.8	80-110
4.0 x 350	100	4.8	110-140

Thermanit GEW 316L-17

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 19 12 3 L R 3 2	E316L-17	1.4430

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °). Corrosion resistant similar to matching low carbon and stabilized austenitic 18/8 CrNiMo steels/cast steel grades.

For joining and surfacing applications with matching/similar – non stabilized and stabilized – austenitic CrNi(N) and CrNiMo(N) steels/cast steel grades.

Materials

TÜV certified parent metals
X10CrNiMoNb18-12 (1.4583) X2CrNiMoN17-13-3 (1.4429)
S31653; AISI 316L, 316Ti, 316Cb

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
<0.04	<0.9	0.8	19.0	2.8	12.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	380	580	35	60 (+20 °C) 40 (–105 °C)

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar non stabilized and stabilized steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to susceptibility to embrittlement

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 0484) DB (Reg. form No. 30.132.14)
GL Controlas
LRS CWB

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 300	340	3.8	40- 60
2.5 x 350	220	4.5	50- 90
3.2 x 350	130	4.4	80-120
4.0 x 350	90	4.6	110-160
5.0 x 450	60	5.9	140-200

Thermanit GEW/F

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 19 12 3 L R 1 5	E316L-16	1.4430

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion resistant similar to matching low carbon and stabilized austenitic 18/8 CrNiMo steels/cast steel grades.

For joining of matching and similar austenitic CrNi(N)- and CrNiMo(N) steels/cast steel grades.
Well suited for vertical-down welding position.

Materials

X10CrNiMoNb18-12 (1.4583)
S31653; AISI 316L, 316Ti, 316Cb

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.02	0.7	0.8	18.5	2.6	11.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	480	580	40	55 (+20 °C) 35 (–105 °C)

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching non stabilized and stabilized austenitic steels	None	Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to susceptibility to embrittlement

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 9092)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	315	4.7	75- 85
3.2 x 300	200	4.8	105-115

Thermanit HE Spezial

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 19 9 Nb B 2 2	E347-15	1.4551

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion resistant similar to matching low carbon and stabilized 18/8 CrNi(N) steels/cast steel grades.

For joining and surfacing applications with matching and similar – stabilized and non stabilized – CrNi(N) steels/cast steel grades. For joining work on steel clad products and for weld cladding on unalloyed/low-alloyed creep-resistant steels/cast steel grades. To be used from the second layer onwards.

Materials

TÜV certified parent metal X6CrNiNb18-10 (1.4550);
AISI 347, 321, 302, 304, 304L, 304LN; ASTM A296 Gr. CF 8 C; A157 Gr. C 9; A320 Gr. B8C or D

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
<0.035	0.5	1.3	19.5	10.0	>13xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	410	600	30	65

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Joining of matching non-stabilized and stabilized 18/8 CrNi(N) steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1020 °C (1868 °F)
Claddings	According to parent metal	Stress relieving at max. 610 °C (1130 °F) max. 25 h

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 7665)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	150	4.8	80-110
4.0 x 350	100	4.8	110-140

Thermanit HW

Rutile covered electrode

Classifications	EN 1600	AWS A 5.4	Mat. No.
	E 19 9 Nb R 3 2	E347-17	1.4551

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion resistant similar to matching stabilized austenitic CrNi(N) steels/cast steel grades.

For joining and surfacing with matching and similar – non stabilized and stabilized – austenitic CrNi steels/cast steel grades.

Materials

TÜV certified parent metal
X6CrNiNb18-10 (1.4550)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
<0.07	<0.9	0.8	19.5	10.0	>10xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	410	550	30	55

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/ cast steel grades	None	Mostly none. If necessary, solution annealing at 1020 °C (1868 °F)

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 0608) Controlas

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 300	340	3.8	40- 60
2.5 x 350	220	4.5	50- 90
3.2 x 350	130	4.3	80-120
4.0 x 350	90	4.6	110-160
5.0 x 450	60	5.9	140-200

Thermanit JE Spezial

Basic covered electrode

Classifications	EN 1600	AWS A 5.4	Mat. No.
	E 19 9 L B 2 2	E308L-15	1.4316

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Corrosion resistant similar to matching low carbon and stabilized austenitic 18/8 CrNi(N) steels/cast steel grades. Good resistance to nitric acid.

For joining and surfacing applications with matching and similar – stabilized and non stabilized – CrNi(N) and CrNiMo(N) steels/cast steel grades. Cold toughness at subzero temperatures as low as –196 °C (–321 °F). For joining and surfacing work with cryogenic matching/similar austenitic CrNi(N) steels/ cast steel grades.
Well suited for out of position welding.

Materials

TÜV certified parent metals
X2CrNiN18-10 (1.4311); X6CrNiNb18-10 (1.4550)
X10CrNiTi18-10 (1.6903); AISI 304, 304L, 304LN, 302, 321, 347; ASTM A157 Gr. C9; A320 Gr. B8C or D

Typical analysis in %

C	Si	Mn	Cr	Ni
<0.04	0.3	1.0	19.5	10.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Wärme-behandlung	0,2%-Dehn-grenze N/mm²	1,0%-Dehn-grenze N/mm²	Zug-festigkeit N/mm²	Dehnung (L_0=5d_0) %	Kerbschlagarbeit ISO-V in J
ungeglüht	350	380	550	35	70 (+20 °C) 35 (–196 °C)

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar non stabilized and stabilized 18/8 CrNi(N) steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1000 °C (1832 °F)
Cryogenic austenitic steels/cast steel grades	None	None

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 6523) DB (Reg. form No. 30.132.13)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
4.0 x 350	100	4.8	110-140
5.0 x 450	60	5.8	130-170

Thermanit JEW 308L-17

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 19 9 L R 3 2	E308L-17	1.4316

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Corrosion resistant similar to matching low carbon and stabilized austenitic 18/8 CrNi(N) steels/cast steel grades.

Good resistance to nitric acid. For joining and surfacing applications with matching and similar – stabilized and non stabilized – CrNi(N) steels/cast steel grades. Cold toughness at subzero temperatures as low as –105 °C (–157 °F).

Materials

TÜV certified parent metals
X2CrNi18-10 (1.4311) X6CrNiNb18-10 (1.4550);
AISI 304, 304L, 304LN, 302, 321, 347;
ASTM A157 Gr. C9; A320 Gr. B8C or D

Typical analysis in %

C	Si	Mn	Cr	Ni
<0.04	<0.9	0.8	19.5	9.5

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	320	350	550	35	65 (+20 °C) 40 (–105 °C)

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar non stabilized and stabilized CrNi(N) steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1000 °C (1832 °F)
Cryogenic austenitic steels/cast steel grades	None	None

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 0558)
Controlas (0627)
DB (Reg. form No. 30.132.07)
CWB

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 300	335	3.8	40- 60
2.5 x 350	215	4.5	50- 90
3.2 x 350	130	4.4	80-120
4.0 x 350	90	4.6	110-160
5.0 x 450	60	5.9	140-200

Thermanit L

Basic covered electrode

Classifications

EN 1600	Mat. No.
E 25 4 B 2 2	1.4820

Characteristics and field of use

Stainless; corrosion resistant similar to matching or similar Mo-free 25 % Cr(Ni) steels/cast steel grades. For joining and surfacing with matching and similar (Mo-free) stainless CrNi steels/cast steel grades. Should parent metal be susceptible to embrittlement, interpass temperature must not rise above 300 °C (572 °F). Resistant to scaling in air and oxidizing combustion gases up to 1150 °C (2102 °F). Good resistance in sulphureous combustion gases at elevated temperatures.
For matching and similar heat resistant steels/cast steel grades.

Materials

GX40CrNi27-4 (1.4340)
X20CrNiSi25-4 (1.4821)
GX8CrNi26-7 (1.4347)
AISI 327; ASTM A297HC

Typical analysis in %

C	Si	Mn	Cr	Ni
0.08	0.5	1.3	26.0	5.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB30
AW	500	700	20	180

Structure

Ferrite/austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar stainless steels/cast steel grades	According to wall thickness: 150-300 °C (302-572 °F). None for steel grade 1.4347	Cooling in air, possibly quenching at 980 °C (1796 °F)/air. To restore toughness for cast steel grades 1.4347 and 1.4336 quench at 1050 °C (1922 °F)/water or air
Matching heat-resistant steels	None	Mostly none

Welding position



Polarity = +

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	170	5.2	70-110
4.0 x 350	120	5.1	90-140

Thermanit LW

Rutile covered electrode

Classifications

EN 1600	Mat. No.
E 25 4 R 1 2	1.4820

Characteristics and field of use

Stainless; corrosion resistant similar to matching or similar Mo-free 25 % Cr(Ni) steels/cast steel grades. For joining and surfacing with matching and similar (Mo-free) stainless CrNi steels/cast steel grades. Should parent metal be susceptible to embrittlement, interpass temperature must not rise above 300 °C (572 °F). Resistant to scaling in air and oxidizing combustion gases up to 1150 °C (2102 °F). Good resistance in sulphureous combustion gases at elevated temperatures. For matching and similar heat resistant steels/cast steel grades.

Materials

GX40CrNi27-4 (1.4340)
X20CrNiSi25-4 (1.4821)
G8CrNi26-7 (1.4347)
AISI327; ASTM A 297 H C

Typical analysis in %

C	Si	Mn	Cr	Ni
0.06	1.0	0.8	26.0	5.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB30
AW	500	700	20	180

Structure

Ferrite/austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar stainless steels/cast steel grades	According to wall thickness: 150-300 °C (302-572 °F). None for steel grade 1.4347	Cooling in air, possibly quenching at 980 °C (1796 °F)/air. To restore toughness for cast steel grades 1.4347 and 1.4336 quench at 1050 °C (1922 °F)/water or air
Matching heat-resistant steels	None	Mostly none

Welding position



Polarity = + / ~

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	215	3.7	50- 80
3.2 x 350	130	4.4	60-110

Thermanit Nicro 82

Basic covered electrode

Classifications

EN ISO 14172	AWS A 5.11	Mat. No.
E Ni 6082 (NiCr20Mn3Nb)	ENiCrFe-3 (mod.)	2.4648

Characteristics and field of use

Stainless; heat resistant; high temperature resistant.
Cold toughness at subzero temperatures as low as –269 °C (–452 °F). Well suited for welding austenitic ferritic joints.
No Cr carbide zones that become brittle in the ferrite weld deposit transition zone, even not as a result of heat treatments above 300 °C (572 °F). Well suited for tough joints and surfacing on heat resistant Cr and CrNi steels/cast steel grades and Ni-base alloys.
Temperature limits: 500 °C (932 °F) in sulphureous atmospheres, 800 °C max (1472 °F) for fully stressed welds.
Resistant to scaling up to 1000 °C (1832 °F).

Materials

TÜV certified parent metals
X10NiCrAlTi32-30H (1.4876); NiCr15Fe (2.4816); X8Ni9; 10CrMo9-10;
Combinations between X10CrNiMoNb18-12 (1.4583), X2NiCrMoCu25-20 (1.4539) and ferritic boiler steels;
Alloy 600, Alloy 600L, Alloy 800 (H)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb	Fe
<0.05	<0.4	4.0	19.5	Bal.	2.0	<4.0

Creep and stress rupture properties

According to matching/similar high temperature resistant materials up to 800 °C (1472 °F).

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	420	620	35	90 (+20 °C) 70 (–196 °C) 50 (–269 °C)

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Unalloyed/low alloy steels to austenitic CrNi(Mo,N) steels/cast steel grades	Ferritic side, according to parent metal	According to parent metal. Attention must be paid to intercrystalline corrosion and embrittlement in the case of stainless austenitic steels/ cast steel grades
Heat resistant Cr steels	According to parent metal	None
Heat resistant CrNi steels, Ni-base alloys	None	None
Cryogenic Ni steels	According to parent metal	According to parent metal

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1775)
GL
TÜV (KTA)
Controlas

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	250	4.5	45- 70
3.2 x 300	168	4.7	65-100
4.0 x 350	112	5.6	85-130
5.0 x 400	74	6.4	130-160

Thermanit Nicro 182

Basic covered electrode

Classifications

EN ISO 14172	AWS A 5.11	Mat. No.
E Ni 6182 (NiCr15Fe6Mn)	ENiCrFe-3	2.4620

Characteristics and field of use

Stainless; resistant to scaling up to 950 °C (1742 °F), high temperature resistant up to 800 °C (1472 °F). Cold toughness at subzero temperatures as low as –196 °C (–321 °F).
Well suited for austenitic ferritic joints.
No Cr carbide zones that become brittle in the ferrite weld deposit transition zone even not as a result of heat treatments above 300 °C (572 °F). Well suited for tough joints and surfacing on heat resistant Cr- and CrNi steels/cast steel grades and Ni-base alloys. Temperature limits: 500 °C (932 °F) in sulphureous atmospheres, 800 °C (1472 °F) max. for fully stressed welds.
For welding work on cryogenic steels/cast steel grades including Ni steels suitable for quenching and tempering.
For joining applications on steels with a low expansion coefficient (Dilavar, Invar).

Materials

TÜV certified parent metals
X10NiCrAlTi32-20 (1.4876); NiCr15Fe (2.4816);
Cryogenic 1,5 - 5 % Ni steels; X8Ni9.
Combinations of X10CrNiMoNb18-12 (1.4583)
and ferritic boiler steels up to 16Mo3; Alloy 800 (H)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb	Fe
<0.05	<0.5	6.5	16	Bal.	2.0	<6.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	380	620	35	90 (+20 °C) 70 (–196 °C)

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Unalloyed/low alloy steels to austenitic CrNi(Mo,N) steels/cast steel grades	Ferritic side, according to parent metal	According to parent metal. Attention must be paid to intercrystalline corrosion and embrittlement in the case of stainless austenitic steels/ cast steel grades
Stainless/heat resistant Cr steels/cast steel grades to austenitic CrNi(Mo,N) steels/cast steel grades	According to parent metal	According to parent metal
Cryogenic Ni steels	According to parent metal	According to parent metal

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 2073) TÜV (KTA) (Certificate No. 8109)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	249	4.4	45- 70
3.2 x 300	155	4.5	65-100
4.0 x 350	106	5.4	95-130
5.0 x 400	75	6.4	130-160

Thermanit Ni 55

Basic covered electrode

Classifications

EN ISO 1071	AWS A 5.15
E C Z NiFe-1	ENiFe-Cl

Characteristics and field of use

Covered electrode with iron-nickel bimetallic core wire thereby producing an excellent droplet transfer, smooth arc, good current-carrying capacity. Preferred for ductile cast iron pipes of public water and gas supply networks. For joining cast iron to steel. Peening of the weld metal is advisable in order to reduce residual stresses. The general rules of the german welding society for welding cast iron (see DVS leaflet 1502 part 1 and 2) also apply in this respect.

Materials

GG10 up to GG40; GTS35 up to GTS70,
GTW35 up to GTW70, GGG40 up to GGG80

Typical analysis in %

C	Si	Mn	Ni	Fe
1.3	0.3	0.3	55.0	Balance

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %	Hardness HB
350	530	20	155

Welding position



Polarity = – / ~

Approvals

SLV Duisburg:
guiding rules “DVS-Merkblatt”/leaflet 1502 part 1 and 2

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	299	5.0	65- 90
3.2 x 350	174	5.6	90-140

Thermanit Nickel A

Basic covered electrode

Classifications

EN ISO 1071	AWS A 5.15
E C ZNi Cl	ENi-Cl

Characteristics and field of use

Electrode with pure nickel core; the electrode melts slowly due to a pulsating arc, thereby achieving very good wetting of the parent metal. Particularly suited for welding joints on grey cast iron (old cast irons).
Suited for repairing cracks and surface welding on sealing faces; weld metal interfaces are soft and easily workable. The weld metal should be peened in order to reduce residual stresses. Useable for cold and hot welding on complicated castings.

Materials

GG10 up to GG40; GTS35 up to GTS60; GTW35 up to GTW60; GGL Ni 130 up to 170 N/mm^2; GGG Ni up to 375 N/mm^2

Typical analysis in %

C	Si	Mn	Fe	Ni
0.5	0.1	0.2	2.3	Balance

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Hardness HB
155

Welding position



Polarity = – / ~

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	262	4.5	55- 90
3.2 x 350	152	5.0	80-120
4.0 x 350	102	5.0	100-145

Thermanit Nimo C 24

Basic covered electrode

Classifications

EN ISO 14172	AWS A 5.11	Mat. No.
E Ni 6059 (NiCr23Mo16)	ENiCrMo-13	2.4609

Characteristics and field of use

Stainless. High corrosion resistance in reducing and, above all, in oxidizing environments.
For joining and surfacing with matching and similar alloys and cast alloys.
For welding the cladded side of plates of matching and similar alloys.

Materials

NiCr21Mo14W (2.4602)
NiMo16Cr16Ti (2.4610)
NiMo16Cr15W (2.4819)
NiCr23Mo16Al (2.4605)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Fe
<0.02	0.10	<0.5	23.0	16.0	Bal.	<1.5

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	700	40	60

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar metals	None. Cooling in air. Welding with electrodes of thin diameter, low heat input (stringer beads recommended)	Heat treatment is mostly not necessary for matching precipitation insensitive parent metals, if the recommendations for welding are observed. Otherwise solution annealing at 1150 °C (2102 °F) to 1175 °C (2147 °F)/water to restore full corrosion resistance

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 9272)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	254	3.6	45- 70
3.2 x 300	157	4.4	65-105
4.0 x 350	105	5.0	85-135

Thermanit X

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 18 8 Mn B 2 2	E307-15 (mod.)	1.4370

Characteristics and field of use

Stainless. Resistant to scaling up to 850 °C (1562 °F). No adequate resistance against sulphureous combustion gases at temperatures above 500 °C (932 °F). For joining and surfacing applications with heat resistant Cr steels/cast steel grades and heat resistant austenitic steels/cast steel grades. Well suited to fabricating austenitc-ferritic joints – max. application temperature 300 °C (572 °F). For joining unalloyed/low alloy or Cr steels/cast steel grades to austenitic steels. Low heat input required in order to avoid brittle martensitic transition zones.
Not suitable for the welding of buffer layer, cladded sheet metal or cladding applications.

Materials

TÜV certified parent metal
X10CrNiMoNb18-12 (1.4583) as well as included parent metals combined with ferritic steels up to fine grained structural steels grade StE460 (P 460 N); high tensile, unalloyed and alloyed structural, quenched and tempered, and armour steels, same parent metal or in combination; unalloyed and alloyed boiler or structural steels with highalloyed Cr and CrNi steels; heat resistant steels up to 850 °C (1,562 °F); austenitic high manganese steel with matching and other steels.
Cryogenic sheet metals and pipe steels in combination with austenitic parent metals.

Typical analysis in %

C	Si	Mn	Cr	Ni	N
0.10	0.6	7.0	18.5	8.0	0.12

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	400	600	40	100

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/cast steel grades	According to wall thickness: 150-300 °C (302-572 °F)	Tempering at 750 °C (1382 °F) is not necessary if service temperature the same or higher
Heat resistant CrNi steels	None	None
Joining of CrNi(MoN) austenitic steels to unalloyed/low alloy steels/cast steel grades	According to ferritic parent metal, mostly unnecessary	No postweld heat treatment >300 °C (572 °F) – risk of carbide precipitation at grain boundaries in the weld fusion zone, loss of toughness, fracturing
Joining of CrNi(MoN) austenitic steels to stainless and heat-resistant Cr steels/ cast steel grades	According to ferritic parent metal	According to parent metals. Attention must be paid to the intercrystalline corrosion resistance and embrittlement susceptibility of the austenitic metal side

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 5650) DB (Reg. form No. 30.132.01)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	260	4.0	55- 75
3.2 x 350	180	5.2	70-110
4.0 x 350	120	5.1	85-130
5.0 x 450	80	6.8	140-170

Thermanit XW

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 18 8 Mn R 1 2	E307-16 (mod.)	1.4370

Characteristics and field of use

Stainless. Resistant to scaling up to 850 °C (1562 °F). No adequate resistance against sulphureous combustion gases at temperatures above 500 °C (932 °F). For joining and surfacing applications with heat resistant Cr steels/cast steel grades and heat resistant austenitic steels/cast steel grades. Well suited to fabricating austenitc-ferritic joints – max. application temperature 300 °C (572 °F). For joining unalloyed/low alloy or Cr steels/ cast steel grades to austenitic steels.
Low heat input required in order to avoid brittle martensitic transition zones. Not suitable for the welding of buffer layer, cladded sheet metal or cladding applications.

Materials

TÜV certified parent metal
X10CrNiMoNb18-12 (1.4583) as well as included parent metals combined with ferritic steels up to fine grained structural steels grade StE 355 (P355N); high tensile, unalloyed and alloyed structural, quenched and tempered, and armour steels, same parent metal or in combination; unalloyed and alloyed boiler or structural steels with highalloyed Cr and CrNi steels; heat resistant steels up to 850 °C (1,562 °F); austenitic high manganese steel with matching and other steels.
Cryogenic sheet metals and pipe steels in combination with austenitic parent metals.

Typical analysis in %

C	Si	Mn	Cr	Ni	N
0.10	0.6	7.0	18.5	8.0	0.08

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	400	600	40	70

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/cast steel grades	According to wall thickness: 150-300 °C (302-572 °F)	Tempering at 750 °C (1382 °F) is not necessary if service temperature the same or higher
Heat resistant CrNi steels	None	None
Joining of CrNi(MoN) austenitic steels to unalloyed/low alloy steels/cast steel grades	According to ferritic parent metal, mostly unnecessary	No postweld heat treatment >300 °C (572 °F) – risk of carbide precipitation at grain boundaries in the weld fusion zone, loss of toughness, fracturing
Joining of CrNi(MoN) austenitic steels to stainless and heat resistant Cr steels/ cast steel grades	According to ferritic parent metal	According to parent metals. Attention must be paid to the intercrystalline corrosion resistance and embrittlement susceptibility of the austenitic metal side

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 1235)
GL (4370)
DB (Reg. form No. 30.132.08)
LR (fu V4R-12)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 300	320	3.9	45- 60
2.5 x 300	200	3.8	55- 70
3.2 x 350	140	4.9	65-105
4.0 x 350	90	4.6	110-140
5.0 x 450	60	6.0	150-200

Thermanit 13/04

Basic covered electrode

Classifications	EN 1600	AWS A 5.4	Mat. No.
	E 13 4 B 2 2	E410NiMo-15	1.4351

Characteristics and field of use

Stainless. Corrosion resistant similar to matching 13 % Cr(Ni) steels/cast steel grades. High resistance to corrosion fatigue cracking. Wear resistant. Cavitation resistant. For joining and surfacing applications with matching 13 % Cr(Ni) and 13 % Cr steels/cast steel grades.

Materials

TÜV certified parent metal
(G)X5CrNiCu13-4 (1.4313); ACI Gr. CA 6 NM, S41500

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.04	<0.4	0.5	12.0	0.5	4.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	Hardness HB30	HRC
600 °C / 8 h:	600	800	15	50	310	
AW						38

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching steels/ cast steel grades	Up to 10 mm wall thickness: none, over 10 mm wall thickness: 100-150 °C (212-302 °F)	Tempering or quenching and tempering, according to parent metal (8 h 600 °C (1112 °F), furnace cooling)
13 % Cr steels/ cast steel grades	According to parent metal	None

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1581)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	170	5.1	90-110
4.0 x 350	110	4.8	120-145
5.0 x 450	75	6.5	140-190

Thermanit 14 K

Basic covered electrode

Classifications	EN 1600	AWS A 5.4	Mat. No.
	E 13 1 B 2 2	E410-15 (mod.)	1.4018

Characteristics and field of use

Stainless. Corrosion resistant similar to matching 13 % Cr(Ni) steels/cast steel grades. Also NDT controlled for saturated steam turbine blades. For joining applications on matching and similar 13 % Cr steels/cast steel grades.
For surfacing on sealing faces of water, steam and gas valves and accessories made of unalloyed and low alloy steels/cast steel grades for service temperatures up to 450 °C (842 °F).

Materials

TÜV certified parent metal; GX8CrNi13 (1.4008); AISI 410, 420

Typical analysis in %

C	Si	Mn	Cr	Ni
0.06	<0.4	0.5	12.5	1.3

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	Hardness HB30	HRC
680 °C / 8 h:	450	650	15	50	180	
AW						35

Structure

Martensite (with part ferrite), suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld heat treatment
Joining: ferritic steels/ cast steel grades	Acc. to wall thickness: 200-300 °C (392-572 °F)	Tempering at 650-750 °C (1202-1382 °F)
Joining: martensitic steels/ cast steel grades	Acc. to wall thickness: 200-400 °C (392-752°F)	Cooling to approx. 120 °C (248 °F), then temper and quench and temper
Surfacing: unalloyed/low alloy steels/cast steel grades	Heavy wall thickness: 100-200 °C (212-392°F)	None; if necessary temper to required hardness
Surfacing: higher strength steels/cast steel grades	100-200 °C (212-392 °F)	None; if necessary temper to required hardness

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1436)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	240	4.0	55- 80
3.2 x 350	155	4.9	70-110
4.0 x 350	120	5.5	90-140
5.0 x 450	70	6.3	130-170

Thermanit 17

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 17 B 2 2	E430-15	1.4015

Characteristics and field of use

Stainless. Corrosion resistant similar to matching 17 % Cr steels/ cast steel grades (seawater, diluted organic and inorganic acids). Resistant to scaling in air and oxidizing combustion gases up to 950 °C (1742 °F) and particularly, in sulphureous combustion gases at elevated temperatures. For joining of matching ferritic and similar quenchable and temperable Cr steels/cast steel grades. Lowest possible heat input is required as ferritic 17 % Cr steels are susceptible to embrittlement due to coarse grain growth. Often used only for cap passes on tougher austenitic fill layers, above all in sulphureous com-bustion gases. For sur-facing work on sealing faces of water, steam and gas valves and accessories, made of unalloyed and low alloy steels/cast steel grades designed for service temperatures up to 450 °C (842 °F).

Materials

X20CrNi17-2 (1.4057)	GX22CrNi17 (1.4059)
GX40CrSi17 (1.4740)	X2CrAlTi18-2 (1.4741)
X10CrAl18 (1.4742)	AISI 430Ti, 431

Typical analysis in %

C	Si	Mn	Cr	Ni
0.06	0.5	0.5	17.0	<0.6

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB30
760 °C / 2 h: AW	340	530	20	150 240

Structure

Ferrite/martensite

Welding instruction

Materials	Preheating	Postweld heat treatment
Joining: matching (ferritic) steels/ cast steel grades	According to wall thickness: 150-300 °C (302-572 °F)	Cooling in air. For the reduction of the stresses induced by welding and for restoration of grain decomposition resistance annealing at 800 °C (1472 °F), cooling in air. Mostly not necessary if annealed during service temperature
Joining: unalloyed and low alloy steels/ cast steel grades	Only for greater wall thicknesses: 100-250 °C (212-482 °F)	None; if necessary tempering to required hardness
Joining: high strength steels/cast steel grades	100-250 °C (212-482 °F)	None; if necessary tempering to required hardness

Welding position



Polarity = +

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	235	3.7	60- 80
3.2 x 350	140	4.3	80-110
4.0 x 350	110	4.8	110-140
5.0 x 450	70	6.1	140-180

Thermanit 17/06

Basic covered electrode

Classifications

EN 1600	Mat. No.
E Z17 6 B 2 2	≈1.4405

Characteristics and field of use

Stainless. Corrosion resistant similar to matching steels/cast steel grades. Higher resistance to corrosion and corrosion fatigue cracking than Thermanit 13/04.
Joining and surfacing on matching 13 - 17 % Cr/Ni(Mo) steels/cast steel grades.

Materials

(G)X5CrNiMo16-5 (1.4405); X4CrNiMo16-5 (1.4418) matching/similar soft martensitic forging and cast steels

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
<0.04	0.3	0.5	17.0	1.0	5.5

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
620 °C / 4 h:	570	800	15	40

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	Up to 10 mm wall thickness: 100-150 °C (212-302 °F). Over 10 mm wall thickness: 150-200 °C (302-392 °F)	Tempering or quenching and tempering according to parent metal

Welding position



Polarity = +

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	160	5.0	70-110
4.0 x 350	110	5.0	90-140

Thermanit 18/17 EW

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 18 16 5 N L R 1 2	E317L-17 (mod.)	≈1.4440

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). High Mo content provides elevated resistance to Cl-bearing environments and pitting corrosion. Non magnetic. Well suited for joining and surfacing with matching and similar austenitic non stabilized and stabilized stainless and non magnetic CrNiMo(N) steels/cast steel grades.

Materials

TÜV certified parent metals
(G)X3CrNiMoN17-13-5 (1.4439), X2CrNiMo18-16 (1.4438), X2CrNiMoN17-13-3 (1.4429)
AISI 316Cb, 316LN, 317LN, 317L, UNS S31726

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
<0.035	<1.0	1.2	18.0	4.5	17.5	0.15

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	320	350	570	34	50

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar non stabilized and stabilized as well as non-magnetic steels/cast steel grades	None. Interpass/service temperature 150 °C (302 °F)	Mostly none; if necessary annealing according to parent metal, otherwise solution annealing at 1050 °C (1922 °F)
Joining of aforementioned austenitic steels to unalloyed/low alloy steels/ cast steel grades	According to ferritic parent metal	According to parent metals. Attention must be paid to resistance to intercrystalline corrosion and susceptibility to embrittlement
Cladded plates with matching/similar metal	According to ferritic parent metal	According to parent metals. Attention must be paid to resistance to intercrystalline corrosion and susceptibility to embrittlement

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 6480)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	220	3.9	50- 80
3.2 x 350	130	4.5	60-110
4.0 x 350	90	4.7	90-150

Thermanit 19/15 H

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 20 16 3 Mn N L B 2 2	E316L-15 (mod.)	1.4455

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Corrosion resistant similar to low carbon CrNiMo(Mn,N) steels/cast steel grades. Seawater resistant, good resistance to nitric acid. Huey test in acc. ASTM A 262-64: 3.3 µ / 48 h max. (0.54 g/m^{2}h), selective attack 200 µm max. Non magnetic (permeability in field of 8000 A/m 1.01 max.).

Particularly suited to corrosion conditions in urea synthesis plants for welding work on steel X 2 CrNiMo 1812 and the overlay side of Thermanit 21/17 E weld claddings. Well suited for joining and surfacing applications with matching austenitic CrNi(N) and CrNiMo(Mn,N) steels/cast steel grades.

Materials

TÜV certified parent metals
X2CrNiMoN17-13-3 (1.4429), X5CrNiN18-9,
X1CrNiMoTi18-13-2 (1.4561), 10CrNiTi18-10 (1.6903),
cryogenic 3,5 - 5 % Ni steels

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
<0.04	<0.50	6.0	20.0	3.0	16.5	0.18

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Yield strength 1.0% N/mm^2	Tensile strength N/mm^2	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	430	450	650	30	80

Structure

Austenite, part ferrite 0.6 % max.

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels CrNi(N) steels/cast steel grades and cryogenic CrNi(N) steels/cast steel grades	None	None
21-17E claddings/ high temperature steels/ cast steel grades	According to parent metal 150 °C (302 °F) max.	In case of excessive hardening of the parent metal, stress relieving at 510 °C (950 °F) 20 h max., annealing above 530 °C (986 °F) only prior to welding the last pass

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 1813)
Stamicarbon
Snamprogetti
DB (Reg. form No. 30.132.12)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	260	4.1	55- 75
3.2 x 350	190	5.5	70-110
4.0 x 350	120	5.3	90-140

Thermanit 20/10 W

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 20 10 3 R 3 2	E308Mo-17 (mod.)	1.4431

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 300 °C (572 °F). For joining of stainless Cr and similar austenitic CrNiMo steels/cast steel grades. For joining of dissimilar materials. For tough joints on high manganese steel (steel castings), CrNiMn steels/cast steel grades and armour steels.
For surfacing and repair welding on wear parts: rotors, rails.
Especially suited for austenitic ferritic joints at max. application temperature 300 °C (572 °F).
Particularly for tough joints between unalloyed/low alloy steels/ cast steel grades or stainless/heat resistant Cr steels/cast steel grades to austenitic steels/cast steel grades.
Unsuited for buffer layers on weld claddings or clad plates.

Materials

TÜV certified parent metals
Combinations of stainless and cryogenic austenitic steels, such as X10CrNiMo18-10 (1.4583) and
ferritic steels up to boiler plates grade P295GH [17Mn4];
high tensile, unalloyed and alloyed structural, quenched and tempered, and armour steels, matching parent metal or in combination; unalloyed and alloyed boiler or structural steels with high alloyed Cr and CrNi steels; austenitic high manganese with matching and other steels.

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.05	0.9	1.0	20.0	3.3	10.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	450	650	25	50

Structure

Austenite with increased amount of ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Stainless CrNi steels	None	None; if necessary solution annealing at 1050 °C (1922 °F)
Stainless CrNi steels; unalloyed/low alloy structural steels of elevated strength (surfacing and repair welding)	According to parent metal mostly not necessary	No stress relieving (risk of carbide precipitation in weld fusion zone, loss of toughness, fracturing)
Joining CrNi(MoN) austenitic to unalloyed/ low alloy steels	According to parent metal mostly not necessary	Max. temperature 200 °C (392 °F) – carbide precipitation in weld fusion zone
Joining CrNi(MoN) austenitic to stainless and heat resistant steels/cast steel grades	According to ferritic parent metal	According to parent metal. Attention must be paid to intercrystalline corrosion and susceptibility to embrittlement
High manganese steel	None	As this steel becomes very brittle at 400–600 °C (752–1112 °F), weld as cold as possible. Cooling possibly with compressed air, or dip workpiece in water. No postweld heat treatment, quench if possible

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 1772)
Controlas
GL (4431)
DB (Reg. form No. 30.132.10)
LRS (gv V4P-12)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	220	3.9	50- 80
3.2 x 350	130	4.4	75-115
4.0 x 350	90	4.7	110-160
5.0 x 450	60	6.0	160-200

Thermanit 20/10 W 140 K

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 20 10 3 R 5 3	E308Mo-17 (mod.)	1.4431

Characteristics and field of use

Rutile covered electrode with high deposition rate.
Stainless; resistant to intercrystalline corrosion – wet corrosion up to 300 °C (572 °F). For joining of stainless Cr and similar austenitic CrNiMo steels/cast steel grades. For joining of dissimilar materials. For tough joints on high manganese steel (steel castings), CrNiMn steels and armour steels. For surfacing and repair welding on wear parts: rotors, rails.
Especially suited for austenitic ferritic joints at max. application temperature 300 °C (572 °F).
Particularly for tough joints between unalloyed/low alloy steels/ cast steel grades or stainless/heat resistant Cr steels/cast steel grades to austenitic steels/cast steel grades.
Unsuited for buffer layers on weld claddings or clad plates.

Materials

Combinations of austenitic steels with ferritic steels

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.05	0.9	0.8	20.0	3.3	10.5

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	450	650	25	50

Structure

Austenite with increased amount of ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Stainless CrNi steels	None.	None; if necessary solution annealing at 1050 °C (1922 °F)
Stainless CrNi steels; unalloyed/low alloy structural steels of elevated strength (surfacing and repair welding)	According to parent metal mostly not necessary	No stress relieving (risk of carbide precipitation in weld fusion zone, loss of toughness, fracturing)
Joining CrNi(MoN) austenitic to unalloyed/ low alloy steels	According to parent metal mostly not necessary	Max. temperature 200 °C (392 °F) – carbide precipitation in weld fusion zone
Joining CrNi(MoN) austenitic to stainless and heat resistant steels/cast steel grades	According to ferritic parent metal	According to parent metal. Attention must be paid to intercrystalline corrosion and susceptibility to embrittlement
High manganese steel	None	As this steel becomes very brittle at 400–600 °C (752–1112 °F), weld as cold as possible. Cooling possibly with compressed air, or dip workpiece in water. No postweld heat treatment, quench if possible

Welding position



Polarity = + / ~

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	85	4.3	90-120
4.0 x 350	55	4.2	130-160

Thermanit 20/16

Rutile covered electrode

Classifications

EN 1600	Mat. No.
E Z20 16 3 Mn N L R 1 2	≈1.3954

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion up to 300 °C (572 °F). Seawater resistant. Non magnetic (permeability in field of 8000 A/m: 1.01 max.) Resistant to stress corrosion cracking.

Materials

X2CrNiN18-10 (1.4311)
X2CrNiMoN17-13-3 (1.4429)
X2CrNiMoN17-12-2 (1.4406)
X2CrNiMnMoNNb21-16-53 (1.3964)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
<0.05	0.8	5.0	21.0	3.0	17.0	0.2

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	430	450	640	30	70

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar non magnetic steels/ cast steel grades	None	None

Welding position



Polarity + – / ~

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
3.2 x 350	145	4.8	65-105
4.0 x 350	95	4.8	110-140

Thermanit 20/16 SM

Rutile covered electrode

Classifications

EN 1600	Mat. No.
E Z22 17 4 Mn N L R 1 2	≈1.3954

Characteristics and field of use

Non-magentic; permeability in field of 8000 A/m: 1.01 max.; stainless; resistant to intercrystalline corrosion – wet corrosion up to 350 °C (662 °F). Seawater resistant. High toughness at subzero temperatures. Specially for joining and surfacing work with matching/similar non magnetic CrNiMo(Mn,N) steels/cast steel grades.

Materials

X4CrNiMnMoN19-13-8 (1.3948)
X2CrNiMnMoNNb21-16-5-3 (1.3964)
X2CrNiMoN17-13-5 (1.4439)
X2CrNiMoN22-15 (1.3951)
X2CrNiMoN18-14-3 (1.3952)
X8Ni9 (1.5662)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
<0.04	1.0	7.0	22.0	3.6	18.0	0.2

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	430	450	640	30	70

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar non magnetic steels/ cast steel grades	None	None

Welding position



Polarity = + / ~

Approvals

WIWEB

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	210	3.3	55- 70
3.2 x 350	145	4.8	65-105
4.0 x 350	95	4.8	110-140

Thermanit 20/25 CuW

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 20 25 5 Cu N L R 3 2	E385-16	1.4519

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion – wet corrosion up to 350 °C (662 °F). Good corrosion resistance similar to matching steels/cast steel grades, above all in reducing environments. For joining and surfacing work with matching austenitic CrNiMoCu steels/cast steel grades. For joining this steels with unalloyed/low alloy steels/cast steel grades.

Materials

TÜV certified parent metals
X1CrNiMoN25-25-2 (1.4465) X4NiCrMoCuNb20-18-2 (1.4505)
X2NiCrMoCuN25-20-5 (1.4539) UNS N08904, S31726

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Cu
<0.03	<0.7	1.3	20.0	4.5	25.0	1.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	370	550	35	55

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	None. If necessary solution annealing at 1120 °C (2048 °F)
Combinations with unalloyed/low alloy steels/cast steel grades	According to unalloyed/ low alloy parent metal mostly not necessary	None

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 4112)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	215	4.0	50- 80
3.2 x 350	140	4.9	80-110
4.0 x 350	90	4.7	100-135
5.0 x 450	60	6.1	140-180

Thermanit 21/33

Basic covered electrode

Classifications

EN 1600	Mat. No.
E Z21 33 Nb B 2 2	≈1.4850

Characteristics and field of use

Heat resistant up to 1050 °C (1922 °F). Good resistance to carburizing atmospheres. For joining and surfacing applications with matching/similar heat resistant steels/cast steel grades.

Atmosphere

	max. application temperature in °C (°F)	
	sulphur-free	max. 2 g S/Nm³
Air and oxidizing combustion gases	1050 (1922)	1000 (1832)
Reducing combustion gases	1000 (1832)	950 (1742)

Materials

TÜV certified parent metals;
X10NiCrAlTi32-20H; X10NiCrAlTi32-20 (1.4876);
Alloy 800(H); Alloy 330

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.15	0.4	2.8	22.0	33.0	1.2

Creep and stress rupture properties

According to matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	400	600	25	50

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	None

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 3931)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	240	4.0	55- 80
3.2 x 350	155	4.9	80-105
4.0 x 350	120	5.5	90-135

Thermanit 21/33 So

Basic covered electrode

Classifications

EN 1600	Mat. No.
E Z21 33 Mn Nb B 2 2	≈1.4850

Characteristics and field of use

Heat resistant up to 1050 °C (1922 °F). Good resistance to carburizing atmospheres. For joining and surfacing applications with matching/similar heat resistant steels/cast steel grades.

Atmosphere

	max. application temperature in °C (°F)	
	sulphur-free	max. 2 g S/Nm³
Air and oxidizing combustion gases	1050 (1922)	1000 (1832)
Reducing combustion gases	1000 (1832)	950 (1742)

Materials

GX10NiCrNb32-20 (1.4859)
X10NiCrAlTi32-20H
X10NiCrAlTi32-20 (1.4876)
Alloy 800(H)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.12	0.5	4.5	21.0	32.0	1.2

Creep and stress rupture properties

According to matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	400	600	25	45

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/ cast steel grades	None; welding with stringer beads or limited weaving motion advisable. Interpass temperature: 150 °C (302 °F) max.	None

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 7235)
Controlas (0626)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	249	4.4	55- 80
3.2 x 350	141	4.9	80-105

Thermanit 22/09

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 22 9 3 N L B 2 2	E2209-15	≈1.4462

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion at max. application temperature 250 °C (482 °F). Good resistance to stress corrosion cracking in chlorine- and hydrogen sulphide bearing environments. High Cr and Mo contents provide resistance to pitting corrosion. For joining and surfacing work with matching and similar austenitc steels/cast steel grades. Attention must be paid to embrittlement susceptibility of the parent metal.

Materials

TÜV certified parent metal
X2CrNiMoN22-5 (1.4462); UNS 31803, S32205

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
<0.04	0.5	0.9	22.5	3.0	9.0	0.13

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	480	520	690	25	50

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	Mostly none; if necessary solution annealing at 1050 °C (1922 °F)/ water or air

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 4300)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	240	4.7	50- 80
3.2 x 350	140	4.4	80-110
4.0 x 350	90	4.4	100-145
5.0 x 450	60	5.7	140-180

Thermanit 22/09 W

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 22 9 3 N L R 3 2	E2209-17	≈1.4462

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion at max. application temperature 250 °C (482 °F). Good resistance to stress corrosion cracking in chlorine- and hydrogen sulphide bearing environments. High Cr and Mo contents provide resistance to pitting corrosion. For joining and surfacing work with matching and similar austenitc steels/cast steel grades. Attention must be paid to embrittlement susceptibility of the parent metal.

Materials

TÜV certified parent metal
X2CrNiMoN22-5 (1.4462); UNS 31803, S32205

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
<0.04	<0.9	0.9	22.5	3.0	9.0	0.15

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	480	520	690	25	50

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	Mostly none; if necessary solution annealing at 1050 °C (1922 °F)/ water or air

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 3297)	GL	ABS
Controlas	DNV	LR

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	240	4.7	40- 75
3.2 x 350	140	4.5	70-110
4.0 x 350	101	4.8	110-140
5.0 x 450	60	5.9	140-190

Thermanit 23/11 MoZLW

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 23 12 2 L R 3 2	E309MoL-17	1.4459

Characteristics and field of use

Well suited for austenitie-ferrite joints, max. application temperature 300 °C (572 °F). Stainless, wet corrosion up to 350 °C (662 °F). For joining unalloyed/low alloy steels/cast steel grades or stainless/heat resistant Cr steels/cast steel grades to austenitic steels/cast steel grades.
For depositing intermediate layers when welding the clad side of plates of low carbon, non stabilized or stabilized austenitic CrNiMo(N) austenitic metals.

Materials

TÜV certified parent metals
Combinations of X10CrNiMoNb18-12 (1.4583), X2CrNiMoN17-13-3 (1.4429) and ferritic steels up to boiler steel S355N; high tensile, unalloyed and alloyed structural and quenched and tempered steels of matching parent metal or in combination; unalloyed and alloyed boiler or structural steels with high alloyed Cr, CrNi and CrNiMo steels. Ferrite-austenite-joints for steam boiler and pressure boiler construction. Weld cladding: for first layer of corrosion resistant clattings on P235GH, P265GH, S255N, P295GH, S355N - S500N; for first layer of corrosion resistant claddings on creep resistant quenched and tempered fine grained structural steels acc. to leaflet “AD-Merkblatt” HPO, group 3.

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
<0.035	<0.9	0.7	23.0	2.6	13.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	500	620	25	45

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Joining CrNi(Mo,N) austenitic steels to unalloyed/low alloy steels/ cast steel grades	According to ferritic parent metal; mostly not necessary	Annealing temperature max. 300 °C (572 °F), otherwise carbide precipitation in weld fusion zone, loss of toughness (risk of fracturing)
Joining CrNi(Mo,N) austenitic steels to stainless/heat resistant Cr steels/cast steel grades	According to ferritic parent metal	According to parent metals. Attention must be paid to resistance to intercrystalline corrosion and susceptibility of the austenitic metal side to embrittlement
Cladded plates and cast materials with austenitic CrNi(Mo,N) metal	According to parent metals	According to parent metals. Attention must be paid to resistance to intercrystalline corrosion and susceptibility of the austenitic metal side to embrittlement

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 4146) Controlas

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	215	4.6	60- 80
3.2 x 350	130	4.6	80-120
4.0 x 350	90	4.6	100-160

Thermanit 25/09 CuT

Basic covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 25 9 4 N L B 2 2	E2553-15 (mod.)	≈1.4501

Characteristics and field of use

Stainless. Resistance to intercrystalline corrosion – wet corrosion up to 250 °C (482 °F).
Very good resistance to pitting corrosion and stress corrosion cracking due to the high CrMo(N) content (pitting index >40).
Well suited for offshore applications.

Materials

GX3CrNiMoCuN26-6-3 (1.4515) GX3CrNiMoCuN26-6-3-3 (1.4517)
25 % Cr-superduplex steels such as SAF 25/07, Zeron 100

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N	Cu	W
0.03	0.5	1.2	25.0	3.7	9.0	0.2	0.7	0.6

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	600	650	750	25	70 (+20°C) 50 (–50°C)

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/ cast steel grades	Mostly none	Mostly none; if necessary, solution annealing at 1070 °C (1958 °F)/water. Welding of root pass with “thick layer”. Next two passes with thin layers and low heat input to avoid precipitation and too high ferrite content

Welding position



Polarity = +

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	220	4.6	55- 80
3.2 x 350	140	4.7	80-105
4.0 x 350	90	4.5	90-140

Thermanit 25/09 CuW

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4
E Z25 9 3 Cu N L R 1 2	E2553-15 (mod.)

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion – wet corrosion at 250 °C (482 °F). Corrosion resistance superior to that of Thermanit 22/09 (W). Good resistance to stress corrosion cracking in chlorine and hydrogen sulphide bearing environments. The high Cr and Mo contents provide resistance to pitting corrosion.

Materials

GX3CrNiMoCuN26-6-3 (1.4515) GX3CrNiMoCuN26-6-3-3 (1.4517)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N	Cu
0.02	0.7	0.9	25.0	3.0	9.0	0.1	2.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	600	650	800	23	35
SR 1120°C/4 h	480	580	750	25	55

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	Mostly none; if necessary solution annealing at 1120 °C (2048 °F)/water

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 5200)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	220	4.6	50- 80
3.2 x 350	130	4.5	60-110
4.0 x 350	90	4.5	90-150

Thermanit 25/14 EW 309L-17

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 23 12 L R 1 2	E309L-17	1.4332

Characteristics and field of use

Well suited for fabricating austenitic/ferritic joints at max. application temperature 300 °C (572 °F). Stainless, wet corrosion up to 350 °C (662 °F). Suitable for depositing intermediate layers when welding clad products. For joining unalloyed/ low alloy steels/cast steel grades or stainless/heat resistant Cr steels/cast steel grades to austenitic steels/cast steel grades. For depositing intermediate layers when welding the clad side of plates of low carbon, unstabilized or stabilized CrNi(Mo,N) austenitic metals.

Materials

TÜV certified parent metals
X10CrNiMoNb18-12 (1.4583) combined with ferritic steels up to fine grained structural steel S355N. Weld cladding (1st Layer) on ferritic steels up to S355N and 20MnMoNi45;
Joints: of and between high-tensile, unalloyed and alloyed quenched and temered steels, stainless, ferritic Cr and austenitic CrNi steels, high manganese steels.
Weld claddings: for first layer of chemical resistant claddings on ferritic-pearlitic steels up to fine grained steel S500N used in steam boiler and pressure boiler construction, moreover for creep resistant fine grained structural steels 22NiMoCr4-7 acc. to leaflet “SEW-Werkstoffblatt” No. 365, 366, 20MnMoNi5-5 and G18NiMoCr3-7.

Typical analysis in %

C	Si	Mn	Cr	Ni
<0.04	<0.9	0.8	24.5	13.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	550	30	55

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Joining CrNi(Mo,N) austenitic steels to unalloyed/low alloy steels/ cast steel grades	According to ferritic parent metal; mostly not necessary	No postweld heat treatment above 300 °C (572 °F) – risk of carbide precipitation in the weld fusion zone, loss of toughness, risk of fracturing
Joining CrNi(Mo,N) austenitic to stainless/ heat resistant Cr steels/ cast steel grades	According to ferritic parent metal	According to the parent metals. Attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement
Cladded plates and parent metals with austenitic CrNi(Mo,N) cladding	According to ferritic parent metal	Attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 0424) Controlas (0287)
CWB

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 350	220	4.7	50- 80
3.2 x 350	130	4.4	60-110
4.0 x 350	90	4.6	90-150
5.0 x 450	60	6.1	150-210

Thermanit 25/22 H

Basic covered electrode

Classifications

EN 1600	Mat. No.
E Z25 22 2 L B 2 2	≈1.4465

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion – wet corrosion up to 350 °C (662 °F). Good resistance to Cl-bearing environments, pitting corrosion and nitric acid. Huey test to ASTM A262-64: 1.5 µ/48 h max., (0.25 g/m²h), selective attack 100 µ max. Particularly suited to corrosion conditions in urea synthesis plants. For joining and surfacing applications with matching/similar steels. For weld cladding on high temperature steels and for fabricating joints on claddings.

Materials

TÜV certified parent metals
X2CrNiMoN25-25 (1.4465) X2CrNiMoN25-22-2 (1.4466)
X2CrNiMo18-14-3 (1.4435)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
<0.035	<0.4	5.0	24.5	2.2	22.0	0.15

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	600	30	80

Structure

Austenite, max. ferrite content 0.5 %

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels	None	Mostly unnecessary

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 4171)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	220	3.9	55- 80
3.2 x 350	140	4.6	80-105
4.0 x 350	100	4.8	90-135

Thermanit 25/35 R

Basic covered electrode

Classifications

EN 1600	Mat. No.
E Z25 35 Nb B 2 2	1.4853

Characteristics and field of use

Resistant to scaling up to 1050 °C (1922 °F).
For surfacing and joining work on matching/similar heat resistant cast steel grades.

Materials

TÜV certified parent metal
GX40NiCrNb35-25 (1.4852)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.40	1.0	1.8	25.0	35.0	1.3

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %
AW	400	450	600	8

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar cast steel grades	None	None

Welding position



Polarity = +

Approvals

TÜV (temp. reg.) Controlas

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	210	3.8	55- 80
3.2 x 350	130	4.2	80-105
4.0 x 350	94	4.6	90-135

Thermanit 30/10 W

Rutile covered electrode

Classifications

EN 1600	AWS A 5.4	Mat. No.
E 29 9 R 1 2	E312-16 (mod.)	1.4337

Characteristics and field of use

Stainless; wet corrosion up to 300 °C (572 °F). High resistance to hot cracking: goot toughness at high yield strength.
For joining and surfacing applications with matching/similar steels/cast steel grades. For fabricating tough joints on unalloyed/low alloy structural steels of higher strength, on high manganese and CrNiMn steels, between dissimilar metals e.g. between stainless or heat resistant and unalloyed/low alloy steels/cast steel grades.

Materials

DB-approved parent metals
X10Cr13 (1.4006), X120Mn12 (1.3401), S235, E295;
Useable for joint welding on limited weldable unalloyed and low alloyed steels of higher strength. Used as stress relieved buffer layer when cladding cold and warm machine tools. For joinings on high manganese steel and CrNiMn steel, as well as for combinations on steels of different chemical composition or strength.

Typical analysis in %

C	Si	Mn	Cr	Ni	N
0.10	1.1	0.8	29.0	9.0	0.1

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	500	750	20	25

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Stainless and heat resistant, unalloyed and low alloy steels/cast steel grades; combinations	According to parent metal	Mostly unnecessary

Welding position



Polarity = + / ~

Approvals

DB (Reg. form No. 30.132.11)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.0 x 250	334	3.1	45- 60
2.5 x 300	215	3.7	50- 80
3.2 x 350	130	4.5	60-110
4.0 x 350	85	4.4	90-150
5.0 x 450	55	5.7	150-210

Thermanit 30/40 EW

Rutile covered electrode

Classifications

EN ISO 14172	Mat. No.
E Ni 8025 (NiCr29Fe30Mo)	2.4653

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion – wet corrosion up to 450 °C (842 °F). Good corrosion resistance, especially in reducing environments. In terms of hot cracking resistance (and corrosion resistance) Thermanit 30/40 EW is superior to the fully austenitic X 6 NiCrCuNb 20 18 and X 5 CrNiMoNb 25 25 welding filler metals, which are very sensitive to hot cracking.
For joining and surfacing work with matching and similar, non stabilized and stabilized fully austenitic steels/cast steel grades containing Mo (and Cu). For joining aforementioned steels to unalloyed/low alloy steels.

Materials

TÜV certified parent metals
X1CrNiMoN25-25-2 (1.4465) X1NiCrMoCu31-27-4 (1.4563)
X5CrNiMoTi25-25 (1.4577) NiCr21Mo (2.4858); Alloy 825

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Cu
<0.03	<0.9	1.5	28.0	4.3	36.0	1.8

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	370	550	30	50

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching metals	None (weld as cold as possible) cooling in air	Mostly none; if necessary solution annealing at 1120 °C (2048 °F)
Joining of matching austenitic steels to unalloyed/low alloy steels/cast steel grades	According to parent metal	None

Welding position



Polarity = + / ~

Approvals

TÜV (Certificate No. 4587)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	210	3.7	50- 80
3.2 x 350	145	5.2	60-110
4.0 x 350	85	4.5	90-150

Thermanit 35/45 Nb

Basic covered electrode

Classifications

EN ISO 14172
E Ni Z 6152 (NiCr35Fe20Nb)

Characteristics and field of use

Resistant to scaling up to 1180 °C (2156 °F).
For surfacing and joining work on matching/similar heat resistant cast steel grades.

Materials

GX45NiCrNbSiTi45-35

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.45	1.4	1.0	35.0	45.5	0.8

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %
AW	245	450	6

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar cast steel grades	None	None

Welding position



Polarity = +

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 300	197	4.2	55- 80

Thermanit 617

Basic covered electrode

Classifications

EN ISO 14172	AWS A 5.11	Mat. No.
E Ni 6617 (NiCr22Co12Mo)	ENiCrCoMo-1 (mod.)	2.4628

Characteristics and field of use

Resistant to scaling up to 1100 °C (2012 °F), high temperature resistant up to 1000 °C (1832 °F). High resistance to hot gases in oxidizing resp. carburizing atmospheres.
Suited for joining and surfacing applications with matching and similar heat resistant steels and alloys.

Materials

TÜV certified parent metals
X8NiCrAlTi32-21 (1.4959) NiCr23Fe (2.4851)
NiCr23Co12Mo (2.4663) Alloy 617

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Co	Al	Ti
<0.08	0.7	<0.5	21.0	9.0	Bal.	12.0	1.0	0.5

Creep and stress rupture properties

According to matching high temperature steels/alloys

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %	Impact values in J CVN
AW	400	700	30	100

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar metals	None	Mostly none. If necessary, solution annealing at 1150 °C (2102 F)

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 6844)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	240	3.6	45- 65
3.2 x 300	142	4.0	65-105
4.0 x 350	87	4.4	85-130

Thermanit 625

Basic covered electrode

Classifications

EN ISO 14172	AWS A 5.11	Mat. No.
E Ni 6625 (NiCr22Mo9Nb)	ENiCrMo-3	2.4621

Characteristics and field of use

Stainless; high resistance to corrosive environments. Resistant to stress corrosion cracking. Resistant to scaling up to 1100 °C (2012 °F). Temperature limit: 500 °C (932 °F) max. in sulphureous atmospheres. High temperature resistant up to 1000 °C (1832 °F). Cold toughness at subzero temperatures as low as –196 °C (–321 °F). For joining and surfacing work with matching/similar corrosion resistant materials as well as on matching and similar heat resistant, high temperature steels and alloys. For joining and surfacing work with cryogenic austenitic CrNi(N) steels/cast steel grades and on cryogenic Ni steels suitable for quenching and tempering.

Materials

TÜV certified parent metals
X10NiCrAlTi32-20 H, X10NiCrAlTi32-20 (1.4876),
NiCr22Mo9Nb (2.4856), X2NiCrMoCu25-20-5 (1.4539),
X2CrNiMoCuN20-18-6, VdTÜV-WBL. 473;
Alloy 600, Alloy 625, Alloy 800, 9% Ni steels

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Nb	Fe
<0.04	<0.7	<1	21.5	9.5	Bal.	3.3	<2.0

Creep and stress rupture properties

As per matching high temperature materials

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	450	760	30	75 (+20 °C) 60 (–196 °C)

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar metals	None	None; if necessary, solution annealing at 1150 °C (2102 °F)
Cryogenic CrNi(N) steels/cast steel grades	None	None
Cryogenic Ni steels/cast steel grades suitable for quenching and tempering	According to parent metal	None

Welding position



Polarity = +

Approvals

TÜV (Certificate No. 3463) Controlas (0920)
DNV (W 10651)

Packaging, weights and amperages

Dimensions (mm)	pcs./pack	kg/pack	Amperage A
2.5 x 250	246	3.5	45- 70
3.2 x 300	167	4.5	65-105
4.0 x 350	105	5.0	85-130
5.0 x 400	62	5.5	130-160

GTAW rods and wires – Gas welding rods (low and medium alloyed)

	Page
Summary	152-153
for the welding of unalloyed steels	160
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for the welding of cryogenic steels and fine grained structural steels	158-159
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Summary
GTAW rods and wires – Gas welding rods (low and medium alloyed)

Page	Brand name	Material No.	EN	AWS	Page
for the welding of unalloyed steels					
160	Union I 52	–	1668 W 42 5 W3Si1	A 5.18 ER70S-6	160
for the welding of creep resistant steels					
154	Thermanit MTS 3	1.4903	12070 W CrMo91	A 5.28 ER90S-B9	154
155	Thermanit MTS 4 Si	1.4937	12070 W CrMoWV12Si	A 5.9 ER505 (mod.)	155
156	Thermanit MTS 616	–	12070 W ZCrMoWVNb9 0.5 1.5	– –	156
157	Thermanit MTS 911	1.4905	12070 W ZCrMoWVNb 9 1 1	– –	157
161	Union I CrMo	1.7339	12070 W CrMo1Si	A 5.28 ER80S-G	161
162	Union I CrMo 910	1.7384	12070 W CrMo2Si	A 5.28 ER90S-G	162
163	Union I Mo	–	1668/12070 W2Mo/W MoSi	A 5.28 ER80S-G	163
164	Union I P23	–	12070 W ZCr2WV	A 5.28 ER90S-G	164
165	Union I P24	–	12070 W ZCr2VTi/Nb	A 5.28 ER 90S-G	165
for the welding of cryogenic steels and fine grained structural steels					
158	Union I 1,2 Ni	–	1668 W 42 6 W3Ni1	A 5.28 ER80S-G	158
159	Union I 2,5 Ni	–	1668 W 46 6 W2Ni2	A 5.28 ER80S-Ni2	159
for oxyacethylene welding of structural steels					
166	Union 37	–	12536 O I	A 5.2 R45	166
167	Union Mo	–	12536 O IV	A 5.2 R60-G	167
168	Union Rot N	–	12536 O III	A 5.2 R60	168
169	Union Schwarz	–	12536 O II	A 5.2 R60	169

Thermanit MTS 3

GTAW rod / wire

Classifications

EN 12070	AWS A 5.28	Mat. No.
W CrMo91	ER90S-B9	1.4903

Characteristics and field of use

High temperature resistant, resistant to scaling up to 600 °C (1112 °F). Suited for joining and surfacing applications with quenched and tempered 9 % Cr steels, particularly for matching high temperature resistant parent metal T91 / P91 according to ASTM.

Marks (Rods only)

W CrMo91 / ER90S-B9

Materials

X10CrMoVNb9-1 (1.4903);
ASTM A199 Gr. T91; A355 Gr. P91(T91); A213/213M Gr. T91

Typical analysis of welding rod in %

C	Si	Mn	Cr	Mo	Ni	Nb	V
0.1	0.3	0.5	9.0	1.0	0.7	0.06	0.2

Creep and stress rupture properties

According to matching high temperature resistant parent metal

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
760 °C / 2 h	530	620	17	50

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating / Interpass temperature	Cool down before PWHT	PWHT
Matching steels/ cast steel grades	200 - 250 °C (392-482 °F) / 200 - 300 °C (392-572 °F)	≤100 °C (≤212 °F)	760 °C (1400 °F) – at least 2 h / air

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 6166) Controlas

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	10.0
2.4 x 1000	10.0
3.2 x 1000	10.0

Thermanit MTS 4 Si

GTAW rod / wire

Classifications

EN 12070	AWS A 5.9	Mat. No.
W CrMoWV12Si	ER505 (mod.)	1.4937

Characteristics and field of use

High temperature resistant up to 550 °C (1022 °F), resistant to scaling up to 600 °C (1112 °F).
For surfacing and joining applications on 12 % Cr steels/cast steel grades suitable for quenching and tempering.

Marks (Rods only)

W CrMoWV12Si / 1.4937

Materials

TÜV certified parent metals
X20CrMoV12-1 (1.4922) X23CrMoWV12-1 (1.4937)
matching high temperature resistant steels:
1.4922 X20CrMoV12-1, 1.4935 X20CrMoWV12-1;
1.4923 X22CrMoV12-1; 1.4913 X19CrMoVNb11-1 (Turbotherm, 20MVNb), 1.4931 GX22CrMoV12-1

Typical analysis of welding rod in %

C	Si	Mn	Cr	Mo	Ni	W	V
0.20	0.3	0.6	11.0	1.0	0.4	0.5	0.3

Creep and stress rupture properties

In the range of matching high temperature resistant parent materials

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
760 °C / 4 h	590	700	15	35

Structure

Martensite, suitable for quenching and tempering, ferrite-free

Welding instruction

Materials	Preheating	Postweld treatment
High-temperature resistant martensitic steels/cast steel grades	According to wall thickness: 250-450 °C (482-842 °F)	For smaller welding jobs, cool slowly to 120 °C (248 °F) (i.e. furnace). Tempering for approx. 4h 720-760 °C (1328-1400 °F) / air or quench and temper 1050 °C (1922 °F) / air or oil + 4h 700-760 °C (1292-1400 °F) / air. For larger welding jobs: intermediate stress-relieving at first from welding temperature 2h 550 °C (1022 °F) max. 580 °C (1076 °F) cool slowly to 120 °C (248 °F), tempering or quenching and tempering as above

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 2624)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.4 x 1000	10

Thermanit MTS 616

GTAW rod / wire

Classifications

EN 12070
W ZCrMoWVNb9 0,5 1,5

Characteristics and field of use

High temperature resistant. Suited for joining and surfacing applications with matching high temperature resistant parent metal P92 according to ASTM A 335.

Marks (Rods only)

P92

Materials

ASTM A 355 Gr. P92, NF 616, ASTM A 355 Gr. P92 (T92); A213 Gr. 92

Typical analysis of welding rod in %

C	Si	Mn	Cr	Mo	Ni	W	V	Nb	N
0.1	0.38	0.45	8.8	0.4	0.6	1.6	0.2	0.06	0.04

Creep and stress rupture properties

According to matching high temperature resistant parent metal

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
760 °C / ≥ 2 h (1400 °F / ≥ 2 h)	560	720	15	41

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating / Interpass temperature	Cool down before PWHT	PWHT
Matching steels/ cast steel grades	200 - 250 °C (392-482 °F) / 200 - 300 °C (392-572 °F)	≤100 °C (≤212 °F)	760 °C (1400 °F) – at least 2 h / air

Polarity = –
Shielding gas (EN 439) **I1**

Approvals:

TÜV (Certificate No. 9290)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	10
2.4 x 1000	10

Thermanit MTS 911

GTAW rod / wire

Classifications

EN 12070	Mat. No.
W ZCrMoWVNb9 1 1	1.4905

Characteristics and field of use

High temperature resistant.
Suited for joining and surfacing applications with high temperature resistant martensitic steels particularly for matching X11CrMoWVNb9-1-1(E911) parent metal.

Marks (Rods only)

E911

Materials

X11CrMoWVNb9-1-1 (1.4905), ASTM A 335 Gr. P911 (T91); A 213 Gr. T91

Typical analysis of welding rod in %

C	Si	Mn	Cr	Mo	Ni	W	V	Nb	N
0.1	0.38	0.45	9.0	1.0	0.7	1.0	0.2	0.06	0.04

Creep and stress rupture properties

According to matching high temperature resistant parent metal

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
760 °C / ≥ 2 h (1400 °F / ≥ 2 h)	560	720	15	41

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating / Interpass temperature	Cool down before PWHT	PWHT
Matching steels/ cast steel grades	200 - 250 °C (392-482 °F) / 200 - 300 °C (392-572 °F)	≤100 °C (≤212 °F)	760 °C (1400 °F) – at least 2 h / air

Polarity = –
Shielding gas (EN 439) **I1**

Approvals:

TÜV (Certificate No. 7992)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10

Union I 1,2 Ni

GTAW rod / wire

Classifications

EN 1668	AWS A 5.28
W 42 6 W3Ni1	ER80S-G

Characteristics and field of use

Ni alloyed welding rod / wire for welding of low temperature fine grained structural steels, boiler and pipeline steels.
In out of position welding good flow characteristics.
Very good impact toughness of weld metal at low temperatures.
Tested according to KTA 1408.

Marks
(Rods only)

W VII

Materials

P235GH; P265GH; low temperature fine grained structural steels up to P-,S460NL;
nuclear reactor construction steel 15 MnNi 63

Typical analysis of rod and wire in %

C	Si	Mn	Ni
0.10	0.70	1.40	1.30

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –60 °C
AW	I1	500	600	25	150 55

Welding position



Polarity = –
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 0513/3711)
DNV

Packaging and weights

Rod Diam. x Length (mm)	kg / pack
2.0 x 1000	25
2.5 x 1000	25
3.0 x 1000	25

Union I 2,5 Ni

GTAW rod / wire

Classifications

EN 1668	AWS A 5.28
W 46 6 W2Ni2	ER80S-Ni2

Characteristics and field of use

Wire and rod for welding of low temperature fine grained structural steels, medium alloyed cryogenic steels for pipeline, tank and boiler constructions.
Very good ductility at low temperatures. High quality joints for tank- and plant constructions.

Marks
(Rods only)

W VI

Materials

12 Ni 14, X 12 Ni 5
P-,S275NL2 - P-,S500QL1, 13 MnNi 6-3;
ASTM A633 Gr. E; A572 Gr. 65; A203 Gr. D;
A333 and A334 Gr. 3; A350 Gr. LF3

Typical analysis of rod and wire in %

C	Si	Mn	Ni
0.08	0.60	1.00	2.35

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –70 °C	–90 °C
AW	I1	510	620	24	130 50	–
SR	I1	440	540	26	140 70	45

Welding position



Polarity = –
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 7500)
Controlas

Packaging and weights

Rod Diam. x Length (mm)	kg / pack
2.5 x 1000	25
3.0 x 1000	25

Union I 52

GTAW rod / wire

Classifications

EN 1668	AWS A 5.18
W 42 5 W3Si1	ER70S-6

Characteristics and field of use

GTAW solid rod and wire for the welding with argon.
Typical fields of use: boiler, tank and pipeline constructions and apparatus engineering.

Marks (Rods only)

W II

Materials

Unalloyed structural steels acc. to EN 10025: S185, S235JR, S235JRG1, S235JRG2, S275JR, S235J0, S275J0, S355J0.
Boiler steels P235GH, P265GH, P295GH, P355GH.
Fine grained structural steels up to S420N.
ASTM A27 and A36 Gr. all; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40, A841; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50; API 5 L Gr. B, X42-X56.

Typical analysis of rod and wire in %

C	Si	Mn
0.08	0.85	1.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -50 °C
AW	I1	440	560	25	130 50

Welding position



Polarity = –
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 1656)
DB (Reg. form No. 42.132.11)
Controlas
DNV

Packaging and weights

Rod Diam. x Length (mm)	kg / pack
1.6 x 1000	25
2.0 x 1000	25
2.4 x 1000	25
3.0 x 1000	25

Union I CrMo

GTAW rod / wire

Classifications

EN 12070	AWS A 5.28	Mat. No.
W CrMo1Si	ER80S-G	1.7339

Characteristics and field of use

Welding rod/wire for the welding with argon.
Suitable for manufacturing creep resistant steels in boiler, tank, pipeline and nuclear reactor construction.

Marks (Rods only)

W CrMo1Si / W IV

Materials

13CrMo4-5, ASTM A193 Gr. B7; A217 Gr. WC6;
A335 Gr. P11 and P12

Typical analysis of rod and wire in %

C	Si	Mn	Cr	Mo
0.10	0.60	1.00	1.10	0.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
SR	I1	450	560	22	90

Welding position



Polarity = –
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 0906)
DB (Reg. form No. 42.132.19)
Controlas
FT

Packaging and weights

Wire Diam. (mm)	Spools	kg / pack
0.8	D100	0.7
2.0 x 1000		10
2.5 x 1000		10
3.0 x 1000		10

Union I CrMo 910

GTAW rod / wire

Classifications

EN 12070	AWS A 5.28	Mat. No.
W CrMo2Si	ER90S-G	1.7384

Characteristics and field of use

Medium alloyed welding rod/wire for the welding with argon. Suitable for manufacturing creep resistant steels in boiler, tank, pipeline and nuclear reactor construction.

Marks (Rods only)

W CrMo2 Si / W V

Materials

10 CrMo 910, ASTM A355 Gr- P22; A217 Gr. WC9

Typical analysis of rod and wire in %

C	Si	Mn	Cr	Mo
0.07	0.60	1.0	2.55	1.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
SR	I1	470	590	20	80

Welding position



Polarity = –
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 0908)
DB (Reg. form No. 42.132.06)
Controlas
FT

Packaging and weights

Rod Diam. x Length (mm)	kg / pack
2.0 x 1000	10
2.5 x 1000	10
3.0 x 1000	10

Union I Mo

GTAW rod / wire

Classifications

EN 1668/12070	AWS A 5.28
W2Mo/W MoSi	ER80S-G

Characteristics and field of use

Medium alloyed welding rod/wire for the welding with argon. Suited for low alloy and creep resistant steels in pipe and tank construction.

Marks (Rods only)

W MoSi / W III

Materials

P235GH, P265GH, P295GH, 16 Mo 3, 17 MnMoV 64,
15 NiCuMoNb 5, 20 MnMo 45, 20 MnMoNi 55,
Fine grained structural steels up to S460N,
Pipe steels acc. to EN 10216 T2: P235GH, P265GH
ASTM A335 Gr. P1; A161-94 Gr. T1 A, A182M Gr. F1;
A204M Gr. A, B, C; A250M Gr. T1; A217 Gr. WC1

Typical analysis of rod and wire in %

C	Si	Mn	Mo
0.10	0.60	1.15	0.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	I1	480	570	23	110

Welding position



Polarity = –
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 1250)
DB (Reg. form No. 42.132.14)
Controlas
FT

Packaging and weights

Rod Diam. x Length (mm)	kg / pack
1.6 x 1000	25
2.0 x 1000	25
2.4 x 1000	25
3.0 x 1000	25

Union I P23

GTAW rod / wire

Classifications	EN 12070	AWS A 5.28
	W ZCr2WV	ER90S-G

Characteristics and field of use

Medium alloyed welding rod / wire for the welding with Argon. Suitable for creep resistant tubes and pipes in power stations.

Marks (Rods only)

W Cr2WV / P23

Materials

HCM 2S; ASTM grade P23 / T23

Typical analysis of rod and wire in %

C	Si	Mn	Cr	W	V	Nb
0.07	0.3	0.5	2.2	1.7	0.22	0.05

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	600	700	15	47
760 °C / 2 h	500	600	17	100

Welding position



Polarity = –
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 10271)

Packaging and weights

Wire Diam. (mm)	Spools	kg / pack
1.0	B300	15
1.2	B300	15
1.6 x 1000		10
2.0 x 1000		10
2.5 x 1000		10
3.2 x 1000		10

Union I P24

GTAW rod / wire

Classifications	EN 12070	AWS A 5.28
	WZ CrMo2VTi/Nb	ER90S-G

Characteristics and field of use

Medium alloyed welding rod / wire for the welding with Argon. Suitable for creep resistant tubes and pipes in power stations, especially 7CrMoVTi B10-10 (T/P24)

Marks (Rods only)

WZ CrMo2VTi/Nb / P24

Materials

7 CrMoVTiB 10-10 (1.7378); ASTM grade P24 / T24

Typical analysis of rod and wire in %

C	Si	Mn	Cr	Mo	V	Ti/Nb
0.05	0.3	0.5	2.2	1.0	0.22	0.04

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	600	700	15	47
760 °C / 2 h	500	600	17	100

Welding position



Polarity = –
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 10157)

Packaging and weights

Wire Diam. (mm)	Spools	kg / pack
1.0	B300	18
1.2	B300	18
1.6 x 1000		10
2.0 x 1000		10
2.4 x 1000		10
3.2 x 1000		10

Union 37

Gas welding rod

Classifications	EN 12536	AWS A 5.2
	O I	R45

Characteristics and field of use

Weld pool fluidity: fluid
Spatter: high
Tendency to porosity: yes

Marks (Rods only)

I

Materials

Unalloyed structural steels according to EN 10025: S185.
Pipe steels according to EN 10217 T2: P195.

Typical analysis of welding rod in %	C	Mn
	0.08	0.45

Approvals

DB (Reg. form No. 70.132.01)

Packaging and weights	Diam. x Length (mm)	kg / pack
	1.5 x 1000	25
	2.0 x 1000	25
	2.5 x 1000	25
	3.0 x 1000	25
	4.0 x 1000	25
	5.0 x 1000	25
	6.0 x 1000	25
	8.0 x 1000	25

Union Mo

Gas welding rod

Classifications	EN 12536	AWS A 5.2
	O IV	R60-G

Characteristics and field of use

Weld pool fluidity: viscous
Spatter: none
Tendency to porosity: none

Marks (Rods only)

IV

Materials

Unalloyed structural steels according to EN 10025: S185, S235JR, S235JRG1, S235JRG2, S275JR, S235J0, S275J0, S355J0.
Pipe steels acc. to EN 10216 T2: P195GH, P235GH, P265GH.
Pipe steels acc. to EN 10217 T2: P235, P265.
Steel pipes for pressure stress acc. to EN 10028.T2: 16 Mo 3.
ASTM A335 Gr. P1, A36 Gr. all; A283 Gr. B, C, D; A285 Gr. B; A414 Gr. C; A442 Gr. 60; A515 Gr. 60; A516 Gr. 55, 60; A570 Gr. 33, 36, 40.

Typical analysis of welding rod in %	C	Si	Mn	Mo
	0.12	0.10	1.00	0.50

Approvals

TÜV (Certificate No. 2188)
DB (Reg. form No. 70.132.06)

Packaging and weights	Diam. x Length (mm)	kg / pack
	2.0 x 1000	25
	2.5 x 1000	25
	3.0 x 1000	25

Union Rot N

Gas welding rod

Classifications

EN 12536	AWS A 5.2
O III	R60

Characteristics and field of use

Weld pool fluidity: viscous
Spatter: none
Tendency to porosity: low

Marks (Rods only)

 III

Materials

Unalloyed structural steels according to EN 10025: S185, S235JR, S235JRG1, S235JRG2, S275JR, S235J0, S275J0, S355J0.
Pipe steels according to EN 10216 T2: P235GH, P265GH, EN 10217 T2: P235, P265.
ASTM A 36 Gr. all; A283 Gr. B, C, D; A285 Gr. B; A414 Gr. C; A442 Gr. 60; A515 Gr. 60; A516 Gr. 55, 60; A570 Gr. 33, 36, 40.

Typical analysis of welding rod in %

C	Si	Mn	Ni
0.10	0.10	1.10	0.50

Approvals

TÜV (Certificate No. 2191) DB (Reg. form No. 70.132.05)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	25
2.5 x 1000	25
3.0 x 1000	25
4.0 x 1000	25
5.0 x 1000	25

Union Schwarz

Gas welding rod

Classifications

EN 12536	AWS A 5.2
O II	R60

Characteristics and field of use

Weld pool fluidity: less fluid
Spatter: low
Tendency to porosity: yes

Marks (Rods only)

 II

Materials

Unalloyed structural steels according to EN 10025: S185, S235JR, S235JRG1, S235JRG2, S275JR.
Pipe steels according to EN 10216 T2; P235GH, P265GH, EN 10217 T2: P235, P265.

Typical analysis of welding rod in %

C	Si	Mn
0.17	0.20	0.80

Approvals

DB (Reg. form No. 70.132.04)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	25
3.0 x 1000	25

GTAW welding rods (high alloyed)

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GTAW welding rods (high alloyed)

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for the welding of duplex stainless steels					
208-209	Thermanit 22/09	≈ 1.4462	12072 W 22 9 3 N L	A 5.9..	ER2209 208-209
210-211	Thermanit 25/09 CuT	≈ 1.4501	12072 W 25 9 4 N L	A 5.9..	ER2553 (mod.) 210-211

*also available as Thermanit 19/15 H

Summary
GTAW welding rods (high alloyed)

Page	Brand name	Material No.	EN / •EN ISO	AWS	Page
for the welding of heat resistant steels					
179	Thermanit ATS 4	1.4948	12072 W 19 9 H	A 5.9..	ER19 -10H 179
180-181	Thermanit C Si	1.4842	12072 W 25 20 Mn	A 5.9..	ER310 (mod.) 180-181
182	Thermanit CR	1.4846	12072 W 25 20 H	A 5.9..	ER310 (mod.) 182
183	Thermanit D	1.4829	12072 W 22 12 H	A 5.9..	ER309 (mod.) 183
188-189	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr -3 188-189
194-195	Thermanit X	1.4370	12072 W 18 8 Mn	A 5.9..	ER307 (mod.) 194-195
206	Thermanit 21/33	≈ 1.4850	12072 W Z21 33 Nb	–	206
207	Thermanit 21/33 So	≈ 1.4850	12072 W Z21 33 Mn Nb	–	207
215	Thermanit 25/35 R	1.4853	12072 W Z25 35	–	215
216	Thermanit 25/35 Zr	≈ 1.4853	12072 W Z25 35 Zr	–	216
218	Thermanit 35/45 Nb	–	12072 W Z35 45 Nb H	–	218
219	Thermanit 617	2.4627	•18274 S Ni 6617 (NiCr22Co12Mo9)	A 5.14	ERNiCrCoMo -1 219
220-221	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo -3 220-221
for the welding of high temperature resistant steels					
179	Thermanit ATS 4	1.4948	12072 W 19 9 H	A 5.9..	ER19 -10H 179
154	Thermanit MTS 3	1.4903	12070 W CrMo91	A 5.28	ER90S -B9 154
155	Thermanit MTS 4 Si	1.4937	12070 W CrMoWV12Si	A 5.9..	ER505 (mod.) 155
156	Thermanit MTS 616	–	12070 W ZCrMoWVNb9 0,5 1,5	–	156
157	Thermanit MTS 911	1.4905	12070 W ZCrMoWVNb9 1 1	–	157
219	Thermanit 617	2.4627	•18274 S Ni 6617 (NiCr22Co12Mo9)	A 5.14	ERNiCrCoMo -1 219
220-221	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo -3 220-221
for the welding of cryogenic steels					
186-187	Thermanit JE-308L	1.4316	12072 W 19 9 L Si	A 5.9..	ER308L 186-187
188-189	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr -3 188-189
202-203	Thermanit 19/15*	1.4455	12072 W 20 16 3 Mn N L	A 5.9..	ER316L (mod.) 202-203
220-221	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo -3 220-221

*also available as Thermanit 19/15 H

Summary
GTAW welding rods (high alloyed)

Page	Brand name	Material No.	EN / •EN ISO	AWS	Page
for the welding of austenite ferrite joints					
188-189	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr -3 188-189
194-195	Thermanit X	1.4370	12072 W 18 8 Mn	A 5.9..	ER307 (mod.) 194-195
212-213	Thermanit 25/14 E-309L	1.4332	12072 W 23 12 L	A 5.9..	ER309L 212-213
217	Thermanit 30/40 E	2.4656	•18274 S Ni 8025 (NiFe30Cr29Mo)	A 5.9..	ER383 (mod.) 217
220-221	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo -3 220-221
for the welding of non magnetic steels					
200-201	Thermanit 18/17 E	≈1.4440	12072 W 18 16 5 N L	A 5.9..	ER317L (mod.) 200-201
202-203	Thermanit 19/15*	1.4455	12072 W 20 16 3 Mn N L	A 5.9..	ER316L (mod.) 202-203
204	Thermanit 20/16 SM	1.3954	12072 W Z22 17 8 4 N L		– 204
for the welding of nickel and nickel base alloys					
188-189	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr -3 188-189
190-191	Thermanit Nimo C	2.4839	•18274 S Ni 6452 (NiCr20Mo15)	A 5.14	ERNiCrMo -7 (mod.) 190-191
192-193	Thermanit Nimo C 24	2.4607	•18274 S Ni 6059 (NiCr23Mo16)	A 5.14	ERNiCrMo -13 192-193
217	Thermanit 30/40 E	2.4656	•18274 S Ni 8025 (NiFe30Cr29Mo)	A 5.9..	ER383 (mod.) 217
220-221	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo -3 220-221
219	Thermanit 617	2.4627	•18274 S Ni 6617 (NiCr22Co12Mo9)	A 5.14	ERNiCrCoMo -1 219
222	Thermanit 690	2.4642	•18274 S Ni 6025 (NiCr30Fe9)	A 5.14	ERNiCrFe -7 222

*also available as Thermanit 19/15 H

Thermanit A

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 19 12 3 Nb	ER318	1.4576

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistant similar to matching stabilized CrNiMo steels. For joining and surfacing application with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades.

Marks

W 19 12 3Nb / ER318

Materials

TÜV-certified parent metal
X10CrNiMoNb18-12 (1.4583), AISI 316L, 316Ti, 316Cb

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Nb
0.04	0.4	1.7	19.5	2.7	11.5	≥12xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	600	30	100

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to tendency to embrittlement

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 09474) Controlas (0582)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.0 x 1000	10
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10
4.0 x 1000	10
5.0 x 1000	10

Other length upon request

Thermanit ATS 4

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 19 9 H	ER19-10H	1.4948

Characteristics and field of use

High temperature resistant up to 700 °C (1292 °F); resistant to scaling up to 800 °C (1472 °F). For surfacing and joining applications on matching/similar high temperature resistant steels/cast steel grades.

Marks

W 19 9 H / ER19-10 H

Materials

TÜV-certified parent metal
X6CrNi18-11 (1.4948) X12CrNiTi18-9 (1.4878)
X6CrNiNb18-10 (1.4850) AISI 304H, 321H, 347H

Typical analysis in %

C	Si	Mn	Cr	Ni
0.05	0.4	1.8	18.8	9.3

Creep and stress rupture properties

In the range of matching high temperature resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	600	30	100

Structure

Austenite with part ferrite, 5 % max.

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	Up to 25 mm wall thickness: none. Over 25 mm: max. 200 °C (392 °F) adviseable	To avoid stress corrosion cracking: 1050 °C (1922 °F)/air

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 1616) Controlas (0948)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10

Thermanit C Si

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 25 20 Mn	ER310 (mod.)	1.4842

Characteristics and field of use

Resistant to scaling up to 1050 °C (1922 °F). For tough joints with heat resistant Cr and CrNi steels/cast steel grades. For surfacing and joining on matching/similar heat resistant steels/cast steel grades. For tough fill layers beneath final weld passes made with Thermanit L and Thermanit 30 when welding thicker cross-sections of Cr steels/cast steel grades to permit use of such steels in sulphureous atmospheres.

	max. application temperature in °C (°F)	
Atmosphere	**sulphur-free**	**max. 2 g S/Nm³**
Air and oxidizing combustion gases	1150 (2102)	1100 (2012)
Reducing combustion gases	1080 (1976)	1040 (1904)

Marks

W 25 20 Mn / 1.4842

Materials

GX40CrNiSi25-12 (1.4837) GX15CrNi25-20 (1.4840)
X15CrNiSi25-20 (1.4841) AISI 305, 310, 314
ASTM A297 HF, A297 HJ

Typical analysis in %

C	Si	Mn	Cr	Ni
0.13	0.9	3.2	25.0	20.5

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	410	580	25	80

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/ cast steel grades	According to parent metal	According to parent metal
Heat resistant matching/ similar steels/cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10
4.0 x 1000	10

Thermanit CR

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 25 20 H	ER310 (mod.)	1.4846

Characteristics and field of use

Resistant to scaling up to 1000 °C (1832 °F).
For surfacing and joining applications on matching heat-resistant cast steel grades.

Marks

1.4846

Materials

GX40CrNiSi25-20 (1.4848) GX40CrNiSi22-9 (1.4826)
GX40CrNiSi25-12 (1.4837)

Typical analysis in %

C	Si	Mn	Cr	Ni
0.45	0.9	1.5	26.0	21.5

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	500	550	700	10	

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching heat resistant cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Packaging and weights

Diam. x Length (mm)	kg / pack
2.4 x 1000	10

Thermanit D

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 22 12 H	ER309 (mod.)	1.4829

Characteristics and field of use

Resistant to scaling up to 950 °C (1742 °F). For joining and surfacing applications with matching/similar heat resistant steels/cast steel grades.

Atmosphere	max. application temperature in °C (°F) sulphur-free	max. 2 g S/Nm³	over 2 g S/Nm³
Air and oxidizing combustion gases	950 (1742)	930 (1706)	850 (1562)
Reducing combustion gases	900 (1652)	850 (1562)	

Marks

W 22 12 H

Materials

X15CrNiSi20-12 (1.4828) AISI 305; ASTM A297HF

Typical analysis in %

C	Si	Mn	Cr	Ni
0.11	1.2	1.2	22.0	11.0

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	470	600	30	85

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/cast steel grades	According to parent metal	Annealing according to parent metal is not necessary if service temperature the same or higher
Matching austenitic steels/cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit GE-316L

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 19 12 3 L	ER316L	1.4430

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistance similar to matching low-carbon and stabilized austenitic 18/8 CrNiMo steels/cast steel grades. For joining and surfacing application with matching and similar – non-stabilized and stabilized – austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades.

Marks

W 19 12 3L / ER316L

Materials

TÜV-certified parent metal
X10CrNiMoNb18-12 (1.4583); S31653, AISI 316L, 316Ti, 316Cb

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.02	0.5	1.7	18.5	2.6	12.3

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	480	580	35	100

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar non-stabilized and stabilized steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to tendency to embrittlement

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 09500)
Controlas (0165)
CWB (ER 316L-Si)
DB (Certificate No. 43.132.10)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.0 x 1000	10
1.2 x 1000	10
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10
4.0 x 1000	10

Thermanit H-347

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 19 9 Nb	ER347	1.4551

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistant similar to matching stabilized austenitic CrNi steels/cast steel grades.
For joining and surfacing application with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) steels and cast steel grades.

Marks

W 19 9 Nb

Materials

TÜV-certified parent metal
X6CrNiNb18-10 (1.4550) and the parent metals also covered by VdTÜV-Merkblatt 1000.
AISI 347, 321, 302, 304, 304L, 304LN
ASTM A296 Gr. CF8, A157 Gr. C9; A320 Gr. B8C or D

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.05	0.5	1.8	19.5	9.5	≥12xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	570	30	65

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar steels/cast steel grades	None	Mostly none. Otherwise solution annealing at 1020 °C (1868 °F)

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 09475)
VUZ

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit JE-308L

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 19 9 L	ER308L	1.4316

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Corrosion-resistant similar to matching low-carbon and stabilized austenitic 18/8 CrNi(N) steels/cast steel grades. High toughness at subzero temperatures as low as –196 °C (–321 °F). For joning and surfacing applications with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels/cast steel grades.
For joining and surfacing work on cryogenic matching/similar austenitic CrNi(N) steels/cast steel grades.

Marks

W 19 9L / ER308L

Materials

TÜV-certified parent metal
X5CrNi18-10 (1.4301)
X2CrNiN18-10 (1.4311)
X6CrNiNb18-10 (1.4550)
AISI 304, 304L, 304LN, 302, 321, 347;
ASTM A157 Gr. C9, A320 Gr. B8G or D

Typical analysis in %

C	Si	Mn	Cr	Ni
0.02	0.5	1.7	20.0	10.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –196 °C
AW	400	430	570	35	100 35

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar non-stabilized and stabilized autstenitic CrNi(N) steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1000 °C (1832 °F)
Cryogenic austenitic steels/ cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 9451)
CWB (ER 308L Si)
DB (Certificate No. 43.132.08)
Controlas (0969)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.0 x 1000	10
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10
4.0 x 1000	10
5.0 x 1000	10

Thermanit Nicro 82

GTAW welding rod

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	2.4806

Characteristics and field of use

Stainless; heat resistant; high temperature resistant.
Cold toughness at subzero temperatures as low as –269 °C (–452 °F). Good for welding austenitic-ferritic joints.
No Cr carbide zone that become brittle in the ferrite weld deposit transition zone, even as a result of heat treatments above 300 °C (572 °F). Good for fabricating tough joints and surfacing with heat resistant Cr and CrNi steels/cast steel grades and Ni-base alloys.
Temperature limits: 500 °C (932 °F) in sulphureous atmospheres, 800 °C max. (1472 °F) for fully stressed welds.
Resistant to scaling up to 1000 °C (1832 °F).

Marks

2.4806 / ERNiCr-3

Materials

TÜV-certified parent metals
X10NiCrAlTi32-20 (1.4876), NiCr15Fe (2.4816), X8Ni9 (1.5662), 10CrMo9-10,
Combinations of X10CrNiMoNb18-12 (1.4583), X1NiCrMoCu25-20-5 (1.4539) and ferritic boiler steels;
Alloy 600, Alloy 600L, Alloy 800(H)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb	Fe
0.02	0.1	3.0	20.0	>67.0	2.5	<2

Creep and stress rupture properties

According to matching/similar high temperature resistant metals up to 800 °C (1472 °F).

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	620	35	150

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Unalloyed/low-alloy steels to austenitic CrNi(Mo,N) steels/ cast steel grades	Ferritic side: according to parent metal	According to parent metal. Attention must be paid to intercrystalline corrosion resistance and embrittlement in the case of stainless austenitic steels/cast steel grades
Heat resistant Cr steels	According to parent metal	According to parent metal
Heat resistant CrNi steels, Ni-base alloys	None	None
Cryogenic Ni steels	According to parent metal	According to parent metal

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 1703)
DNV (NV5Ni)
DB (Certificate No. 43.132.11)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit Nimo C

GTAW welding rod

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6452 (NiCr20Mo15)	ERNiCrMo-7 (mod.)	2.4839

Characteristics and field of use

Nickel based alloy. High corrosion resistance in reducing and, above all, in oxidizing environments. Thermanit Nimo C has the same corrosion resistance as AWS welding fill metal ERNiCrMo-7. Thermanit Nimo C contains no W, the Cr content is higher and the content of Fe is lower.
For joining and surfacing applications with matching and similar alloys and cast alloys (Hastelloy C-type).

Marks

2.4839

Materials

TÜV-certified parent metal
NiMo16Cr16Ti (2.4610) NiMo16Cr15W (2.4819)
and combinations of these alloys with boiler steels up to S355J
X2CrNiMnMoNbN 25-18-5-4 (1.4565)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Fe	V
0.015	0.1	1.0	20.0	15.0	Bal.	<1.0	+

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	480	700	35	120

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar metals (with or without W content)	None. Cooling in air. For the new precipitation-insensitive parent and welding filler metals (very low C and Si contents) please observe: thin electrode diameter, stringer-type beads, low heat input, additional cooling of the weld region to avoid precipitations that cause embrittlement and reduce corrosion resistance in the temperature range from 600 °C (1112 °F) to 1000 °C (1832 °F)	Heat treatment is mostly not necessary for matching precipitation-insensitive parent metals if the recommendations on welding are observed. Otherwise solution annealing at 1150 °C (2102 °F) to 1175 °C (2147 °F) / water, to restore full corrosion resistance

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 1790)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit Nimo C 24

GTAW welding rod

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6059 (NiCr23Mo16)	ERNiCrMo -13	2.4607

Characteristics and field of use

Nickel based alloy. High corrosion resistance in reducing and, above all, in oxidzing environments. For joining and surfacing with matching and similar alloys and cast alloys.
For welding the cladded side of plates of matching and similar alloys.

Marks

2.4607 / ERNiCrMo-13

Materials

NiCr21Mo14W (2.4602)
NiMo16Cr15W (2.4819)
NiMo16Cr16Ti (2.4610)
NiCr23Mo16Al (2.4605)
X2CrNiMnMoNbN 25-18-5-4 (1.4565)
Alloy 59

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Fe
0.01	<0.10	<0.5	23.0	16.0	Bal.	<1.5

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation ($L_0=5d_0$) %	Impact values in J CVN
AW	450	700	35	120

Structure

Austenite, ferrite-free

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar metals	None	None. Otherwise solution annealing: 1120 °C (2048 °F)/water

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 6462)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10
4.0 x 1000	10

Thermanit X

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 18 8 Mn	ER307 (mod.)	1.4370

Characteristics and field of use

Stainless. Resistant to scaling up to 850 °C (1562 °F).
No adequate resistance against sulphureous combustion gases at temperatures above 500 °C (932 °F). For joining and surfacing applications with heat resistant Cr steels/cast steel grades and heat resistant austenitic steels/cast steel grades. Well suited for fabricating austenitic-ferritic joints – max. application temperature 300 °C (572 °F). For joining unalloyed/low-alloy or Cr steels/ cast steel grades to austenitic steels.
Low heat input required in order to avoid brittle martensitic transition zones.

Marks

W 18 8 Mn / 1.4370

Materials

TÜV-certified parent metal
X10CrNiMoNb18-12 (1.4583) and included parent metals combined with ferritic steels up to boiler plate P295GH.
High tensile, unalloyed and alloyed structural, quenched and tempered, and armour steels, same parent metal or in combination; unalloyed and alloyed boiler or structural steels with high alloyed Cr and CrNi steels; heat resistant steels up to 850 °C (1562 °F); austenitic high manganese steel with matching and other steels.
Cryogenic sheet metals and pipe steels in combination with austenitic parent metals.

Typical analysis in %

C	Si	Mn	Cr	Ni
0.08	0.8	7.0	19.0	9.0

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	500	620	35	100

Structure

Austenite with small amount of ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Heat resistant Cr steels/cast steel grades	According to wall thickness: 150-300 °C (302-572 °F)	Tempering at 750 °C (1382 °F) not necessary if service temperature is the same or higher
Heat resistant CrNi steels	None	None
Joining of CrNi(MoN) austenitic steels to unalloyed/low-alloy steels/cast steel grades	According to ferritic parent metal, mostly not necessary	No Postweld heat treatment >300 °C (572 °F) – risk of carbide precipitation at grain boundaries in the weld fusion zone, loss of toughness, fracturing
Joining of CrNi(MoN) austenitic steels to stainless and heat-resistant Cr steels/ cast steel grades	According to ferritic parent metal	According to parent metals. Attention must be paid to the intercrystalline corrosion resistance and embrittlement susceptibility of the austenitic metal side

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 1234)
Controlas (0229)
DB (Certificate No. 43.132.01)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 13/04 Si

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 13 4	ER410NiMo (mod.)	1.4351

Characteristics and field of use

Stainless; corrosion-resistant similar to matching 13 % Cr(Ni) steels/cast steel grades. High resistance to corrosion fatigue cracking. For joining and surfacing applications with matching 13 % Cr(Ni) and 13 % Cr steels/cast steel grades.

Marks

W 13 4

Materials

(G)X5CrNi13-4 (1.4313) X6CrAl13 (1.4002)
ACI Gr. CA 6 NM

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.02	0.7	0.7	12.3	0.5	4.7

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield str. 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	Hardness HB30	HRC
600 °C / 8 h (1112 °F / 8 h) AW	720	800	18	50	250	38

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching steels/ cast steel grades	Up to 10 mm wall thickness: none, over 10 mm wall thickness: 100-150 °C (212-302 °F)	Tempering or quenching and tempering, according to parent metal
13 % Cr steels/ cast steel grades	According to parent metal	Tempering or quenching and tempering, according to parent metal

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 1582)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.4 x 1000	10

Thermanit 14 K

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W Z13 1	ER410 (mod.)	1.4018

Characteristics and field of use

Stainless; corrosion-resistant similar to matching 13 % Cr(Ni) steels/cast steel grades. For joining applications with matching and similar 13 % Cr steels/cast steel grades. For surfacing with sealing faces of water, steam and gas valves and accessories made of unalloyed and low-alloy steels/cast steel grades for service temperatures up to 450 °C (842 °F).

Marks

W 1.4018

Materials

(X8Cr14 (1.4008))
X6Cr13 (1.4000)
X10Cr13 (1.4006)

Typical analysis in %

C	Si	Mn	Cr	Ni
0.06	0.3	0.5	12.5	1.3

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	Hardness HB30	Hardness HRC
680 °C / 8 h (1256 °F / 8 h)	500	650	15	50	180	
AW						35

Structure

Martensite with part ferrite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld heat treatment
Joining: Ferritic Cr steels/ cast steel grades	Acc. to wall thickness: 200-300 °C (392-572 °F)	Tempering at 650-750 °C (1202-1382 °F)
Joining martensitic Cr steels/ cast steel grades	Acc. to wall thickness: 200-400 °C (392-752°F)	Cooling to approx. 120 °C (248 °F), then temper or quench and temper
Surfacing: unalloyed/low-alloy steels/cast steel grades	Larger wall thickness: 100-200 °C (212-392°F)	None; if necessary temper to required hardness
Surfacing: higher-strength steels/cast steel grades	100-200 °C (212-392 °F)	None; if necessary temper to required hardness

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 1437)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.4 x 1000	10

Thermanit 18/17 E

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 18 16 5 N L	ER317L (mod.)	≈1.4440

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). High Mo content provides high resistance to Cl-bearing environment and pitting corrosion. Non magnetic. Well suited for joining and surfacing to matching and similar austenitic non-stabilized and stabilized stainless and non magnetic CrNiMo(N) steels/cast steel grades.
Recommended for joining matching/similar austenitic and ferritic steels/cast steel grades with a maximum application temperature of 300 °C (572 °F). Well suited for depositing intermediate layers when welding products clad with an matching or similar overlay.

Marks

W 1.4440

Materials

TÜV-certified parent metal
X2CrNiMoN17-13-5 (1.4439), X2CrNiMo18-16-4 (1.4438), X3CrNiMo17-13-3 (1.4436), X2CrNiMoN17-13-5 (1.4439), X2CrNiMo17-13-3 (1.4429), X2CrNiMo18-15-4 (1.4438), X10CrNiMoNb18-12 (1.4583).
AISI 316Cb, 316LN, 317LN, 317L; UNS S31726

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
0.02	0.3	3.5	18.5	4.2	17.5	0.1

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	410	570	35	100

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching and similar austenitic non-stabilized and stabilized CrNiMo(N) steels/cast steel grades	None	If necessary, solution annealing at 1050 °C (1922 °F)
Non magnetic CrNiMo(N) steels/cast steel grades	None; keep interpass welding temperature low	If necessary, stress relieving according to parent metal, otherwise solution annealing at 1050 °C (1922 °F)

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 2071) Controlas (0539)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 19/15*

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 20 16 3 Mn N L	ER316L (mod.)	1.4455

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Corrosion-resistant similar to low-carbon CrNiMo(Mn,N) steels/cast steel grades. Seawater resistant, good resistance to nitric acid, selective attack max. 200 µm. Non magnetic (permeability in field of 8000 A/m 1.01 max.). Particularly suited for corrosion conditions in urea synthesis plants for welding work on steel X 2 CrNiMo 18 12 and the overlay side of Type 1.4455 weld claddings. Well suited for joining and surfacing applications with matching and similar austenitic CrNi(N) and CrNiMo(Mn,N) steels/cast steel grades.

Marks

1.4455 / 19/15 bzw. 1.4455 (19/15 H)

Materials

TÜV-certified parent metal
X2CrNiMoN17-13-3 (1.4429), X5CrNiN19-9 (1.4315), X1CrNiMoTi18-13-2 (1.4561) and 10CrNiTi18-10 (1.6903) and cryogenic 3.5 - 5 % Ni-steels, X8Ni9 (1.5662)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
0.03	0.5	7.5	20.5	2.8	15.5	0.18

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	430	450	650	30	80

Structure

Austenite with part ferrite, 0.6 % max.

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar materials	None	Mostly not necessary
Type 1.4455 claddings	According to parent metal mostly 150 °C (302 °F)	In case of excessive hardening of the parent metal, stress relieving at 510 °C (950 °F) 20 h max., annealing above 530 °C (986 °F) only **prior** to welding the last pass

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 3497) (Stamicarbon)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

*also available as Thermanit 19/15 H
((Huey test in acc. ASTM A 262: max. 3.3 µm/48 h (0.54 g/m²h)

Thermanit 20/16 SM

GTAW welding rod

Classifications

EN 12072	Mat. No.
W Z22 17 8 4 N L	1.3954

Characteristics and field of use

Non magnetic; Permeability in field of 800 A/m: 1.01 max. Specially for joining and surfacing work with matching/similar non magnetic CrNiMo(Mn,N) steels/cast steel grades. Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Seawater-resistant. High toughness at subzero temperatures.

Marks

W Z 22 17 8 4 NL / 1.3954

Materials

X4CrNiMnMoN19-13-8 (1.3948)
X2CrNiMoN18-14-3 (1.3952)
X2CrNiMnMoNNb21-16-5-3 (1.3964)
X2CrNiMoN17-13-5 (1.4439)
X2CrNiMoN22-15 (1.3951)
X2CrNiMo18-15 (1.3953)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
0.03	0.7	7.5	22.0	3.6	17.5	0.24

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	480	680	30	70

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar non magnetic steels/cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

GL (3954) WIWEB

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	10
2.4 x 1000	10

Thermanit 20/25 Cu

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 20 25 5 Cu L	ER385	1.4519

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Good corrosion resistance similar to matching steels/cast steel grades, above all in reducing environment. For joining and surfacing work with matching austenitic CrNiMoCu steels/cast steel grades. For joining these steels with unalloyed/low-alloy steels/cast steel grades.

Marks

W 1.4519 / ER385

Materials

TÜV-certified parent metal
X1NiCrMoCu25-20-5 (1.4539), X4NiCrMoCuNb20-18-2 (1.4505) with X1CrNiMoN25-25-2 (1.4465), X2CrNiMoN17-13-5 (1.4439), X1CrNiMoCuN25-25-5 (1.4537) and others, as well as ferritic steels up to S355J; matching high Mo containing CrNi steels; UNS N08904, S31726

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Cu
<0.025	0.20	2.5	20.5	4.8	25.0	1.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	370	550	35	55

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	None. If necessary solution annealing at 1120 °C (2048 °F)
Combinations with unalloyed/low-alloy steels/cast steel grades	According to unalloyed/low alloy parent metal mostly not necessary	None

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 4301)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 21/33

GTAW welding rod

Classifications

EN 12072	Mat. No.
W Z21 33 Nb	≈1.4850

Characteristics and field of use

Resistant to scaling up to 1050 °C (1922 °F). Good resistance to carburizing atmospheres. For joining and surfacing applications with matching/similar heat resistant steels/ cast steel grades.

Atmosphere	max. application temperature in °C (°F) sulphur-free	max. 2 g S/Nm³
Air and oxidizing combustion gases	1050 (1922)	1000 (1832)
Reducing combustion gases	1000 (1832)	950 (1746)

Marks

1.4850 / 21/33

Materials

X10NiCrAlTi32-20 (1.4876) Alloy 800 H
GX10NiCrNb32-20 (1.4859)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.20	0.20	2.3	22.0	33.0	1.7

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	480	620	17	50

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 21/33 So

GTAW welding rod

Classifications

EN 12072	Mat. No.
W Z21 33 Mn Nb	≈1.4850

Characteristics and field of use

Resistant to scaling up to 1050 °C (1922 °F). Good resistance to carburizing atmospheres. For joining and surfacing applications with matching/similar heat resistant steels/ cast steel grades.

Atmosphere	max. application temperature in °C (°F) sulphur-free	max. 2 g S/Nm³
Air and oxidizing combustion gases	1050 (1922)	1000 (1832)
Reducing combustion gases	1000 (1832)	950 (1746)

Marks

1.4850 (mod.) / W Z21 33 Mn Nb

Materials

X10NiCrAlTi32-20 (1.4876) Alloy 800 H
GX10NiCrNb32-20 (1.4859)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.12	0.20	4.8	22.0	33.0	1.20

Creep and stress rupture properties

According to matching/similar heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	600	17	50

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 7256) Controlas (0658)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.4 x 1000	10
3.2 x 1000	10

Thermanit 22/09

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 22 9 3 N L	ER2209	≈1.4462

Characteristics and field of use

Duplex stainless steel; resistant to intercrystalline corrosion and wet corrosion up to 250 °C (482 °F). Good resistance to stress corrosion cracking in chlorine- and hydrogen sulphide-bearing environment. High Cr and Mo contents provide resistance to pitting corrosion. For joining and surfacing work with matching and similar austenitc steels/cast steel grades. Attention must be paid to embrittlement susceptibility of the parent metal.

Marks

W 22 9 3 NL / ER2209

Materials

TÜV-certified duplex stainless steels
X2CrNiMoN22-5-3 (1.4462) and others,
combinations of mentioned steels and ferritic steels up to S355J, 16Mo3 and X10CrNiMoNb18-12 (1.4583)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
0.02	0.4	1.7	22.5	3.2	8.8	0.15

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	600	650	720	25	100

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	None	Mostly none; if necessary solution annealing at 1050 °C (1922 °F)/ water

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 3343)
Controlas (0416)
DNV
GL (4462)
ABS

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 25/09 CuT

GTAW welding rod / solid wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 25 9 4 N L	ER2553 (mod.)	≈1.4501

Characteristics and field of use

Super duplex stainless steel; resistant to intercrystalline corrosion (Service temperature: –50 °C up to +220 °C).
Very good resistance to pitting corrosion and stress corrosion cracking due to the high CrMo(N) content (pitting index ≥40).
Well suited for conditions in offshore application, particularly for welding of supermartensitic stainless steels (13 % Cr);
extra low hydrogen in the filler material available on request.

Marks

W 25 9 4 NL

Materials

GX3CrNiMoCuN26-6-3 (1.4515)
GX3CrNiMoCuN25-6-3-3 (1.4517)
25 %ige Cr-superduplex steels such as Zeron 100, SAF 25/07, FALC 100

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N	Cu	W
0.02	0.3	0.8	25.3	3.7	9.5	0.22	0.6	0.6

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –40 °C
AW	700	750	850	25	120 100

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels/cast steel grades	Mostly none	Mostly none; if necessary, solution annealing at 1120 °C (2048 °F)/ water.
		Welding of root pass with “thick layer”. Next two passes with thin layers and low heat input to avoid precipitation and too high ferrite content

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

Controlas (0923)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	10
2.4 x 1000	10
Spools on request	

Thermanit 25/14 E-309L

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 23 12 L	ER309L	1.4332

Characteristics and field of use

Stainless; wet corrosion up to 350 °C (662 °F). Well suited for depositing intermediate layers when welding cladded materials. Favourably high Cr and Ni contents, low C content. For joining unalloyed/low-alloy steels/cast steel grades or stainless heat resistant Cr steels/cast steel grades to austenitic steels/cast steel grades. For depositing intermediate layers when welding the side of plates clad with low-carbon – non-stabilized and stabilized – austenitic CrNi(MoN) austenitic metals.

Marks

 W 23 12 L / ER309L

Materials

TÜV-certified parent metal.
Combinations between X10CrNiMoNb18-12 (1.4583) and ferritic steels up to S355N.
Joints of and between high-tensile, unalloyed and alloyed quenched and tempered steels, stainless, ferritic Cr and austenitic Cr-Ni steels, high manganese steels as well as claddings: for the first layer of chemical resistant weld claddings on ferritic-pearlitic steels up to fine grained structural steels S500N, in steam boiler and pressure boiler construction, as well as creep resistant fine grained structural steels 11NiMoCr4-7 acc. to leaflet “SEW-Werkstoffblatt” No. 365, 366, 20MnMoNi5-5 and G18NiMoCr3-7.

Typical analysis in %

C	Si	Mn	Cr	Ni
0.02	0.5	1.7	24.0	13.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	430	460	580	30	80

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld heat treatment
Joining: CrNi(MoN) austenitic steels with unalloyed/low-alloy steels/ cast steel grades	According to ferritic parent metal; mostly not necessary	No Postweld heat treatment above 300 °C (572 °F); risk of carbide precipitation in weld fusion zone, loss of toughness, fracturing
Joining: CrNi(MoN) austenitic steels with stainless heat resistant Cr steels/cast steel grades	According to ferritic parent metal	According to the parent metals. Attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement
Cladded plates and cast materials with austenitic CrNi(MoN) overlay	According to ferritic parent metal	According to the parent metals. Attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 2661) Controlas (0651)
CWB (ER 309L-Si)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 25/22 H

GTAW welding rod

Classifications

EN 12072	AWS A 5.9	Mat. No.
W 25 22 2 L	ER310 (mod.)	1.4465

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Good resistance to Cl-bearing environment, pitting corrosion and nitric acid. Huey test acc. to ASTM A262: max. 1,5 µm/48 h (0,25 g/m²h), selective attack max. 100 µm. Particularly suited for corrosion conditions in urea synthesis plants. For joining and surfacing applications with matching/similar steels. For weld cladding on high temperature steels and for fabricating joints on claddings.

Marks

1.4465 / 25/22 H

Materials

TÜV-certified parent metal
X2CrNiMoN25-22-2 (1.4466) and combinations with
X1CrNiMoN25-25-2 (1.4465), X2CrNiMo18-14-3 (1.4435)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
0.025	0.20	6.0	25.0	2.2	22.5	0.13

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	600	30	80

Structure

Austenite, max. ferrite 0.5 %

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar steels	None	Mostly not necessary
Claddings and joining of cladded creep-resistant steels/cast steel grades	According to parent metal mostly 150 °C (302 °F)	In case of excessive hardening of the parent metal, stress relieving at 510 °C (950 °F) 20 h max., annealing above 530 °C (986 °F) only **prior** to welding the last pass

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 4875) (Stamicarbon) (Snamprogetti)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10

Thermanit 25/35 R

GTAW welding rod

Classifications

EN 12072	Mat. No.
W Z25 35	1.4853

Characteristics and field of use

Resistant to scaling up to 1050 °C (1922 °F).
For joining and surfacing work with matching/similar heat resistant cast steel grades

Marks

1.4853 / 25/35 R

Materials

TÜV-certified parent metal
GX40NiCrSiNb35-25 (1.4852)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.42	1.0	1.8	26.0	35.0	1.3

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	500	650	8	

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

Controlas (0637)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 25/35 Zr

GTAW welding rod

Classifications

EN 12072	Mat. No.
W Z25 35 Zr	≈1.4853

Characteristics and field of use

Resistant to scaling up to 1150 °C (2102 °F).
For joining and surfacing work on matching/similar heat resistant cast steel grades

Marks

≈1.4853 Zr

Materials

GX40NiCrSiNb35-25 (1.4852)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb	Zr
0.42	1.2	1.8	26.0	35.0	1.3	<0.15

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	500	650	8	

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Packaging and weights

Diam. x Length (mm)	kg / pack
2.4 x 1000	10
3.2 x 1000	10

Thermanit 30/40 E

GTAW welding rod

Classifications

EN ISO 18274	AWS A 5.9	Mat. No.
SNi 8025 (NiFe30Cr29Mo)	ER383 (mod.)	2.4656

Characteristics and field of use

Nickel based alloy; resistant to intercrystalline corrosion and wet corrosion up to 450 °C (842 °F). Good corrosion resistance, especially in reducing environment. For joining and surfacing work with matching and similar – non-stabilized and stabilized – fully austenitic steels/cast steel grades containing Mo (and Cu). For joining mentioned steels with unalloyed/low-alloy steels.

Marks

2.4656

Materials

TÜV-certified parent metal
X1CrNiMoN25-25-2 (1.4465), X3CrNiMoTi25-25 (1.4577), NiCr21Mo (2.4858) and combinations of aforementioned materials with ferritic steels P265GH and X10CrNiMoNb18-12 (1.4583); Sanicro 28, Alloy 825

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Cu
0.02	0.2	2.6	29.0	4.3	36.0	1.8

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	380	550	30	120

Structure

Austenite, ferrite-free

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching metals	None (weld as cold as possible) cooling in air	Mostly none; if necessary solution annealing at 1120 °C (2048 °F)
Joining of matching austenitic steels to unalloyed/low-alloy steels/cast steel grades	According to parent metal	None

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 0118)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 35/45 Nb

GTAW welding rod

Classifications

EN 12072
W Z35 45 Nb H

Characteristics and field of use

Resistant to scaling up to 1180 °C (2156 °F).
For joining and surfacing work on matching/similar heat resistant cast steel grades

Marks

35/45 Nb

Materials

GX45NiCrNbSiTi45-35

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.42	1.5	1.0	35.0	45.5	0.8

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %
AW	450	450	6

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar cast steel grades	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 617

GTAW welding rod

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
SNi 6617 (NiCr22Co12Mo9)	ERNiCrCoMo-1	2.4627

Characteristics and field of use

Resistant to scaling up to 1100 °C (2012 °F), high temperature resistant up to 1000 °C (1832 °F). High resistance to hot gases in oxidizing resp. carburizing atmospheres.
For joining and surfacing applications with matching and similar heat resistant steels and alloys.

Marks

2.4627 / ERNiCrCoMo-1

Materials

TÜV-certified parent metal
X10NiCrAlTi32-20 (1.4876)
NiCr23Fe (2.4851)
Alloy 617
GX10NiCrNb32-20 (1.4859)
NiCr23Co12Mo (2.4663)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Co	Al	Ti	Fe
0.05	0.1	0.1	21.5	9.0	Bal.	11.0	1.0	0.5	1.0

Creep and stress rupture properties

According to matching high temperature steels/alloys

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	700	30	60

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar metals	None	Mostly none. If necessary, solution annealing at 1150 °C (2102 °F)

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 6845)

Packaging and weights

Diam. x Length (mm)	kg / pack
2.0 x 1000	10
2.4 x 1000	10

Thermanit 625

GTAW welding rod

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
SNi 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	2.4831

Characteristics and field of use

Nickel based alloy; high resistance to corrosive environment. Resistant to stress corrosion cracking. Resistant to scaling up to 1100 °C (2012 °F). Temperature limit: 500 °C (932 °F) max. in sulphureous atmospheres. High temperature resistant up to 1000 °C (1832 °F). Cold toughness at subzero temperatures as low as –196 °C (–321 °F). For joining and surfacing work with matching/similar corrosion-resistant materials as well as on matching and similar heat resistant, high temperature resistant steels and alloys. For joining and surfacing work on cryogenic austenitic CrNi(N) steels/cast steel grades and on cryogenic Ni steels suitable for quenching and tempering.

Marks

2.4831 / ERNiCrMo-3

Materials

TÜV-certified parent metal
Alloy 800 H, NiCr22Mo9Nb (2.4856), X1CrNiMoCuN20-18-7 (1.4547) and combinations of aforementioned materials with ferritic steels up to S355J, 10CrMo9-10; ASTM A533 Gr. 1; Alloy 600, Alloy 625, Alloy 800 (H), 9% Ni steels.

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Nb	Fe
0.03	0.1	0.1	22.0	9.0	Bal.	3.6	<1.0

Creep and stress rupture properties

According to matching/similar creep resistant materials.

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –196 °C	
AW	460	500	740	35	120	100

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar metals	None	None; if necessary, solution annealing at 1150 °C (2102 °F)
Cryogenic CrNi(N) steels/ cast steel grades	None	None
Cryogenic Ni steels (X8Ni9) suitable for quenching and tempering	According to parent metal	None

Polarity = –
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 3464)
DNV (W 10652)
Controlas (1006)

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10
3.2 x 1000	10

Thermanit 690

GTAW welding rod

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6025 (NiCr30Fe9)	ERNiCrFe -7	2.4642

Characteristics and field of use

High resistance to stress corrosion cracking in oxidizing acids and water at high temperatures.
Particularly suited for the conditions in nuclear fabrication.
Useable for joining matching and similar steels, surfacing with low-alloy and stainless steels.

Marks

ERNiCrFe-7

Materials

NiCr29Fe (2.4642)
Alloy 690

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Fe	Co
0.02	0.2	0.3	29.0	0.1	Bal.	9.0	<0.1

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	600	35	100

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching/similar metals	None	None

Polarity = –
Shielding gas (EN 439) **I1**

Packaging and weights

Diam. x Length (mm)	kg / pack
1.6 x 1000	10
2.0 x 1000	10
2.4 x 1000	10

GMAW solid wires (low and medium alloyed)

	Page
Summary	226-227
for the welding of unalloyed structural steels	233-235, 240-243
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Summary
GMAW solid wires (low and medium alloyed)

Page	Brand name	EN		AWS		Page
for the welding of unalloyed structural steels						
233	Union K 40	440	G2Si1 (mod.)	A 5.18	ER70S-G [ER70S-3 (mod.)]	233
234	Union K 52	440	G 42 2 C G3Si1/G 42 4 M G3Si1	A 5.18	ER70S-6	234
235	Union K 56	440	G 46 2 C G4Si1/G 46 4 M G4Si1	A 5.18	ER70S-6	235
240	Union Rob 2	440	G 42 2 C G3Si1/G 42 4 M G3Si1	A 5.18	ER70S-6	240
241	Union Rob 3	440	G 46 2 C G4Si1/G 46 4 M G4Si1	A 5.18	ER70S-6	241
242	Union SG 2-H	440	G 42 2 C G3Si1/G 42 3 M G3Si1	A 5.18	ER70S-6	242
243	Union SG 3-H	440	G 46 2 C G4Si1/G 46 4 M G3Si1	A 5.18	ER70S-6	243
for the welding of creep resistant steels						
228	Thermanit MTS 3	12070	G CrMo91	A 5.28	ER90S -B9	228
229	Thermanit MTS 4 Si	12070	G CrMoWV12Si	A 5.9	ER505 (mod.)	229
230	Thermanit MTS 616	12070	G ZCrMoWVNb9 0,5 1,5	–		230
231	Thermanit MTS 911	12070	G ZCrMoWVNb9 1 1	–		231
247	Union I CrMo	12070	G CrMo1Si	A 5.28	ER80S-G	247
248	Union I CrMo 910	12070	G CrMo2Si	A 5.28	ER90S-G	248
249	Union I Mo	440/12070	G 46 4 M G2Mo/GMoSi	A 5.28	ER80S-G	249
for the welding of fine grained structural steels						
236	Union MoNi	12534	G 62 5 M Mn3Ni1Mo	A 5.28	ER90S-G	236
238	Union NiMoCr	12534	G 69 5 M Mn4Ni1,5CrMo	A 5.28	ER100S-G [ER100S-1 (mod.)]	238
244	Union X 85	12534	G 79 5 M Mn4Ni1,5CrMo	A 5.28	ER110S-G	244
245	Union X 90	12534	G 89 6 M Mn4Ni2CrMo	A 5.28	ER120S-G	245
246	Union X 96	12534	G 89 5 M Mn4Ni2,5CrMo	A 5.28	ER120S-G	246
for the welding of cryogenic steels						
232	Union K 5 Ni	440	G 46 3 C G3Ni1/G 50 5 M G3Ni1	A 5.28	ER80S-G	232
237	Union Ni 2,5	440	G 50 6 M G2Ni2	A 5.28	ER80S-Ni2	237
for the welding of weatherproof steels						
239	Union Patinax	440	G 42 3 C G0/G 46 4 M G0	A 5.18	ER70S-G	239

Thermanit MTS 3

GMAW solid wire

Classifications	EN 12070	AWS A 5.28	Mat. No.
	G CrMo91	ER90S-B9	1.4903

Characteristics and field of use

High temperature resistant, resistant to scaling up to 600 °C (1112 °F). Suited for joining and surfacing applications with quenched and tempered 9% Cr steels, particularly for matching high temperature resistant parent metal T91 / P91 according to ASTM.

Materials

X10CrMoVNb9-1 (1.4903)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Nb	V
0.1	0.3	0.5	9.0	1.0	0.7	0.06	0.2

Creep and stress rupture properties

According to matching high temperature resitant parent metal

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %	Impact values in J CVN
760 °C / 2 h (1400 °F / 2 h)	520	620	16	50

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching steels/ cast steel grades	200-250 °C (392-482 °F)	Tempering at 760 °C (1400 °F) – at least 2 h / air

Polarity = +
Shielding gas (EN 439) **M12, (M13)**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit MTS 4 Si

GMAW solid wire

Classifications	EN 12070	AWS A 5.9	Mat. No.
	G CrMoWV12Si	ER505 (mod.)	1.4937

Characteristics and field of use

High temperature resistant up to 550 °C (1022 °F), resistant to scaling up to 600 °C (1112 °F).
For surfacing and joining applications on 12 % Cr steels/cast steel grades suitable for quenching and tempering.

Materials

X20CrMoV12-1 (1.4922) X23CrMoWV12-1 (1.4937)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	W	V
0.20	0.3	0.6	11.0	1.0	0.4	0.5	0.3

Creep and stress rupture properties

In the range of matching high temperature resistant parent materials

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %	Impact values in J CVN
760 °C / 4 h (1400 °F / 4 h)	590	700	15	35

Structure

Martensite, suitable for quenching and tempering, ferrite-free

Welding instruction

Materials	Preheating	Postweld heat treatment
High temperature resistant martensitic steels/cast steel grades	According to wall thickness: 250-450 °C (482-842 °F)	For smaller welding jobs, cool slowly to 120 °C (248 °F) – (i.e. furnace), tempering for approx. 4 h 720-760 °C (1328-1400 °F) / air or quench and temper at 1050 °C (1922 °F) / air or oil and 4 h 700-760 °C (1292-1400 °F) / air. For larger welding jobs, intermediate stress-relieving at first from welding temperature 2 h 550 °C (1022 °F) – max. 580 °C (1076 °F), cool slowly to 120 °C (248 °F) tempering or quenching and tempering as above

Polarity = +
Shielding gas (EN 439) **M12, (M13)**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15

Thermanit MTS 616

GMAW solid wire

Classifications

EN 12070
G ZCrMoWVNb9 0,5 1,5

Characteristics and field of use

High temperature resistant. Suited for joining and surfacing applications with matching high temperature resistant parent metal P92 according to ASTM A 335.

Materials

ASTM A 355 Gr. P92, NF 616

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	W	V	Nb	N
0.1	0.38	0.45	8.8	0.4	0.6	1.6	0.2	0.06	0.04

Creep and stress rupture properties

According to matching high temperature resistant parent metal

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %	Impact values in J CVN
760 °C / ≥ 2 h (1400 °F / ≥ 2 h)	560	720	15	41

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching steels/cast steel grades	200-250 °C (392-482 °F)	Tempering at 760 °C (1400 °F) – at least 2 h / air

Polarity = +
Shielding gas (EN 439) **M12, (M13)**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit MTS 911

GMAW solid wire

Classifications

EN 12070	Mat. No.
G ZCrMoWVNb9 1 1	1.4905

Characteristics and field of use

High temperature resistant.
Suited for joining and surfacing applications with high temperature resistant martensitic steels particularly for matching X11CrMoWVNb9-1-1(E911) parent metal.

Materials

X11CrMoWVNb9-1-1 (1.4905)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	W	V	Nb	N
0.1	0.38	0.45	9.0	1.0	0.7	1.0	0.2	0.06	0.04

Creep and stress rupture properties

According to matching high temperature resistant parent metal

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %	Impact values in J CVN
760 °C / ≥ 2 h (1400 °F / ≥ 2 h)	560	720	16	41

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld heat treatment
Matching steels/cast steel grades	200-250 °C (392-482 °F)	Tempering at 760 °C (1400 °F) – at least 2 h / air

Polarity = +
Shielding gas (EN 439) **M12, (M13)**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Union K 5 Ni

GMAW solid wire

Classifications

EN 440	AWS A 5.28
G 46 3 C G3Ni1/ G 50 5 M G3Ni1	ER80S-G

Characteristics and field of use

Ni alloyed solid wire electrode for gas-shielded arc welding of cryogenic fine grained structural steels.
Shielding gases: CO_2 and gas mixture.
Extremely metallurgically pure weld metal with good low temperature toughness when deposited in combination with gas mixtures.

Materials

S355NL - S500QL
cryogenic special structural steels 15 MnNi 63

Typical analysis in %

C	Si	Mn	Ni
0.10	0.70	1.40	1.40

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	−40 °C	−50 °C
AW	CO_2	450	570	26	110	45	–
AW	M21	500	600	25	130	–	50

Welding position



Polarity = +
Shielding gas (EN 439) **M1 - M3 and CO_2**

Approvals

TÜV (Certificate No. 0514) DB (Certificate No. 42.132.13)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	18
1.2	B300	18

Union K 40

GMAW solid wire

Classifications

EN 440	AWS A 5.18
G2Si1 (mod.)	ER70S-G [ER70S-3 (mod.)]

Characteristics and field of use

GMAW solid wire electrode for welding unalloyed and low alloy steels with shielding gas. Especially suited for electrolytically and hot-dip galvanized thin sheets. Used primarily in vehicle and autobody fabrication in conjunction with gas mixtures M12 to M23.

Materials

DC01+ZE - DC04+ZE, S220GD+Z - S350GD+Z

Typical analysis in %

C	Si	Mn
0.10	0.35	1.10

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	M23	360	440	25	80

Welding position



Polarity = +
Shielding gas (EN 439) **M12 - M23**

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
0.9	B300	18
1.0	B300	18
1.2	B300	18

Union K 52

GMAW solid wire

Classifications

EN 440	AWS A 5.18
G 42 2 C G3Si1/ G 42 4 M G3Si1	ER70S-6

Characteristics and field of use

GMAW solid wire electrode for welding unalloyed and low alloy steels with shielding gas. All-purpose useable with gas mixture or CO_2, low-spatter transfer in the short and spray arc range. Used in boiler and pipeline construction, shipbuilding, vehicle manufacturing and structural engineering.

Materials

S235JRG2 - S355J2;
boiler steels P235GH, P265GH, P295GH;
fine grained structural steels up to S420N;
ASTM A27 u. A36 Gr. all; A106 Gr. A, B; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A556 Gr. B2A; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50

Typical analysis in %

C	Si	Mn
0.08	0.85	1.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield str. 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	–20 °C	–40 °C
AW	CO_2	420	540	25	85	50	–
AW	M21	440	560	24	95	60	50

Welding position



Polarity = +
Shielding gas (EN 439) **M1 - M3 and CO_2**

Approvals

TÜV (Certificate No. 0106)	DB (Certificate No. 42.132.02)
ABS	GL (3YHS)
LR	DNV
Controlas	FT

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
0.9	B300	18
1.0	B300	18
1.2	B300	18
1.6	B300	18

Union K 56

GMAW solid wire

Classifications

EN 440	AWS A 5.18
G 46 2 C G4Si1/ G 46 4 M G4Si1	ER70S-6

Characteristics and field of use

GMAW solid wire electrode for welding unalloyed and low alloy steels with CO_2 or gas mixture.
Low spatter transfer in short and spray arc range. High arc stability also at high welding current amperage. Large application range; specially suited for steels of higher strength in boiler and pipeline construction, shipbuilding, vehicle manufacturing and structural engineering.

Materials

S235JRG2 - S355J2;
boiler steels P235GH, P265GH, P295GH, P355GH;
fine grained structural steels up to S460N; ASTM A27 and A36 Gr. all; A106 Gr. A, B; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A556 Gr. B2A; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50

Typical analysis in %

C	Si	Mn
0.08	1.05	1.65

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	–20 °C	–40 °C
AW	CO_2	450	550	25	90	50	–
AW	M21	480	580	24	95	65	50

Welding position



Polarity = +
Shielding gas (EN 439) **M2, M3, CO_2**

Approvals

TÜV (Certificate No. 0376)	DB (Certificate No. 42.132.01)
ABS	BV
GL (3YHS)	CWB
LR	DNV
Controlas	FT

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
0.9	B300	18
1.0	B300	18
1.2	B300	18
1.6	B300	18

Union MoNi

GMAW solid wire

Classifications

EN 12534	AWS A 5.28
G 62 5 M Mn3Ni1Mo	ER90S-G

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered and thermomechanically treated fine grained structural steels; creep resistant structural steels with higher yield strength.
Outstanding toughness values of the weld metal at low temperatures when deposited with CO_2 and gas mixture.

Materials

S550QL - S620QL, S550MC, P550M, 15 NiCuMoNb 5, 20 MnMoNi 55 etc; API Spec. 5L: X70, X80; ASTM A517 Gr. A, B, C, E, F, H, J, K, M, P; A255 Gr. C; A633 Gr. E; A572 Gr. 65

Typical analysis in %

C	Si	Mn	Mo	Ni
0.10	0.65	1.55	0.40	1.10

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	–40 °C	–60 °C
AW	CO_2	550	640	20	80	35	–
AW	M21	620	700	18	100	–	40

Welding position



Polarity = +
Shielding gas (EN 439) **M2, M3 and CO_2**

Approvals

TÜV (Certificate No. 0926)
GL
WIWEB
DB (Certificate No. 42.132.09)
DNV

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	18
1.2	B300	18

Union Ni 2,5

GMAW solid wire

Classifications

EN 440	AWS A 5.28
G 50 6 M G2Ni2	ER80S-Ni2

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of cryogenic fine grained structural steels.
Outstanding toughness values at low temperatures when deposited in combination with gas mixture.

Materials

12 Ni 14 G 1, X 12 Ni 5
P-,S275NL2 - P-,S500QL1; 13 MnNi 6-3; ASTM A633 Gr. E; A572 Gr. 65; A203 Gr. D; A333 and A334 Gr. 3; A350 Gr. LF3

Typical analysis in %

C	Si	Mn	Ni
0.08	0.60	1.00	2.35

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	–70 °C	–80 °C
AW	M21	510	620	24	120	50	–
SR	M21	450	560	24	140	–	55

Welding position



Polarity = +
Shielding gas (EN 439) **M1, M2**

Approvals

TÜV (Certificate No. 01627)
GL (7YS)
BV
ABS
LR
DNV

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	18
1.2	B300	18

Union NiMoCr

GMAW solid wire

Classifications

EN 12534	AWS A 5.28
G 69 5 M Mn4Ni1,5CrMo	ER100S-G [ER100S-1 (mod.)]

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered and thermomechanically treated fine grained structural steels; for joint welding of wear resistant steels. For use with CO_2 and gas mixture. Outstanding toughnesss of the weld metal at low temperatures. For use in crane and vehicle manufacturing.

Materials

S690QL1 (Dillimax 690; N-A-XTRA 70; Weldox 700),
S620QL1 (Dillimax 620; N-A-XTRA 63),
S700MC (PAS 70)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.08	0.60	1.70	0.20	0.50	1.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	−40 °C	−60 °C
AW	CO_2	680	740	18	80	45	–
AW	M21	720	780	16	100	–	45

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and CO_2**

Approvals

TÜV (Certificate No. 2760)
ABS
BV
DB (Certificate No. 42.132.12)
DNV
GL (6Y69S)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	18
1.2	B300	18

Union Patinax

GMAW solid wire

Classifications

EN 440	AWS A 5.18
G 42 3 C G0/ G 46 4 M G0	ER70S-G

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of weatherproof structural steels. The weld metal has the same corrosion properties as matching weatherproof structural steels. For use with CO_2 and gas mixture. Outstanding toughnesss of the weld metal at low temperatures. For use in steel framed structures, in bridge building and rail vehicle manufacture.

Materials

S235J2W - S355K2W; ASTM A36; A36; A283 Gr. B, C

Typical analysis in %

C	Si	Mn	Ni	Cu
0.09	0.85	1.50	0.50	0.40

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	−40 °C
AW	CO_2	450	570	26	90	50
AW	M21	480	590	24	100	–

Welding position



Polarity = +
Shielding gas (EN 439) **CO_2 and M2**

Approvals

TÜV (Certificate No. 0337)
DB (Certificate No. 42.132.05)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	18
1.2	B300	18

Union Rob 2

GMAW solid wire

Classifications

EN 440	AWS A 5.18
G 42 2 C G3Si1/ G 42 4 M G3Si1	ER70S-6

Characteristics and field of use

GMAW solid wire electrode for welding of unalloyed and low alloy steels. Especially designed for mechanized gas-shielded arc welding with robots. Comparable metallurgically to Union K 52. High analysis maintenance and particularly good feeding and electric contact characteristics; spooling quality suitable for robots.

Materials

S235JRG2 - S355J2;
boiler steels P235GH, P265GH, P295GH;
fine grained structural steels up to S420N

Typical analysis in %

C	Si	Mn
0.08	0.85	1.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	–20 °C	–40 °C
AW	CO_2	420	540	25	85	50	–
AW	M21	450	570	24	95	60	50

Welding position



Polarity = +
Shielding gas (EN 439) **M1 - M3 and CO_2**

Approvals

TÜV (Certificate No. 4168) DB (Certificate No. 42.132.16)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
0.9	B300	18
1.0	B300	18
1.2	B300	18
1.6	B300	18

Union Rob 3

GMAW solid wire

Classifications

EN 440	AWS A 5.18
G 46 2 C G4Si1/ G 46 4 M G4Si1	ER70S-6

Characteristics and field of use

GMAW solid wire electrode for welding of unalloyed and low alloy steels. Especially designed for mechanized gas-shielded arc welding with robots. Comparable metallurgically to Union K 56. High analysis maintenance and particularly good feeding and electric contact characteristics; spooling quality suitable for robots.

Materials

S235JRG2 - S355J2;
boiler steels P235GH, P265GH, P295GH, P355GH;
fine grained structural steels up to S460N

Typical analysis in %

C	Si	Mn
0.08	1.00	1.70

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	–20 °C	–40 °C
AW	CO_2	470	570	25	90	50	–
AW	M21	490	600	24	95	65	50

Welding position



Polarity = +
Shielding gas (EN 439) **M2, M3, CO_2**

Approvals

TÜV (Certificate No. 4169) DB (Certificate No. 42.132.17)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
0.9	B300	18
1.0	B300	18
1.2	B300	18
1.6	B300	18

Union SG 2-H

GMAW solid wire

Classifications

EN 440	AWS A 5.18
G 42 2 C G3Si1/ G 42 3 M G3Si1	ER70S-6

Characteristics and field of use

GMAW solid wire electrode for welding unalloyed and low alloy steels with gas mixtures (M1 – M3). Low spatter transfer in the short and spray arc range. Used in boiler construction, shipbuilding, structural engineering and vehicle manufacturing.

Materials

S235JRG2 - S355J2;
boiler steels P235GH, P265GH, P295GH;
fine grained structural steels up to S355N

Typical analysis in %

C	Si	Mn
0.08	0.80	1.40

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	–20 °C
AW	M21	430	560	24	90	50

Welding position



Polarity = +
Shielding gas (EN 439) **M1 - M3**

Approvals

TÜV (Certificate No. 3640)
GL (3YS)
DB (Certificate No. 42.132.15)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	18
1.2	B300	18
1.6	B300	18

Union SG 3-H

GMAW solid wire

Classifications

EN 440	AWS A 5.18
G 46 2 C G4Si1/ G 46 4 M G4Si1	ER70S-6

Characteristics and field of use

GMAW-solid wire for welding unalloyed and low alloy steels with CO_2 and gas mixture. Low spatter transfer in the short and spray arc range. All-purpose usable wire electrode with large application range.

Materials

S235JRG2 - S355J2;
boiler steels P235GH, P265GH, P295GH, P355GH;
fine grained structural steels up to S420N

Typical analysis in %

C	Si	Mn
0.08	1.00	1.65

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	–20 °C	–30 °C
AW	CO_2	440	550	25	90	50	–
AW	M21	470	580	24	95	–	50

Welding position



Polarity = +
Shielding gas (EN 439) **M2, M3, CO_2**

Approvals

TÜV (Certificate No. 7461)
GL (3YS)
DB (Certificate No. 42.132.29)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	18
1.2	B300	18
1.6	B300	18

Union X 85

GMAW solid wire

Classifications

EN 12534	AWS A 5.28
G 79 5 M Mn4Ni1,5CrMo	ER110S-G

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered fine grained structural steels. Outstandingly tough weld metal at low temperatures when deposited with gas mixture.
Good deformability; outstanding mechanical properties even at higher electric heat input per unit length of weld.
Good resistance to cold cracking due to high purity of the wire surface. For use in crane and vehicle manufacturing.

Materials

S690QL and higher strength pipe grades;
S690QL (Dillidur 690; N-A-XTRA 70; Weldox 690)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.09	0.7	1.70	0.30	0.60	1.85

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
						–50 °C
AW	CO_2	720	770	17	80	–
AW	M21	770	880	16	90	47

Welding position



Polarity = +
Shielding gas (EN 439) **M2, M3, CO_2**

Approvals

DB (Certificate No. 42.132.21)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	18
1.2	B300	18

Union X 90

GMAW solid wire

Classifications

EN 12534	AWS A 5.28
G 89 6 M Mn4Ni2CrMo	ER120S-G

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered fine grained structural steels. Outstandingly tough weld metal at low temperatures when deposited with gas mixture. Good resistance to cold cracking due to high purity of the wire surface. Used in crane and vehicle manufacture.

Materials

S890QL (Dillidur 890; Weldox 890; XABO 890);
S960QL (Dillidur 960; Weldox 960; XABO 960);
USS-T1

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.10	0.80	1.80	0.35	0.60	2.30

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
						–60 °C
AW	M21	890	950	15	90	50

Welding position



Polarity = +
Shielding gas (EN 439) **M2, M3**

Approvals

TÜV (Certificate No. 07675) DB (Certificate No. 42.132.12)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.9	B300	15
1.0	B300	18
1.2	B300	18

Union X 96

GMAW solid wire

Classifications

EN 12534	AWS A 5.28
G 89 5 M Mn4Ni2,5CrMo	ER120S-G

Characteristics and field of use

Medium alloy solid wire electrode for shielded arc welding of quenched and tempered fine grained structural steels in crane and vehicle manufacturing. Good deformability in spite of very high strength values. Good resistance to cold cracking due to high purity of the wire surface.

Materials

S960QL (Dillidur 960; Weldox 960; XABO 960);
S890QL (Dillidur 890; Weldox 890; XABO 890);
OX 1002

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.12	0.80	1.90	0.45	0.55	2.35

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	–50 °C
AW	M21	930	980	14	80	50

Welding position



Polarity = +
Shielding gas (EN 439) **M2**

Approvals

DB (Certificate No. 42.132.26)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	18
1.2	B300	18

Union I CrMo

GMAW solid wire

Classifications

EN 12070	AWS A 5.28	Mat. No.
G CrMo1Si	ER80S-G	1.7339

Characteristics and field of use

Medium alloy solid wire electrode useable both with CO_2 and with gas mixture.
Applications include the welding of creep resistant steels in boiler, tank, pipeline and reactor construction.

Materials

13CrMo4-5; ASTM A193 Gr. B7; A335 Gr. P11 and P12; A217 Gr. WC6

Typical analysis in %

C	Si	Mn	Cr	Mo
0.09	0.60	1.05	1.10	0.50

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
SR	M21*	450	560	22	80

*) Also weldable with CO_2 in this case the mechanical properties will change.

Welding position



Polarity = +
Shielding gas (EN 439) **M1 - M3 and CO_2**

Approvals

TÜV (Certificate No. 0905) DB (Certificate No. 42.132.19)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	18
1.2	B300	18

Union I CrMo 910

GMAW solid wire

Classifications

EN 12070	AWS A 5.28	Mat. No.
G CrMo2Si	ER90S-G	1.7384

Characteristics and field of use

Medium alloy solid wire electrode for gas-shielded arc welding both with gas mixture and CO_2.
Applications include the welding of creep resistant steels in boiler, tank, pipeline and reactor construction.

Materials

10 CrMo9-10; ASTM A335 Gr. P22; A217 Gr. WC9

Typical analysis in %

C	Si	Mn	Cr	Mo
0.09	0.55	0.90	2.55	1.00

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
SR	M21*	460	570	20	65

*) Also weldable with CO_2 in this case the mechanical properties will change.

Welding position



Polarity = +
Shielding gas (EN 439) **M1 - M3 and CO_2**

Approvals

TÜV (Certificate No. 0907) DB (Certificate No. 42.132.06)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	18
1.2	B300	18

Union I Mo

GMAW solid wire

Classifications

EN 440/12070	AWS A 5.28	Mat. No.
G46 4M G2Mo / G MoSi	ER80S-G	1.5424

Characteristics and field of use

GMAW solid wire electrode for the welding of low alloy and creep resistant steels.
All-purpose, medium-alloyed solid wire electrode, useable both with CO_2 and with gas mixture. Applications include the welding of low alloyed and creep resistant steels in boiler, tank, pipeline and reactor construction.

Materials

P235GH, P265GH, P295GH, 16 Mo 3;
fine grained structural steels up to S460N;
pipe steels according to DIN 17 175; ASTM A335 Gr. P1;
A161-94 Gr. T1 A; A182M Gr. F1; A204M Gr. A, B, C;
A250M Gr. T1; A217 Gr. WC1

Typical analysis in %

C	Si	Mn	Mo
0.10	0.60	1.15	0.50

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN +20 °C	−40 °C
AW	CO_2	450	550	24	80	
AW	M21	490	600	23	90	50

Welding position



Polarity = +
Shielding gas (EN 439) **M1 - M3 and CO_2**

Approvals

TÜV (Certificate No. 1831) DB (Certificate No. 42.132.14)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	18
1.2	B300	18

GMAW solid wires (high alloyed)

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Wire electrodes (GMAW) (high alloyed)

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278	Thermanit 14 K Si	1.4009	12072 G 13	A 5.9	ER410 (mod.) 278
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288-289	Thermanit 20/10	1.4431	12072 G 20 10 3	A 5.9	ER308Mo (mod.) 288-289
290	Thermanit 20/16 SM	1.3954	12072 G Z22 17 8 4 N L	–	290
291	Thermanit 20/25 Cu	1.4519	12072 G 20 25 5 Cu L	A 5.9	ER385 291
293	Thermanit 22/09	≈ 1.4462	12072 G 22 9 3 N L	A 5.9	ER2209 293
294-295	Thermanit 25/09 CuT	≈ 1.4501	12072 G 25 9 4 N L	A 5.9	ER2553 (mod.) 294-295
300	Thermanit 30/10	1.4337	12072 G 29 9	A 5.9	ER312 300
301	Thermanit 30/40 E	2.4656	•18274 S Ni 8025 (NiFe30Cr29Mo)	A 5.9	ER383 (mod.) 301
307	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo-3 307
for the welding of duplex stainless steels					
293	Thermanit 22/09	≈ 1.4462	12072 G 22 9 3 N L	A 5.9	ER2209 293
294-295	Thermanit 25/09 CuT	≈ 1.4501	12072 G 25 9 4 N L	A 5.9	ER2553 (mod.) 294-295

Summary
Wire electrodes (GMAW) (high alloyed)

Page	Brand name	Material No.	EN / •EN ISO	AWS	Page
for the welding of heat resistant steels					
259	Thermanit ATS 4	1.4948	12072 G 19 9 H	A 5.9	ER19-10 H 259
260	Thermanit C Si	1.4842	12072 G 25 20 Mn	A 5.9	ER310 (mod.) 260
261	Thermanit CR	1.4846	12072 G 25 20 H	A 5.9	ER310 (mod.) 261
262	Thermanit D	1.4829	12072 G 22 12 H	A 5.9	ER309 (mod.) 262
267	Thermanit L	1.4820	12072 G 25 4	–	– 267
268-269	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr-3 268-269
274-275	Thermanit X	1.4370	12072 G 18 8 Mn	A 5.9	ER307 (mod.) 274-275
292	Thermanit 21/33	≈ 1.4850	12072 G Z21 33 Nb	–	– 292
298	Thermanit 25/35 R	1.4853	12072 G Z25 35	–	– 298
299	Thermanit 25/35 Zr	≈ 1.4853	12072 G Z25 35 Zr	–	– 299
302	Thermanit 35/45 Nb	–	12072 G Z35 45 Nb H	–	– 302
306	Thermanit 617	2.4627	•18274 S Ni 6617 (NiCr22Co12Mo9)	A 5.14	ERNiCrCoMo-1 306
307	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo-3 307
for the welding of high temperature resistant steels					
259	Thermanit ATS 4	1.4948	12072 G 19 9 H	A 5.9	ER19-10 H 259
228	Thermanit MTS 3	1.4903	12070 G CrMo91	A 5.28	ER90S-B9 228
229	Thermanit MTS 4 Si	1.4937	12070 G CrMoWV12Si	A 5.9	ER505 (mod.) 229
230	Thermanit MTS 616	–	12070 G ZCrMoWVNb9 0,5 1,5	–	– 230
231	Thermanit MTS 911	1.4905	12070 G ZCrMoWVNb9 1 1	–	– 231
268-269	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr-3 268-269
306	Thermanit 617	2.4627	•18274 S Ni 6617 (NiCr22Co12Mo9)	A 5.14	ERNiCrCoMo-1 306
307	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo-3 307
for the welding of cryogenic steels					
266	Thermanit JE-308L Si	1.4316	12072 G 19 9 L Si	A 5.9	ER308L Si 266
268-269	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr-3 268-269
282	Thermanit 17/15 TT	–	12072 G Z17 15 Mn W	–	– 282
286-287	Thermanit 19/15	1.4455	12072 G 20 16 3 Mn N L	A 5.9	ER316L (mod.) 286-287
307	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo-3 307
for the welding of exhaust systems					
266	Thermanit JE-308L Si	1.4316	12072 G 19 9 L Si	A 5.9	ER308LSi 266
268-269	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr-3 268-269
274-275	Thermanit X	1.4370	12072 G 18 8 Mn	A 5.9	ER307 (mod.) 274-275
279	Thermanit 1610 Si	1.4502	12072 G Z17 Ti	A 5.9	ER430 (mod.) 279
303	Thermanit 409 Cb	≈ 1.4009	12072 G Z13 Nb L	A 5.9	ER409Cb 303
304	Thermanit 430L Cb	≈ 1.4511	12072 G Z18 Nb L	A 5.9	ER430 (mod.) 304
305	Thermanit 439 Ti	≈ 1.4009	12072 G Z18 Ti L	–	– 305

Summary
Wire electrodes (GMAW) (high alloyed)

Page	Brand name	Material No.	EN / •EN ISO	AWS	Page
for the welding of austenite ferrite joints					
268-269	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.15	ERNiCr-3 268-269
274-275	Thermanit X	1.4370	12072 G 18 8 Mn	A 5.9	ER307 (mod.) 274-275
288-289	Thermanit 20/10	1.4431	12072 G 20 10 3	A 5.9	ER308Mo (mod.) 288-289
296-297	Thermanit 25/14 E-309L Si	1.4332	12072 G 23 12 L Si	A 5.9	ER309L-Si 296-297
301	Thermanit 30/40 E	2.4656	•18274 S Ni 8025 (NiFe30Cr29Mo)	A 5.9	ER383 (mod.) 301
307	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo-3 307
for the welding of non magnetic steels					
284-285	Thermanit 18/17 E	≈ 1.4440	12072 G 18 16 5 N L	A 5.9	ER317L (mod.) 284-285
286-287	Thermanit 19/15	1.4455	12072 G 20 16 3 Mn N L	A 5.9	ER316L (mod.) 286-287
290	Thermanit 20/16 SM	1.3954	12072 G Z22 17 8 4 N L	–	290
for the welding of nickel and nickel base alloys					
268-269	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr-3 268-269
270-271	Thermanit Nimo C	2.4839	•18274 S Ni 6452 (NiCr20Mo15)	A 5.14	ERNiCrMo-7 (mod.) 270-271
272-273	Thermanit Nimo C 24	2.4607	•18274 S Ni 6059 (NiCr23Mo16)	A 5.14	ERNiCrMo-13 272-273
301	Thermanit 30/40 E	2.4656	•18274 S Ni 8025 (NiFe30Cr29Mo)	A 5.9	ER383 (mod.) 301
306	Thermanit 617	2.4627	•18274 S Ni 6617 (NiCr22Co12Mo9)	A 5.14	ERNiCrCoMo-1 306
307	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo-3 307
308-309	Thermanit 690	2.4642	•18274 S Ni 6052 (NiCr30Fe9)	A 5.14	ERNiCrFe-7 308-309
for the welding of cast iron					
310	Union FeNi 60 H IG		•1071 SC NiFe-2	–	310
311	Union FeNi 60 IG	2.4560	•1071 SC NiFe-1 (mod.)	–	311

Thermanit A Si

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 19 12 3 Nb Si	ER318 (mod.)	1.4576

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistant similar to matching stabilized CrNiMo steels. For joining and surfacing application on matching and similar – stabilized and non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades.

Materials

TÜV-certified parent metal
X10CrNiMoNb18-12 (1.4583); AISI 316L, 316Ti, 316Cb

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Nb
0.05	0.8	1.5	19.0	2.8	12.0	≥12xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	390	410	600	30	70

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to tendency to embrittlement

Polarity = +
Shielding gas (EN 439) **M12, M13**

Approvals

TÜV (Certificate No. 0601)
Controlas (0242)
DB (Certificate No. 43.132.02)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit ATS 4

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 19 9 H	ER19-10 H	1.4948

Characteristics and field of use

High temperature resistant up to 700 °C (1292 °F); resistant to scaling up to 800 °C (1472 °F). For surfacing and joining applications on matching/similar high temperature resistant steels/cast steel grades.

Materials

X6CrNi18-11 (1.4948)
X6CrNiNb18-10 (1.4550)
X12CrNiTi18-9 (1.4878)
AISI 304H, 321H, 347H

Typical analysis in %

C	Si	Mn	Cr	Ni
0.05	0.3	1.8	18.8	9.3

Creep and stress rupture properties

In the range of matching high temperature resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	370	550	35	70

Structure

Austenite with part ferrite, 5 % max.

Welding instruction

Materials	Preheating	Postweld treatment
Matching/ similar steels/ cast steel grades	Up to 25 mm wall thickness: none. Over 25 mm wall-thickness: max. 200 °C (392 °F) advisable	Up to 25 mm wall thickness: none. Over 25 mm wall thickness: to avoid stress corrosion cracking 1050 °C (1922 °F)/air

Polarity = +
Shielding gas (EN 439) **M12**

Approvals

TÜV (Certificate No. 6522)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit C Si

GMAW wire

Classifications	EN 12072	AWS A 5.9	Mat. No.
	G 25 20 Mn	ER310 (mod.)	1.4842

Characteristics and field of use

Resistant to scaling up to 1150 °C (2102 °F). For surfacing and joining on matching/similar heat resistant steels/cast steel grades. For tough fill layers beneath cap passes made with Thermanit L when welding thicker cross-sections of Cr steels/cast steel grades to permit use of such steels in sulphureous atmospheres.

Atmosphere	max. application temperature in °C (°F) sulphur-free	max. 2 g S/Nm³
Air and oxidizing combustion gases	1150 (2102)	1100 (2012)
Reducing combustion gases	1080 (1976)	1040 (1904)

Materials

GX40CrNiSi25-12 (1.4837); GX15CrNi25-20 (1.4840); X15CrNiSi25-20 (1.4841); AISI 305, 310, 314; ASTM A297 HF, A297HJ

Typical analysis in %

C	Si	Mn	Cr	Ni
0.13	1.0	3.2	25.0	20.5

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	380	550	25	80

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Heat resistant Cr steels/ cast steel grades	According to parent metal	According to parent metal
Heat resistant matching/ similar steels/cast steel grades	None	None

Polarity = +
Shielding gas (EN 439) **M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15

Thermanit CR

GMAW wire

Classifications	EN 12072	AWS A 5.9	Mat. No.
	G 25 20 H	ER310 (mod.)	1.4846

Characteristics and field of use

Resistant to scaling up to 1000 °C (1832 °F).
For surfacing and joining applications on matching heat-resistant cast steel grades.

Materials

GX40CrNiSi25-20 (1.4848) GX40CrNiSi22-9 (1.4826)
GX40CrNiSi25-12 (1.4837)

Typical analysis in %

C	Si	Mn	Cr	Ni
0.45	1.0	1.5	26.0	21.8

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %
AW	400	450	600	10

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Matching heat resistant cast steel grades	None	None

Polarity = +
Shielding gas (EN 439) **M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15
1.6	B300	15

Thermanit D

GMAW wire

Classifications	EN 12072	AWS A 5.9	Mat. No.
	G 22 12 H	ER309 (mod.)	1.4829

Characteristics and field of use

Resistant to scaling up to 950 °C (1742 °F). For joining and surfacing applications with matching/similar heat resistant steels/cast steel grades.

Atmosphere	max. application temperature in °C (°F) sulphur-free	max. 2 g S/Nm³	over 2 g S/Nm³
Air and oxidizing combustion gases	950 (1742)	930 (1706)	850 (1562)
Reducing combustion gases	900 (1652)	850 (1562)	

Materials

X15CrNiSi20-12 (1.4828); AISI 305; ASTM A297HF

Typical analysis in %

C	Si	Mn	Cr	Ni
0.11	1.2	1.2	22.0	11.0

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	370	550	30	70

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Heat resistant Cr steels/cast steel grades	According to parent metal	Annealing according to parent metal is not necessary, if service temperatures are the same or higher
Matching austenitic steels/cast steel grades	None	None

Polarity = +
Shielding gas (EN 439) **M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit GE-316L Si

GMAW wire

Classifications	EN 12072	AWS A 5.9	Mat. No.
	G 19 12 3 L Si	ER316LSi	1.4430

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistance similar to matching low-carbon and stabilized austenitic 18/8 CrNiMo steels/cast steel grades. For joining and surfacing application with matching and similar – non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels and cast steel grades.

Materials

TÜV-certified parent metal
X 10 CrNiMoNb 18 12 (1.4583);
UNS S31653; AISI 316L, 316Ti, 316Cb

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.02	0.8	1.7	18.8	2.8	12.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	420	560	35	70

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching and similar non-stabilized and stabilized steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1050 °C (1922 °F) – pay attention to tendency to embrittlement

Polarity = +
Shielding gas (EN 439) **M12, M13**

Approvals

TÜV (Certificate No. 0489)
Controlas (0972)
GL (4429S)
DB (Certificate No. 43.132.10)
LR (ftV3R-12)
CWB (ER 316L-Si)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit H Si

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 19 9 Nb Si	ER347Si	1.4551

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion-resistant similar to matching stabilized austenitic CrNi steels/cast steel grades.
For joining and surfacing application with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) steels and cast steel grades.

Materials

TÜV-certified parent metal
X6CrNiNb18-10 (1.4550) and the parent metals also covered by VdTÜV-Merkblatt 1000;
AISI 347, 321, 302, 304, 304L, 304LN;
ASTM A296 Gr. CF 8C; A157 Gr. C9; A320 Gr. B8C or D

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.06	0.8	1.5	19.5	9.5	≥12xC

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	570	30	65

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching and similar steels/cast steel grades	None	Mostly none. Otherwise solution annealing at 1020 °C (1868 °F)

Polarity = +
Shielding gas (EN 439) **M12, M13**

Approvals

TÜV (Certificate No. 0604)
DB (Certificate No. 43.132.06)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15

Thermanit JE-308L Si

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 19 9 L Si	ER308LSi	1.4316

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Corrosion-resistant similar to matching low-carbon and stabilized austenitic 18/8 CrNi(N) steels/cast steel grades. Cold toughness at subzero temperatures as low as –196 °C (–321 °F). For joining and surfacing applications with matching and similar – stabilized and non-stabilized – austenitic CrNi(N) and CrNiMo(N) steels/cast steel grades.
For joining and surfacing work on cryogenic matching/similar austenitic CrNi(N) steels/cast steel grades.

Materials

TÜV-certified parent metal
X5CrNi18-10 (1.4301); X2CrNiN18-10 (1.4311);
X6CrNiNb18-10 (1.4550); AISI 304, 304L, 304LN, 302, 321, 347;
ASTM A157 Gr. C9, A320 Gr. B8C or D.

Typical analysis in %

C	Si	Mn	Cr	Ni
0.02	0.9	1.7	20.0	10.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
						–196 °C
AW	350	370	570	35	75	35

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching and similar non-stabilized and stabilized autstenitic CrNi(N) steels/cast steel grades	None	Mostly none. If necessary, solution annealing at 1000 °C (1832 °F)
Cryogenic austenitic steels/ cast steel grades	None	None

Polarity = +
Shielding gas (EN 439) **M11, M12, M13**

Approvals

TÜV (Certificate No. 0555) DB (Certificate No. 43.132.08)
Controlas (0003) CWB (ER 308L-Si) DNV

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit L

GMAW wire

Classifications

EN 12072	Mat. No.
G 25 4	1.4820

Characteristics and field of use

Stainless; corrosion-resistant similar to matching or similar Mo-free 25 % Cr(Ni) steels/cast steel grades. Should parent metal be susceptible to embrittlement interpass temperature must not be allowed to rise above 300 °C (572 °F).
Resistant to scaling in air and oxidizing combustion gases up to 1150 °C (2102 °F). Good resistance in sulphureous combustion gases at elevated temperatures. For matching and similar heat resistant steels/cast steel grades.

Materials

GX40CrNi27-4 (1.4340) GX8CrNi26-7 (1.4347)
X20CrNiSi25-4 (1.4821) AISI 327; ASTM A297HC

Typical analysis in %

C	Si	Mn	Cr	Ni
0.06	0.8	0.8	26.0	5.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB30
AW	500	520	650	20	180

Structure

Ferrite/austenite

Welding instruction

Materials	Preheating	Post weld treatment
Matching and similar stainless steels/cast steel grades	According to wall thickness: 150-300 °C (302-572 °F). None for steel grade 1.4347	Cooling in air, possibly quenching at 980 °C (1796 °F)/air. To restore toughness for cast steel grades 1.4347 and 1.4336 quench at 1050 °C (1922 °F)/water or air
Matching heat-resistant steels	None	Mostly none

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15
1.6	B300	15

Thermanit Nicro 82

GMAW wire

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	2.4806

Characteristics and field of use

Nickel based alloy; heat resistant; high temperature resistant. Cold toughness at subzero temperatures as low as –269 °C (–452 °F). Good for welding austenitic-ferritic joints.
No Cr carbide zone that become brittle in the ferrite weld deposit transition zone, even as a result of heat treatments above 300 °C (572 °F). Good for fabricating tough joints and surfacing with heat resistant Cr and CrNi steels/cast steel grades and Ni-base alloys.
Temperature limits: 500 °C (932 °F) in sulphureous atmospheres, 800 °C (1472 °F) max. for fully stressed welds.
Resistant to scaling up to 1000 °C (1832 °F).

Materials

TÜV-certified parent metals
X10NiCrAlTi32-20 (1.4876), NiCr15Fe (2.4816), X8Ni9 (1.5662), 10CrMo9-10,
Combinations of X10CrNiMoNb18-12 (1.4583), X1NiCrMoCu25-20-5 (1.4539) and ferritic boiler steels;
Alloy 600, Alloy 600 L, Alloy 800 (H)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb	Fe
0.02	0.2	2.8	19.5	>67	2.5	<2.0

Creep and stress rupture properties

According to matching/similar high temperature resistant metals up to 800 °C (1472 °F).

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	420	620	35	90

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Unalloyed/low-alloy steels to austenitic CrNi(Mo,N) steels/ cast steel grades	Ferritic side: according to parent metal	According to parent metal. Attention must be paid to intercrystalline corrosion resistance and embrittlement in the case of stainless austenitic steels/cast steel grades
Heat resistant Cr steels	According to parent metal	According to parent metal
Heat resistant CrNi steels, Ni base alloys	None	None
Cryogenic Ni steels	According to parent metal	According to parent metal

Polarity = +
Shielding gas (EN 439) **I1**

Approvals

TÜV (Certificate No. 3089)
DNV (NV 5 Ni)
GL (NiCr20Nb)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit Nimo C

GMAW wire

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6452 (NiCr20Mo15)	ERNiCrMo-7 (mod.)	2.4839

Characteristics and field of use

Nickel based alloy. High corrosion resistance in reducing and above all in oxidizing environments. Thermanit Nimo C has the same corrosion resistance as AWS welding fill metal ER NiCrMo-7. Thermanit Nimo C contains no W, the Cr content is higher and the content of Fe is lower.
For joining and surfacing applications with matching and similar alloys and cast alloys (Hastelloy C-type).

Materials

TÜV-certified parent metal
NiMo16Cr16Ti (2.4610) – (Alloy C-4)
NiMo16Cr15W (2.4819) – (Alloy C-276)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Fe	V
0.015	0.1	1.0	20.0	15.0	Bal.	<1.0	+

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	450	470	700	40	60

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar metals (with or without W content)	None. Cooling in air. To be heeded for the new precipitation-insensitive parent and welding filler metals (very low C and Si contents): thin electrode diameter, stringer-type beads, low heat input, additional cooling of the weld region to avoid precipitations that cause embrittlement and reduce corrosion resistance in the temperature range from 600 °C (1112 °F) to 1000 °C (1832 °F)	Heat treatment is mostly not necessary for matching precipitation-insensitive parent metals if the recommendations on welding are observed. Otherwise solution annealing at 1150 °C (2102 °F) to 1175 °C (2147 °F) / water to restore full corrosion resistance

Polarity = +
Shielding gas (EN 439) **I1, M12(1)** (Ar + 30 % He + 0,5 % CO_2)

Approvals

TÜV (Certificate No. 4381)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit Nimo C 24

GMAW wire

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6059 (NiCr23Mo16)	ERNiCrMo-13	2.4607

Characteristics and field of use

Nickel based alloy. High corrosion resistance in reducing and, above all, in oxidizing environments. For joining and surfacing with matching and similar alloys and cast alloys.
For welding the cladded side of plates of matching and similar alloys.

Materials

NiCr21Mo14W (2.4602) – (Alloy 22)
NiMo16Cr15W (2.4819) – (Alloy C-276)
NiMo16Cr16Ti (2.4610) – (Alloy C-4)
NiCr23Mo16Al (2.4605) – (Alloy 59)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Fe
0.01	0.10	<0.5	23.0	16.0	Bal.	<1.5

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	420	700	40	60

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching and similar metals	None	None. Otherwise solution annealing: 1120 °C (2048 °F)/water

Polarity = +
Shielding gas (EN 439) **I1, M12(1)** (Ar + 30 % He + 0,5 % CO_2)

Approvals

TÜV (Certificate No. 6461)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit X

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 18 8 Mn	ER307 (mod.)	1.4370

Characteristics and field of use

Stainless. Resistant to scaling up to 850 °C (1562 °F). No adequate resistance against sulphureous combustion gases at temperatures above 500 °C (932 °F). For joining and surfacing applications with heat resistant Cr steels/cast steel grades and heat resistant austenitic steels/cast steel grades. Well suited for fabricating austenitic-ferritic joints – max. application temperature 300 °C (572 °F). For joining unalloyed/low-alloy or Cr steels/ cast steel grades to austenitic steels.
Low heat input required in order to avoid brittle martensitic transition zones.

Materials

TÜV-certified parent metal
X10CrNiMoNb18-12 (1.4583) and included parent metals combined with ferritic steels up to fine-grained structural steel P460NL2;
on and between high-tensile, unalloyed and alloyed structural steels, quenched and tempered steels and armour steels; unalloyed as well as alloyed boiler or structural steels with high alloyed Cr and CrNi steels; heat resistant steels up to 850 °C (1562 °F), on austenitic high manganese steels and with other steels; cryogenic plate and pipe steels in combination with cryogenic austenitic materials.

Typical analysis in %

C	Si	Mn	Cr	Ni
0.08	0.8	7.0	19.0	9.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	370	400	600	35	100

Structure

Austenite with small amount of ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Heat resistant Cr steels/cast steel grades	According to wall thickness: 150-300 °C (302-572 °F)	Tempering at 750 °C (1382 °F) not necessary if service temperature the same or higher
Heat resistant CrNi steels/cast steel grades	None	None
Joining of CrNi(MoN) austenitic steels to unalloyed/low-alloy steels/cast steel grades	According to ferritic parent metal, mostly not necessary	No postweld heat treatment >300 °C (572 °F) – risk of carbide precipitation at grain boundaries in the weld fusion zone, loss of toughness, fracturing
Joining of CrNi(MoN) austenitic steels to stainless and heat-resistant Cr steels/ cast steel grades	According to ferritic parent metal	According to parent metals. Attention must be paid to the intercrystalline corrosion resistance and embrittlement susceptibility of the austenitic metal side

Polarity = +
Shielding gas (EN 439) **M12, M13, M21**

Approvals

TÜV (Certificate No. 5651)
GL (4370 S)
DNV
DB (Certificate No. 43.132.01)
Controlas (0595)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit 13/04 Si

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 13 4	ER410NiMo (mod.)	1.4351

Characteristics and field of use

Stainless. Corrosion-resistant similar to matching 13 % Cr(Ni) steels/cast steel grades. High resistance to corrosion fatigue cracking. For joining and surfacing applications with matching 13 % Cr(Ni) and 13 % Cr steels/cast steel grades.

Materials

(G)X5CrNi13-4 (1.4313)
ACI Gr. CA 6NM

X6CrAl13 (1.4002)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.03	0.8	0.7	13.0	0.5	4.7

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield str. 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	Hardness HB30	HRC
600 °C / 8 h (1112 °F / 8 h) AW	680	800	15	50	250	38

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Post weld treatment
Matching steels/ cast steel grades	Up to 10 mm wall thickness: none, over 10 mm wall thickness: 100-150 °C (212-302 °F)	Tempering or quenching and tempering, according to parent metal
13 % Cr steels/ cast steel grades	According to parent metal	Tempering or quenching and tempering, according to parent metal

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 14 K Si

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 13	ER410 (mod.)	1.4009

Characteristics and field of use

Stainless; corrosion-resistant similar to matching 13 % Cr(Ni) steels/cast steel grades. For surfacing applications with matching or similar 13 % Cr steels/cast steel grades. For surfacing sealing faces of water, steam and gas valves and accessories made of unalloyed and low-alloy steels/cast steel grades for service temperatures up to 450 °C (842 °F).

Materials

(X8Cr14 (1.4008)) X10Cr13 (1.4006)
X6Cr13 (1.4000) AISI 410, 420

Typical analysis in %

C	Si	Mn	Cr	Ni
0.08	0.9	0.65	14.0	0.4

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB30	Hardness HRC
680 °C / 8 h	450	650	15	180	
AW					35

Structure

Martensite with part ferrite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld treatment
Surfacing: martensitic Cr steels/ cast steel grades	Acc. to wall thickness: 200-400 °C (392-752°F)	Cooling to around 120 °C (248 °F), then tempering or quenching and tempering
Surfacing: unalloyed/ low-alloy steels/cast steel grades	Larger wall thickness: 100-200 °C (212-392°F)	None; if necessary tempering to required hardness
Surfacing: higher-strength steels/cast steel grades	100-200 °C (212-392 °F)	None; if necessary tempering to required hardness

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15
1.6	B300	15

Thermanit 1610 Si

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G Z17 Ti	ER430 (mod.)	1.4502

Characteristics and field of use

Stainless; corrosion-resistant similar to matching 17 % Cr steels/ cast steel grades (seawater, diluted organic and inorganic acids). For joining and surfacing work on matching ferritic and similar Cr steels/cast steel grades, suitable for quenching and tempering. Lowest possible heat input is required, as ferritic 17 % Cr steels are susceptible to embrittlement due to grain growth.

Materials

X6Cr17 (1.4016) X8CrTi17 (1.4502)

Typical analysis in %

C	Si	Mn	Cr	Ti
0.065	1.0	0.6	17.5	>8xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB30
800 °C / 1 h	300	500	20	130
AW				170

Structure

Ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching ferritic steels	200 - 300 °C (392 - 572 °F)	Cooling in air. For reduction of stresses induced by welding and restoration of grain decomposition resistance annealing at 800 °C (1472 °F), cooling in air. Not necessary for single-layer welds under corresponding service temperatures.
Matching steels/cast steel grades, suitable for quenching and tempering	300 - 400 °C (572 - 752 °F)	Cooling to roughly 120 °C (248 °F), then temper or quench and temper, according to parent metal

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.6	B300	15

Thermanit 17

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 17	ER430 (mod.)	1.4015

Characteristics and field of use

Stainless; corrosion-resistant similar to matching 17 % Cr steels/ cast steel grades (seawater, diluted organic and inorganic acids). Resistant to scaling in air and oxidizing combustion gases up to 950 °C (1742 °F) and particularly, in sulphureous combustion gases at elevated temperatures. For joining and surfacing work on matching ferritic and similar quenchable and temperable Cr steels/cast steel grades. Lowest possible heat input is required as ferritic 17 % Cr steels are susceptible to embrittlement due to coarse grain growth. Often used only for final passes on tougher austenitic fill layers, above all in sulphureous combustion gases. For surfacing sealing faces of water, steam and gas valves and accessories, made of unalloyed and low-alloy steels/cast steel grades designed for service temperatures up to 450 °C (842 °F).

Materials

X20CrNi17-2 (1.4057)
GX22CrNi 7 (1.4059)
AISI 430Ti; AISI 431
GX40CrSi17 (1.4740)
X10CrAl18 (1.4742)

Typical analysis in %

C	Si	Mn	Cr
0.07	0.8	0.7	17.5

Creep and stress rupture properties

In the range of matching heat resistant parent metals

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB30
800 °C / 1 h (1472 °F / 1 h)	340	540	20	150
AW				240

Structure

Ferrite/martensite

Welding instruction

Materials	Preheating	Postweld treatment
Joining: matching (ferritic) steels/ cast steel grades	According to wall thickness: 150-300 °C (302-572 °F)	Cooling in air. For the reduction of stresses induced by welding and for restoration of grain decomposition resistance annealing at 800 °C (1472 °F), cooling in air. Mostly not necesssary if annealed with service temperature
Surfacing: unalloyed and low-alloy steels/ cast steel grades	Only for larger wall thicknesses: 100-250 °C (212-482 °F)	None; if necessary tempering to required hardness
Surfacing: high-strength steels/ cast steel grades	100-250 °C (212-482 °F)	None; if necessary tempering to required hardness

Polarity = +

Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15
1.6	B300	15

Thermanit 17/15 TT

GMAW wire

Classifications

EN 12072
G Z17 15 Mn W

Characteristics and field of use

Permitting toughness at subzero temperatures as low as –196 °C (–321 °F). Suitable for joining applications with cryogenic austenitic CrNi(N) steels/cast steel grades and cryogenic Ni steels suitable for quenching and tempering.

Materials

TÜV-certified parent metal
X8Ni9 (1.5662) X2CrNiN18-10 (1.4311)

Typical analysis in %

C	Si	Mn	Cr	Ni	W
0.20	0.40	10.5	17.5	14.0	3.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –196 °C
AW	430	460	600	30	80 50

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Cryogenic CrNi(N) steels/cast steel grades	None	None
Cryogenic Ni steels suitable for quenching and tempering	According to parent metal	None

Polarity = +
Shielding gas (EN 439) **M12, M13, M21**

Approvals

TÜV (Certificate No. 2890) BV (SAW (-196))
GL (5680 S) LR (ftV13R-12)
DNV (NV 5; [M13])

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15

Thermanit 1740

GMAW wire

Classifications

EN 12072	Mat. No.
G Z17 Mo H	1.4122

Characteristics and field of use

Stainless; corrosion-resistant similar to matching 17 % Cr steels/ cast steel grades (water, steam, seawater, diluted organic acids).
For joining and surfacing with matching and similar stainless Cr steels/cast steel grades. For surfacing sealing faces of water, steam and gas valves made of unalloyed/low-alloy steels/cast steel grades.
Designed for service temperatures up to 450 °C (842 °F).

Materials

(G)X35CrMo17 (1.4122)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.40	<0.5	<0.5	16.5	1.0	0.50

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB30	Hardness HRC
760 °C / 2 h (1400 °F / 2 h) AW	600	800	12	230	48

Structure

Martensite, suitable for quenching and tempering

Welding instruction

Materials	Preheating	Postweld treatment
Joining: matching (ferritic) steels/cast steel grades	300-400 °C (572-752 °F)	Cooling to around 120 °C (248 °F), then tempering or quenching and tempering
Surfacing: unalloyed/low-alloy steels/cast steel grades	Acc. to wall thickness: 150-350 °C (302-662 °F)	None; if necessary tempering to required hardness
Surfacing: higher-strength steels/cast steel grades	350 °C (662 °F)	None; if necessary tempering to required hardness

Polarity = +
Shielding gas (EN 439) **M12, M13**

Approvals

DB (Certificate No. 43.132.07)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit 18/17 E

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 18 16 5 N L	ER317L (mod.)	≈1.4440

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). High Mo content provides elevated resistance to Cl-bearing environment and pitting corrosion. Non magnetic. Well suited for joining and surfacing to matching and similar austenitic non-stabilized and stabilized stainless and non magnetic CrNiMo(N) steels/cast steel grades.
Recommended for joining matching/similar austenitic and ferritic steels/cast steel grades with a maximum application temperature of 300 °C (572 °F). Well suited for depositing intermediate layers when welding products clad with a matching or similar overlay.

Materials

TÜV-certified parent metal
X2CrNiMoN17-13-5 (1.4439) X2CrNiMo18-16-4 (1.4438)
X2CrNiMoN17-13-3 (1.4429) X10CrNiMoNb18-12 (1.4583)
AISI 316Cb, 316LN, 317LN, 317L; UNS S31726

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
0.03	0.30	3.7	18.5	4.2	17.5	0.15

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	320	350	570	34	65

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching and similar austenitic non-stabilized and stabilized CrNiMo(N) steels/cast steel grades	None	If necessary, solution annealing at 1050 °C (1922 °F)
Non magnetic CrNiMo(N) steels/cast steel grades	None; keep interpass welding temperature low	If necessary, stress relieving according to parent metal, otherwise solution annealing at 1050 °C (1922 °F)

Polarity = +
Shielding gas (EN 439) **M12, M13**

Approvals

TÜV (Certificate No. 2077) DB (Certificate No. 43.132.09)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 19/15

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 20 16 3 Mn N L	ER316L (mod.)	1.4455

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Corrosion-resistant similar to low-carbon CrNiMoMn(N) steels/cast steel grades. Seawater resistant, good resistance to nitric acid;
Non magnetic (permeability in field of 8000 A/m 1.01 max.). Particularly suited for corrosion conditions in urea synthesis plants; well suited for joining and surfacing applications with matching and similar austenitic CrNi(N) and CrNiMo(Mn,N) steels/cast steel grades.

Materials

TÜV-certified parent metal
X2CrNiMoN17-13-3 (1.4429); X5CrNiN19-9 (1.4315); X1CrNiMoTi18-13-2 (1.4561) as well as 10CrNiTi18-10 (1.6903) and cryogenic 3.5 - 5 % Ni-steels

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
0.03	0.5	7.5	20.5	3.0	15.5	0.18

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	430	450	650	30	80

Structure

Austenite with part ferrite, 0.6 % max.

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar materials	None	Mostly not necessary
Type 1.455 claddings	According to parent metal mostly 150 °C (302 °F)	In case of excessive hardening of the parent metal, stress relieving at 510 °C (950 °F) 20 h max., annealing above 530 °C (986 °F) only prior to welding the last pass

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 20/10

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 20 10 3	ER308Mo (mod.)	1.4431

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 300 °C (572 °F). For joining of stainless Cr and similar austenitic CrNiMo steels/cast steel grades. For joining of dissimilar materials. For tough joints on high manganese steel (steel castings), CrNiMn steels/cast steel grades and armour steels. For surfacing and repair welding on wear-exposed parts: rotors, rails. Especially suited for austenitic-ferritic joints at max. application temperature 300 °C (572 °F). Particularly for tough joints of unalloyed/low-alloy steels/cast steel grades or stainless heat resistant Cr steels/cast steel grades with austenitic steels/ cast steel grades.

Materials

TÜV-certified parent metal
Combinations of stainless resp. cryogenic austenitic steels such as X10CrNiMoNb18-12 (1.4583) and ferritic steels up to boiler plates P295GH;
on and between high-tensile, unalloyed and alloyed structural steels, quenched and tempered steels and armour steels;
unalloyed as well as alloyed boiler or structural steels with high alloyed Cr and CrNi steels;
on austenitic high manganese steels and with other steels.

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni
0.05	0.5	1.3	20.5	3.3	10.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	470	520	670	25	50

Structure

Austenite with increased amount of ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Unalloyed/low-alloy structural steels of elevated strength (surfacing and repair welding)	According to parent metal mostly not necessary	No stress relieving (risk of carbide precipitation in weld fusion zone, loss of toughness, fracturing)
Stainless Cr steels	According to parent metal	None
Stainless CrNi steels	None	None
High manganese steel	None	As this steel becomes very brittle at 400–600 °C (752–1112 °F), weld as cold as possible, cooling possibly with compressed air, or dip workpiece in water. No postweld heat treatment, quench if possible

Polarity = +
Shielding gas (EN 439) **M12 (max. 3 % CO_2), M13**

Approvals

TÜV (Certificate No. 1773)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15
1.6	B300	15

Thermanit 20/16 SM

GMAW solid wire

Classifications

EN 12072	Mat. No.
G Z22 17 8 4 N L	1.3954

Characteristics and field of use

Non magnetic; permeability in field of 8000 A/m: 1.01 max.; stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Seawater-resistant. Cold toughness at subzero temperatures. Specially for joining and surfacing work on matching/similar non magnetic CrNiMo(Mn,N) steels/ cast steel grades.

Materials

X4CrNiMnMoN19-13-8 (1.3948)
X2CrNiMoN18-14-3 (1.3952)
X2CrNiMnMoNNb21-16-5-3 (1.3964)
X2CrNiMoN17-13-5 (1.4439)
X2CrNiMoN22-15 (1.3951)
X2CrNiMo18-15 (1.3953)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
0.03	0.70	7.3	22.2	3.6	18.0	0.24

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	430	460	640	30	70

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar non magnetic steels/cast steel grades	None	None

Polarity = +
Shielding gas (EN 439) **M12, M12(1)** (15%He+2%CO_2+83%Ar)

Approvals

WIWEB
GL (39549)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 20/25 Cu

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 20 25 5 Cu L	ER385	1.4519

Characteristics and field of use

Stainless; resistant to intercrystalline corrosion and wet corrosion up to 350 °C (662 °F). Good corrosion resistance similar to matching steels/cast steel grades, above all in reducing environment. For joining and surfacing work on matching austenitic CrNiMoCu steels/cast steel grades. For joining these steels with unalloyed/low-alloy steels/cast steel grades.

Materials

TÜV-certified parent metal
X1NiCrMoCu25-20-5 (1.4539), X4NiCrMoCuNb20-18-2 (1.4505) with X1CrNiMoN25-25-2 (1.4465) and others,
as well as ferritic steels up to S355J;
matching Cr-Ni steels with high Mo content;
X2CrNiMoN17-13-5 (1.4439); X1CrNiMoCuN25-25-5 (1.4537); UNS N08904, S31726

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Cu
<0.025	0.20	2.5	20.5	4.8	25.0	1.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	350	370	550	35	55

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar steels/cast steel grades	None	None. If necessary solution annealing at 1120 °C (2048 °F)
Combinations with unalloyed/low-alloy steels/cast steel grades	According to unalloyed/ low alloy parent metal mostly not necessary	None

Polarity = +
Shielding gas (EN 439) **M12, M13**

Approvals

TÜV (Certificate No. 4302)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 21/33

GMAW wire

Classifications

EN 12072	Mat. No.
G Z21 33 Nb	≈1.4850

Characteristics and field of use

Resistant to scaling up to 1050 °C (1922 °F). Good resistance to carburizing atmospheres. For joining and surfacing applications with matching/similar heat resistant steels/ cast steel grades.

Atmosphere	max. application temperature in °C (°F) sulphur-free	max. 2 g S/Nm³
Air and oxidizing combustion gases	1050 (1922)	1000 (1832)
Reducing combustion gases	1000 (1832)	950 (1742)

Materials

X10NiCrAlTi32-20 (1.4876) Alloy 800 H
GX10NiCrNb32-20 (1.4859)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.20	0.20	2.3	22.0	33.0	1.7

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	380	400	600	25	50

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar steels/cast steel grades	None	None

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15

Thermanit 22/09

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 22 9 3 N L	ER2209	≈1.4462

Characteristics and field of use

Duplex stainless steel; resistant to intercrystalline corrosion and wet corrosion up to 250 °C (482 °F). Good resistance to stress corrosion cracking in chlorine- and hydrogen sulphide-bearing environment. High Cr and Mo contents provide resistance to pitting corrosion. For joining and surfacing work on matching and similar austenitc steels/cast steel grades. Attention must be paid to embrittlement susceptibility of the parent metal.

Materials

TÜV-certified duplex stainless steels
X2CrNiMoN22-5-3 (1.4462) and others, also combinations of aforementioned steels and ferritic steels up to S355J, 16Mo3 and X10CrNiMoNb18-12 (1.4583);
UNS S31803, S32205

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N
0.025	0.5	1.6	23.0	3.0	9.0	0.14

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	510	550	700	25	70

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar steels/ cast steel grades	None	Mostly none; if necessary solution annealing at 1050 °C (1922 °F)/ water

Polarity = +
Shielding gas (EN 439) **M12, M13**

Approvals

TÜV (Certificate No. 3342) GL (4462S)
DNV Controlas (0083)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	15
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit 25/09 CuT

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 25 9 4 N L	ER2553 (mod.)	≈1.4501

Characteristics and field of use

Superduplex stainless steel; resistant to intercrystalline corrosion and wet corrosion up to 220 °C (428 °F). Very good resistance to pitting corrosion and stress corrosion cracking due to the high CrMo(N) content (pitting index ≥40).
Well suited for the conditions in the offshore field.

Materials

GX3CrNiMoCuN26-6-3 (1.4515)
GX3CrNiMoCuN25-6-3-3 (1.4517)
X2CrNiMoCuN 25-7-4 (1.4501; UNS S 32760)
25 % Cr-superduplex steels such as Zeron 100, SAF 25/07, FALC 100, NIROSTA® 4501

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N	Cu	W
0.02	0.3	1.5	25.5	3.7	9.5	0.22	0.8	0.6

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN −46 °C	
AW	650	700	750	25	80	50

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar steels/cast steel grades	Mostly none	Mostly none; if necessary, solution annealing at 1120 °C (2048 °F)/ water.

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 25/14 E-309L Si

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 23 12 L Si	ER309LSi	1.4332

Characteristics and field of use

Stainless; (wet corrosion up to 350 °C (662 °F)). Well suited for depositing intermediate layers when welding cladded materials. Favourably high Cr and Ni contents, low C content. For joining unalloyed/low-alloy steels/cast steel grades or stainless heat resistant Cr steels/cast steel grades to austenitic steels/cast steel grades. For depositing intermediate layers when welding the side of plates clad with low-carbon – non stabilized or stabilized – austenitic CrNiMo(N) austenitic metals.

Materials

Joints of and between high-tensile, unalloyed and alloyed quenched and tempered, stainless, ferritic Cr and austenitic CrNi steels, high manganese steels as well as weld claddings for the first layer of chemical resistant weld claddings on ferritic-pearlitic steels up to fine grained structural steel S500N for steam boiler and pressure boiler constructions, as well as on creep resistant fine grained structural steels 22NiMoCr4-7 axx. to leaflet “SEW-Werkstoffblatt” No. 365, 366, 20MnMoNi5-5 and G18NiMoCr3-7.

Typical analysis in %

C	Si	Mn	Cr	Ni
0.03	0.9	2.0	24.0	13.0

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN
AW	400	430	550	30	55

Structure

Austenite with part ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Joining: CrNi(MoN) austenitic steels with unalloyed/low-alloy steels/cast steel grades	According to ferritic parent metal; mostly not necessary	No postweld heat treatment above 300 °C (572 °F); risk of carbide precipitation in weld fusion zone, loss of toughness, fracturing
Joining: CrNi(MoN) austenitic steels with stainless heat resistant Cr steels/cast steel grades	According to ferritic parent metal	According to parent metals. Attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement
Cladded plates and cast materials with austenitic CrNi(MoN) overlay	According to ferritic parent metal	According to parent metals. Attention must be paid to resistance to intercrystalline corrosion and to susceptibility of the austenitic metal side to embrittlement

Polarity = +
Shielding gas (EN 439) **M12, M13**

Approvals

TÜV (Certificate No. 02661) GL (4332)
CBW (ER309LSi)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	BS300	15
1.0	B300	15
1.2	B300	15

Thermanit 25/35 R

GMAW wire

Classifications

EN 12072	Mat. No.
G Z25 35	1.4853

Characteristics and field of use

Resistant to scaling up to 1050 °C (1922 °F).
For joining and surfacing work on matching/similar heat resistant cast steel grades.

Materials

GX40NiCrSiNb35-25 (1.4852)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.42	1.2	1.8	26.0	35.0	1.3

Creep and stress rupture properties

In the range of matching cast steel grade

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation ($L_0=5d_0$) %
AW	400	450	600	8

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar cast steel grades	None	None

Polarity = +
Shielding gas (EN 439) **M12, M13**

Approvals

Controlas (0100)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15

Thermanit 25/35 Zr

GMAW wire

Classifications

EN 12072	Mat. No.
G Z25 35 Zr	≈1.4853

Characteristics and field of use

Resistant to scaling up to 1150 °C (2102 °F).
For joining and surfacing work on matching/similar heat resistant cast steel grades.

Materials

GX40NiCrSiNb35-25 (1.4852)

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb	Zr
0.42	1.2	1.8	26.0	35.0	1.3	<0.15

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation ($L_0=5d_0$) %
AW	400	450	600	8

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar cast steel grades	None	None

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15

Thermanit 30/10

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G 29 9	ER312	1.4337

Characteristics and field of use

Stainless; wet corrosion up to 300 °C (572 °F). High resistance to hot cracking: good toughness at high yield strength.
For joining and surfacing applications with matching/similar steels/cast steel grades. For fabricating tough joints on unalloyed/low-alloy structural steels of higher strength, on high manganese steel and CrNiMn steels, between dissimilar metals e.g. between stainless or heat resistant and unalloyed/low-alloy steels/cast steel grades.

Materials

X10Cr13 (1.4006), X120Mn12 (1.3401), S235J, S355J

Typical analysis in %

C	Si	Mn	Cr	Ni
0.15	0.5	1.6	30.0	9.0

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %	Impact values in J CVN
AW	500	750	20	27

Structure

Austenite/ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Stainless and heat resistant, unalloyed and low-alloy steels/cast steel grades; combinations	According to parent metal	Mostly not necessary

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 30/40 E

GMAW wire

Classifications

EN ISO 18274	AWS A 5.9	Mat. No.
S Ni 8025 (NiFe30Cr29Mo)	ER383 (mod.)	2.4656

Characteristics and field of use

Nickel based alloy; resistant to intercrystalline corrosion and wet corrosion up to 450 °C (842 °F). Good corrosion resistance, especially in reducing environment. For joining and surfacing work on matching and similar – non-stabilized and stabilized – fully austenitic steels/cast steel grades containing Mo (and Cu). For joining aforementioned steels to unalloyed/low-alloy steels.

Materials

TÜV-certified parent metal
X3CrNiMoTi25-25 (1.4577), and combinations of aforementioned materials with ferritic steels up to S355J

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Cu
0.02	0.20	2.6	29.0	4.3	36.0	1.8

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Yield strength 1.0% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %	Impact values in J CVN
AW	350	370	550	30	75

Structure

Austenite, no ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching metals	None (weld as cold as possible) cooling in air	If necessary solution annealing at 1120 °C (2048 °F)
Joining of matching austenitic steels to unalloyed/low-alloy steels/cast steel grades	According to parent metal	None

Polarity = +
Shielding gas (EN 439) **I1, I3, M12(1)** (29,5%He+0,5%CO_2+70%Ar)

Approvals

TÜV (Certificate No. 5588)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	12.5
1.0	B300	15
1.2	B300	15

Thermanit 35/45 Nb

GMAW wire

Classifications

EN 12072
G Z35 45 Nb H

Characteristics and field of use

Resistant to scaling up to 1180 °C (2156 °F).
For joining and surfacing work on matching/similar heat resistant cast steel grades

Materials

GX45NiCrNbSiTi45-35

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.42	1.5	1.0	35.0	45.5	0.8

Creep and stress rupture properties

In the range of matching cast steel grades

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation ($L_0=5d_0$) %
AW	245	450	6

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar cast steel grades	None	None

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15

Thermanit 409 Cb

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G Z13 Nb L	ER409Cb	≈1.4009

Characteristics and field of use

Stainless. Scaling resistant up to 900 °C (1652 °F).
For joining and surfacing of similar and matching steels.
Exhaust systems.

Materials

AISI 409; X2CrTi12/X6CrTi12 (1.4512), X12Cr13 (1.4006), X15Cr13 (1.4024), X20 Cr13 (1.4021)

Typical analysis in %

C	Si	Mn	Cr	Nb
≤0.05	0.6	0.6	11.5	≥10xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Hardness HB30
AW	≈150
750 °C / 2 h (1382 °F / 2 h)	≈130

Structure

Ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar steels	According to wall thickness 200 - 300 °C (392 - 572 °F)	According to wall thickness 700 - 750 °C (1292 - 1382 °F); Not necessary for single-layer welds under corresponding service temperatures

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 430L Cb

GMAW wire

Classifications

EN 12072	AWS A 5.9	Mat. No.
G Z18 Nb L	ER430 (mod.)	≈1.4511

Characteristics and field of use

Stainless. Scaling resistant up to 900 °C (1,652 °F).
For joining and surfacing of similar and matching steels.
Exhaust systems.

Materials

AISI 430; X3CrNb17 (1.4511), X6Cr17 (1.4016)

Typical analysis in %

C	Si	Mn	Cr	Nb
≤0.02	0.5	0.5	18.0	≥12xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Hardness HB30
AW	≈150
650 °C / 2 h (1202 °F / 2 h)	≈130

Structure

Ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar steels	According to wall thickness 200 - 300 °C (392 - 572 °F)	According to wall thickness 750 - 800 °C (1,383 - 1,472 °F); Not necessary for single-layer welds under corresponding service temperatures

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 439 Ti

GMAW wire

Classifications

EN 12072	Mat. No.
G Z18 Ti L	≈1.4510

Characteristics and field of use

Stainless. Scaling resistant up to 900 °C (1652 °F).
For joining and surfacing of similar and matching steels.
Exhaust systems.

Materials

AISI 439; X3CrTi17 (1.4510), X6Cr17 (1.4016), X8CrTi18 (1.4502)

Typical analysis in %

C	Si	Mn	Cr	Ti
≤0.03	0.8	0.8	18.0	≥12xC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Hardness HB30
AW				≈150
800 °C / 1 h (1472 °F / 1 h)	280	430	20	≈130

Structure

Ferrite

Welding instruction

Materials	Preheating	Postweld treatment
Matching ferritic steels	200 - 300 °C 392 - 572 °F)	Air cooling. Stress releaving heat treatment at 800 °C (1,472 °F), Air cooling is recommended when multi layer welding. Not necessary for single-layer welds under corresponding service temperatures

Polarity = +
Shielding gas (EN 439) **M12, M13**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Thermanit 617

GMAW wire

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6617 (NiCr22Co12Mo9)	ERNiCrCoMo-1	2.4627

Characteristics and field of use

Resistant to scaling up to 1100 °C (2012 °F), high temperature resistant up to 1000 °C (1832 °F). High resistance to hot gases in oxidizing resp. carburizing atmospheres.
Suited for joining and surfacing applications with matching and similar heat resistant steels and alloys. For joining and surfacing work on cryogenic austenitic CrNi(N) steels/cast steel grades and on cryogenic Ni steels suitable for quenching and tempering.

Materials

X10NiCrAlTi32-20 (1.4876) – (Alloy 800(H))
GX10NiCrNb32-20 (1.4859)
NiCr23Fe (2.4851) – (Alloy 601)
NiCr23Co12Mo (2.4663) – (Alloy 617)
9% Ni steels

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Co	Al	Ti	Fe
0.05	0.1	0.1	21.5	9.0	Bal.	11.0	1.0	0.5	1.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –196 °C
AW	400	700	40	100 47

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar metals	None	Mostly none. If necessary, solution annealing at 1150 °C (2102 °F)

Polarity = +
Shielding gas (EN 439) **I1, M12(1)** (Ar+30%He+0,5%CO_2)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.2	B300	15

Thermanit 625

GMAW wire

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	2.4831

Characteristics and field of use

Nickel based alloy; high resistance to corrosive environment. Resistant to stress corrosion cracking. Resistant to scaling up to 1100 °C (2012 °F). Temperature limit: 500 °C (932 °F) max. in sulphureous atmospheres. High temperature resistant up to 1000 °C (1832 °F). Cold toughness at subzero temperatures as low as –196 °C (–321 °F). For joining and surfacing work with matching/similar corrosion-resistant materials as well as with matching and similar heat resistant, high temperature resistant steels and alloys. For joining and surfacing work on cryogenic austenitic CrNi(N) steels/cast steel grades and on cryogenic Ni steels suitable for quenching and tempering.

Materials

TÜV-certified parent metal; Alloy 800 H, NiCr22Mo9Nb (2.4856), X1CrNiMoCuN20-18-7 (1.4547) and combinations of afore-mentioned materials with ferritic steels up to S355J, 10CrMo9-10; Alloy 600, Alloy 625, Alloy 800, 9% Ni steels.

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Nb	Fe
0.03	0.25	0.20	22.0	9.0	Bal.	3.6	<1.0

Creep and stress rupture properties

According to matching/similar creep resistant materials

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Yield strength 1.0% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –196 °C*
AW	460	500	740	30	60 40

* (–321 °F)

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar metals	None	None; if necessary, solution annealing at 1150 °C (2102 °F)
Cryogenic CrNi(N) steels/ cast steel grades	None	None
Cryogenic Ni steels (X 8 Ni 9) suitable for quenching and tempering	According to parent metal	None

Polarity = +
Shielding gas (EN 439) **I1, M12(1)** (Ar+30%He+0,5%CO_2)

Approvals

TÜV (Certificate No. 3462)

Packaging and weights

Diam. (mm)	Spool	kg / pack
0.8	B300	12.5
1.0	B300	15
1.2	B300	15
1.6	B300	15

Thermanit 690

GMAW wire

Classifications

EN ISO 18274	AWS A 5.14	Mat. No.
S Ni 6052 (NiCr30Fe9)	ERNiCrFe -7	2.4642

Characteristics and field of use

High resistance to stress corrosion cracking in oxidizing acids and water at high temperatures.
Particularly suited for the conditions in nuclear fabrication.
Useable for joining matching and similar steels, surfacing with low-alloy and stainless steels.

Materials

NiCr29Fe (2.4642) – (Alloy 690)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Fe	Co
0.03	0.3	0.3	29.0	0.1	Bal.	9.0	<0.1

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation ($L_0=5d_0$) %	Impact values in J CVN
AW	350	600	35	80

Structure

Austenite

Welding instruction

Materials	Preheating	Postweld treatment
Matching/similar metals	None	None

Polarity = +
Shielding gas (EN 439) **I1, M12(1)** (Ar+30%He+0,5%CO_2)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	B300	15
1.2	B300	15

Union FeNi 60 H IG

GMAW wire

Classifications

EN ISO 1071
SC NiFe -2

Characteristics and field of use

Union FeNi 60 H IG is a nickel-iron-copper alloyed wire electrode for the welding of joinings and claddings on cast materials with spherical graphite as well as combinations between cast iron and steel

Materials

EN-GJL-250 to EN-GJL 350 (EN-JL 1040 to EN-JL 1050)
EN-GJMB-350-10 to EN-GJMB-700-2 (B35-10; P45-06 to P70-02)
EN-GJS-350-22-LT to EN-GJS-700-2 (EN-JS 1015 to EN-JS 1070)

Typical analysis in %

C	Si	Mn	Ni	Cu	Fe
0.1	0.25	3.0	55.0	2.0	Bal.

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Hardness HB 30
AW	250	450	200

Polarity = +
Shielding gas (EN 439) **M12, M12(1)**

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	BS300	15.0
1.2	BS300	15.0

Union FeNi 60 IG

GMAW wire

Classifications

EN ISO 1071	Mat. No.
SC NiFe -1 (mod.)	2.4560

Characteristics and field of use

Union FeNi 60 IG is a nickel-iron alloyed wire electrode for the welding of joinings and claddings on cast iron.
Suited for joinings between cast iron and high alloyed (stainless, heat-resistant) steels.

Materials

EN-GJS-350-22-LT to EN-GJS-700-2 (EN-JS 1015 to EN-JS 1070)
EN-GJMB-350-10 to EN-GJMB-700-2 (B35-10; P45-06 to P70-02)
EN-GJMW-350-4 to EN-GJMW-550-4 (W35-04 to W55-04)

Typical analysis in %

C	Si	Mn	Ni	Fe
0.1	0.15	0.9	59.0	Bal.

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat-treatment	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Hardness HB 30
AW	200	400	180

Polarity = +
Shielding gas (EN 439) **I** (Ar); **M12, M12(1)**

Approvals

DB (Certificate No. 62.132.02)

Packaging and weights

Diam. (mm)	Spool	kg / pack
1.0	BS300	15.0
1.2	BS300	15.0

Sub arc wires and fluxes (low and medium alloyed)

	Page
Summary	314-315
Wires	316-323
for submerged arc welding unalloyed steels	
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for submerged arc welding unalloyed steels	326-335
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Summary – Sub arc wires and fluxes (low and medium alloyed)

Page	Brand name	EN		AWS		Page
Wires.....**for submerged arc welding unalloyed steels**						
316-317	Union S 1	756	S1	A 5.17	EL12	316-317
316-317	Union S 1 Mo 1,2	756	SZ	A 5.23	EG	316-317
318-319	Union S 2	756	S2	A 5.17	EM12	318-319
320-321	Union S 2 Si	756	S2Si	A 5.17	EM12K	320-321
320-321	Union S 3	756	S3	A 5.17	EH10K	320-321
320-321	Union S 3 Mo Ti B	756	SZ	A 5.23	EG	320-321
322-323	Union S 3 Si	756	S3Si	A 5.17	EH12K	322-323
	.....for submerged arc welding creep resistant and cryogenic steels					
316-317	Thermanit MTS 3	12070	S CrMo91	A 5.23	EB 9	316-317
316-317	Thermanit MTS 4	12070	S CrMoWV12	A 5.23	EG	316-317
316-317	Thermanit MTS 616	12070	S ZCrMoWVNb9 0,5 1,5	A 5.23	EG [B9 (mod.)]	316-317
316-317	Thermanit MTS 911	12070	S ZCrMoWVNb9 1 1	A 5.23	EG [B9 (mod.)]	316-317
316-317	Union S 1 CrMo 2	12070	S CrMo2	A 5.23	EB3R	316-317
316-317	Union S 1 CrMo 2 V	12070	S ZCrMoV2	A 5.23	EG	316-317
316-317	Union S 1 CrMo 5	12070	S CrMo5	A 5.23	EB6	316-317
318-319	Union S 2 CrMo	12070	S CrMo1	A 5.23	EB2R	318-319
320-321	Union S 3 Mo	756/12070	S3Mo / S MnMo	A 5.23	EA4	320-321
320-321	Union S 3 NiMo	756/14295	S3Ni1,5Mo	A 5.23	EG [EF1 (mod.)]	320-321
320-321	Union S 3 NiMo 1	756/14295	S3Ni1Mo	A 5.23	EG [EF3 (mod.)]	320-321
322-323	Union S P 23	12070	S ZCr2WV	A 5.23	EG	322-323
322-323	Union S P 24	12070	S ZCrMo2VN6	A 5.23	EG	322-323
	.....for submerged arc welding fine grained structural steels					
318-319	Union S 2 Mo	756/12070	S2Mo / S Mo	A 5.23	EA2	318-319
318-319	Union S 2 Ni 2,5	756	S2Ni2	A 5.23	ENi2	318-319
318-319	Union S 2 Ni 3,5	756	S2Ni3	A 5.23	ENi3	318-319
318-319	Union S 2 Ni 370	756	S2Ni1,5	A 5.23	EG [ENi1 (mod.)]	318-319
318-319	Union S 2 NiMo 1	756	SZ2Ni1	A 5.23	ENi1	318-319
320-321	Union S 3 NiMoCr	14295	SZ3Ni2,5CrMo	A 5.23	EG [EF6 (mod.)]	320-321
322-323	Union S 4 Mo	756	S4Mo	A 5.23	EA3	322-323
Fluxes.....**for submerged arc welding unalloyed steels**						
326	UA 600	760	SA AB 1 65 DC H5	–	–	326
327-328	UV 300	760	SA MS 1 87 AC H5	–	–	327-328
329	UV 305	760	SA AR 1 76 AC H5	–	–	329
330-331	UV 306	760	SA AR 1 77 AC H5	–	–	330-331
332	UV 309 P	760	SA AB 1 65 AC H5	–	–	332
333	UV 310 D	760	SA FB 1 55 DC H5	–	–	333
334-335	UV 400	760	SA AB 1 67 A C H5	–	–	334-335
	.....for submerged arc welding creep resistant and cryogenic steels					
324-325	Marathon 543	760	SA FB 2 55 DC	–	–	324-325
339-343	UV 420 TT / UV 420 TT-LH	760	SA FB 1 65 DC/SA FB 1 65 DC H5	–	–	339-343
344-347	UV 420 TTR / UV 420 TTR-W	760	SA FB 1 65 DC/SA FB 1 65 AC	–	–	344-347
348	UV 420 TTRC	760	SA FB 1 65 DC	–	–	348
353-354	UV 430 TTR-W	760	SA FB 1 55 AC	–	–	353-354
	.....for submerged arc welding fine grained structural steels					
336-338	UV 418 TT	760	SA FB 1 55 AC H5	–	–	336-338
349-352	UV 421 TT	760	SA FB 1 65 DC H5	–	–	349-352

Wires for submerged arc welding of unalloyed, creep resistant, cryogenic and fine grained structural steels

Sub-arc wires	Classification		Typical analysis of the wire electrodes (%) C	Si	Mn	Cr	Mo		Ni	Nb	others	Field of application/Materials
Thermanit MTS 3	EN 12070 AWS A 5.23	S CrMo91 EB9	0.12	0.30	0.60	9.0	1.00		0.70	0.06	0.20 V	Creep resistant 9 % Cr-Stahl such as X 10 CrMoVNb 9 1, A 213-T 91, A 335-P 91. ASTM A199 Gr. T91, A335 Gr. P91 (T91), A213/213M Gr. T91; **Flux: Marathon 543**.
Thermanit MTS 4	EN 12070 AWS A 5.23	S CrMoWV12 EG	0.25	0.25	0.70	11.5	1.00		0.50		0.50 W 0.30 V	Creep resistant martensitic Cr steels and cast steel grades, e.g. X 20 CrMoWV 12. Matching highly heat resistant steels: 1.4935 X20CrMoWV12-1, 1.4922 X20CrMoV12-1, 1.4923 X22CrMoV12-1, 1.4913 X19CrMoVNb11-1 (Turbotherm, 20 MVNb), 1.4931 GX22CrMoV12-1; **Flux: Marathon 543**.
Thermanit MTS 616	EN 12070 AWS A 5.23	S ZCrMoWVNb9 0,5 1,5 EG [B9 (mod.)]	0.11	0.38	0.45	8.8	0.45		0.65	0.06	1.65 W 0.20 V	Creep resistant martensitic steel of type P 92 acc. to ASTM A 335. ASTM A355 Gr. P92 (T92), A213/213M Gr. T92; **Flux: Marathon 543**.
Thermanit MTS 911	EN 12070 AWS A 5.23	S ZCrMoWVNb9 1 1 EG [B9 (mod.)]	0.11	0.35	0.45	9.0	1.00		0.75	0.06	1.00 W 0.20 V	Creep resistant martensitic steel of type X11CrMoWVNb9-1-1, E 911 (P911). **Flux: Marathon 543**.
Union S1	EN 756 AWS A 5.17	S1 EL12	0.10	0.10	0.50							Steels S185 up to S235JR, boiler plates P235GH, ship building steels, pipe steels up to S275N, fine grained structural steels up to P275N, S275N.
Union S 1 CrMo 2	EN 12070 AWS A 5.23	S CrMo2 EB3R	0.10	0.10	0.50	2.40	1.00					Creep resistant boiler structural steels 10CrMo9-10 i.g. 12CrMo9-10. ASTM A335 Gr. P22, A217 Gr. WC9; A387 Gr. 22; **Flux: UV 420 TTR, UV 420 TTR-W.**
Union S 1 CrMo 2 V	EN 12070 AWS A 5.23	S ZCrMoV2 EG	0.12	0.10	0.60	2.50	1.00			0.02	0.30 V	Creep resistant steel of type 2 1/4 % Cr - 1 % Mo - 0,25 % V. **Flux: UV 430 TTR-W.**
Union S1 CrMo 5	EN 12070 AWS A 5.23	S CrMo5 EB6	0.08	0.30	0.50	5.80	0.60					Creep resistant and steels resistant to hydrogene such as 12 CrMo 19 5 and similar steels. ASTM A213 Gr. T5, A217 Gr. C5, A335 Gr. P5; **Flux: Marathon 543.**
Union S 1 Mo 1,2	EN 756 AWS A 5.23	SZ EG	0.06	0.20	0.50		1.25					For the welding of pipe steels, e.g. API 5LX60-X80, with two-run technique. **Flux: UV 309 P.**

Wires for submerged arc welding of unalloyed, creep resistant, cryogenic and fine grained structural steels

Sub-arc wires	Classification		Typical analysis of the wire electrodes (%) C	Si	Mn	Cr	Mo		Ni	Field of application//Materials
Union S 2	EN 756 AWS A 5.17	S2 EM12	0,10	0,10	1,00					General structural steels up to S355JR, boiler plates up to P295GH, shipbuilding steels, pipe steels up to L360 and unalloyed boiler tubes, fine grained structural steels up to P355N, S355N. ASTM A36 Gr. all; A106 Gr. A, B; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A556 Gr. B2A; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A841; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50; **Flux: UV 420 TT, UV 421 TT, UV 418 TT, UV 306, UV 400.**
Union S 2 CrMo	EN 12070 AWS A 5.23	S CrMo1 EB2R	0,12	0,10	0,80	1,20	0,50			CrMo-alloyed boiler plates and boiler tubes of quality 13CrMo4-5 and similar steels. ASTM A193 Gr. B7, A355 Gr. P11 u. P12, A217 Gr. WC6; **Flux: UV 420 TTR (UV 420 TTR-W), UV 420 TT.**
Union S 2 Mo	EN 756 EN 12070 AWS A 5.23	S2Mo S Mo EA2	0,10	0,10	1,00		0,50			Mo-alloyed steels and boiler plates of quality 16Mo3, fine grained structural steels up to S460N, P460N, and corresponding pipeline steels up to StE 480 TM. ASTM A355 Gr. P1, A161-94 Gr. T1A, A182M Gr. F1, A204M Gr. A, B, C, A250M Gr. T1, A217 Gr. WC1; **Flux: UV 420 TT, UV 421 TT, UV 418 TT, UV 400, UV 306.**
Union S 2 Ni 2,5	EN 756 AWS A 5.23	S2Ni2 ENi2	0,10	0,10	1,00				2,50	Cryogenic fine grained structural steels up to S460NL, P460NL and special structural steels such as 12 Ni 14 G 1. ASTM A633 Gr. E, A572 Gr. 65, A203 Gr. D, A333 and 334 Gr. 3, A350 Gr. LF; **Flux: UV 421 TT, UV418 TT.**
Union S 2 Ni 3,5	EN 756 AWS A 5.23	S2Ni3 ENi3	0,09	0,15	0,90				3,30	For the welding of cryogenic steels: 10Ni14, SA350G.LF3, SA 203 Gr. D. **Flux: UV 421 TT, UV 418 TT.**
Union S 2 Ni 370	EN 756 AWS A 5.23	S2Ni1,5 EG [ENi1 (mod.)]	0,08	0,10	0,95				1,30	Fine grained structural steels up to S420NL, P420ML, especially 15MnNi6-3 and other cryogenic steels. (In combination with UV 421 TT tested acc. to KTA 1408.) **Flux: UV 421 TT, UV 418 TT.**
Union S 2 NiMo 1	EN 756 AWS A 5.23	SZ2Ni1 ENi1	0,11	0,10	1,00		0,25		0,90	Creep resistant and cryogenic fine grained structural steels up to S460NL, P460NL and corresponding offshore and pipe steels. **Flux: UV 421 TT, UV 418 TT.**

Wires for submerged arc welding of unalloyed, creep resistant, cryogenic and fine grained structural steels

Sub-arc wires	Classification		Typical analysis of the wire electrodes (%) C	Si	Mn	Cr	Mo		Ni	Field of application//Materials
Union S 2 Si	EN 756 AWS A 5.17	S2Si EM12K	0.10	0.30	1.00					General structural steels up to S355JR, boiler plates up to P295GH, especially for pipe steels up to L360 and unalloyed boiler tubes. **Flux: UV 306, UV 400, UV 421 TT, UV 418 TT.**
Union S 3	EN 756 AWS A 5.17	S3 EH10K	0.12	0.10	1.50					General structual steels up to S355JR, boiler plates up to P355GH, ship building steels, fine grained structural steels up to P355N, S355N. ASTM A36 Gr. all; A106 Gr. A, B; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A515 Gr. 60, 65, 70; A516 Gr. 55; A556 Gr. B2A; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A841; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50 **Flux: UV 420 TT, UV 421 TT, UV 418 TT, UV 306, UV 400.**
Union S 3 Mo	EN 756 EN 12070 AWS A 5.23	S3Mo S MnMo EA4	0.12	0.10	1.50		0.50			Mo-alloyed steels and boiler plates of quality 16Mo3 and fine grained structural steels up to S460N, P460N. **Flux: UV 420 TT, UV 421 TT, UV 418 TT.**
Union S 3 Mo Ti B	EN 756 AWS A 5.23	SZ EG	0.08	0.25	1.20		0.55		+ Ti + B	For the welding of pipe steels in two-run technique. **Flux: UV 309 P.**
Union S 3 NiMo	EN 756 AWS A 5.23	S3Ni1,5Mo EG [EF1 (mod.)]	0.08	0.10	1.50		0.45		1.50	Creep resistant and cryogenic fine grained structural steels up to S550NL, P550ML and WB 35, WB 36, HY 80. **Flux: UV 420 TTR, UV 421 TT, UV 418 TT.**
Union S 3 NiMo 1	EN 756 AWS A 5.23	S3Ni1Mo EG [EF3 (mod.)]	0.12	0.10	1.60		0.60		0.95	Reactor structural steels such as 22 NiMoCr 37, 20 MnMo 44, 20 MnMoNi55, WB 36, Welmonil 35, Welmonil 43,GS-18 NiMoCr 37; In Combination with UV 420 TTR tested according to KTA 1408. ASTM A517 Gr. A, B, C, E, F, H, J, K, M, P; A255 Gr. C; A633 Gr. E; A572 Gr. 65; **Flux: UV 420 TT (R), UV 421 TT, UV 418 TT.** **With flux UV 310 D also for pipe steels (double joint).**
Union S 3 NiMoCr	EN 14295 AWS A 5.23	S3Ni2,5CrMo EG [EF6 (mod.)]	0.14	0.10	1.70	0.35	0.60		2.10	Fine grained structural steels water quenched and tempered up to P690Q such as N-A-XTRA 70, T 1 and HY 100. USS-T 1 etc.; **Flux: UV 421 TT, UV 418 TT.**

Wires for submerged arc welding of unalloyed, creep resistant, cryogenic and fine grained structural steels

Sub-arc wires	Classification		Typical analysis of the wire electrodes (%) C	Si	Mn	Cr	Mo		Ni	Field of application//Materials
Union S 3 Si	EN 756 AWS A 5.17	S3Si EH12K	0.10	0.30	1.70					General structural steels and fine grained structural steels up to S460N, P460N. Expecially for offshore steels with flux UV 418 TT (COD tested). **Flux: UV 421 TT, UV 418 TT.**
Union S 4 Mo	EN 756 AWS A 5.23	S4Mo EA3	0.12	0.10	2.00		0.50			Mo-alloyed steels and boiler plates of quality 16Mo3 as well as for surfacing and for pipe steels, such as API 5L X60-X80 (two-run technique). **Flux: UV 420 TT, UV421 TT, UV 418 TT, UV 310 D, UV 309 P.**
Union S P 23	EN 12070 AWS A 5.23	SZCr2WV EG	0.07	0.30	0.50	2.20			W=1.70 V=0.24 Nb=0.05	HCM2S: T/P 23 **Flux: UV 430 TTR-W**
Union S P 24	EN 12070 AWS A 5.23	SZCrMo2VNb EG	0.06	0.20	0.50	2.40	1.00		V=0.24 Ti/Nb=0.04	7 CrMoVTiB10-10 (1.7378); T/P 24 **Flux: UV 430 TTR-W**

Marathon 543

Fluoride basic type

Classifications

EN 760

SA FB 2 55 DC

Characteristics and field of use

Marathon 543 is an agglomerated flux of fluoride basic type with a high basicity.
Outstanding good welding properties.
For joining and surfacing applications of creep resistant CrMo steels such as e.g. 12CrMo19-5 (Mat. No. 1.7362), P 91/T 91, X10CrMoVNb9-1 (Mat. No. 1.4903), X20CrMoWV12-1 (Mat. No. 1.4935).

In combination with the new sub arc wires Thermanit MTS 616 the flux is suited for welding steels of type P 92 according to ASTM A 335 and with Thermanit MTS 911 for steels of type X11CrMoWVNb9-1-1 (1.4905), E 911 (P911).

Grain size

EN 760: 3 - 20 (0,3 - 2,0 mm)

Packaging

25 kg plastic bag

Advice

It is advisable to redry the welding flux for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF2
14	32	18	31

Basicity (Boniszewski)

Mol.-%	Wt.-%
3,8	2,9

Approvals	TÜV	Controlas
Thermanit MTS 3	6527	1373
Thermanit MTS 4	7814	
Thermanit MTS 616	9391	
Thermanit MTS 911	9228	

Marathon 543

Fluoride basic type

Typical analysis for wire and weld metal in wt. %:

Designation	C	Si	Mn	Cr	Mo	Ni	V	Nb	N	W
Thermanit MTS 3	0.11	0.30	0.50	9.00	1.00	0.80	0.20	0.06	0.05	-
Weld metal	0.11	0.30	0.60	8.90	0.98	0.75	0.20	0.05	0.05	-
Thermanit MTS 4	0.25	0.25	0.70	11.50	0.90	0.50	0.30	-	-	0.50
Weld metal	0.18	0.25	0.65	11.40	0.88	0.45	0.30	-	-	0.50
Thermanit MTS 616	0.11	0.38	0.45	8.8	0.45	0.65	0.20	0.06	0.05	1.65
Weld metal	0.09	0.38	0.60	8.7	0.43	0.60	0.20	0.05	0.05	1.65
Thermanit MTS 911	0.11	0.35	0.45	9.0	0.98	0.75	0.20	0.06	0.05	1.05
Weld metal	0.10	0.35	0.60	8.9	0.96	0.70	0.20	0.05	0.05	1.05
Union S 1 CrMo 5	0.08	0.30	0.50	5.80	0.60	-	-	-	-	-
Weld metal	0.07	0.30	0.60	5.70	0.58	-	-	-	-	-

Mechanical properties of the weld metal (as welded):

Designation	Heat treatment	Test temp. °C	0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact value at RT ≥ J (CVN)
Thermanit MTS 3	750 °C / 4 h	RT	540	700	18	47
	760 °C / 2 h	400	400	540	14	
		460	380	500	14	
		500	360	480	14	
Thermanit MTS 4	760 °C / 4 h*	RT	550	700	18	47
		450	450	500	14	
Thermanit MTS 616	760 °C / 4 h	RT	560	700	18	41
		600	290	350	16	
Thermanit MTS 911	760 °C / 4 h	RT	560	700	18	41
		600	300	360	16	
Union S 1 CrMo 5	740 °C / 2 h	RT	420	580	18	47
		450	350	480	14	

*Special heat treatment

UA 600

Aluminate basic type

Classifications

EN 760

SA AB 1 65 DC H5

Characteristics and field of use

UA 600 is an agglomerated flux of aluminate basic type for surface welding of unalloyed and low alloyed steels. Due to its neutral Si and Mn pick-up behaviour it is possible to apply the flux with different unalloyed and low alloyed sub arc wires within a large field of use. Very low carbon burn-out of weld metal.
If used in combination with corresponding wires it is possible to manufacture crack-free weld metal up to about 50 HRC.
UA 600 is suited for welding single and multi wire. Outstanding low consumption of flux and good slag detachability even at high interpass temperatures.

Grain size

EN 760: 3 - 20 (0.3 - 2.0 mm)

Packaging

25 kg plastic bag

Advice

If transported and stored properly the flux can be used without redrying directly from the bag. Flux that has become humid should be redried for aout 2 h at 350-400 °C (662-752 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
18	36	24	20

Basicity (Boniszewski)

Mol.-%	Weight %
2.9	2.2

UV 300

Manganese-silicate type

Classifications

EN 760

SA MS 1 87 AC H5

Characteristics and field of use

UV 300 is an agglomerated flux of manganese-silicate type. Designed for single and multiple layer welding and especially suited for two run technique (pipe fabrication). Outstanding slag removability. Very low weld metal consumption of about 0.8 kg flux material when welding 1 kg wire.
Suited for welding unalloyed and low alloyed steels.

Grain size

EN 760: 3 - 16 (0.3 - 1.6 mm)

Packaging

25 kg plastic bag

Advice

If stored properly the flux can be used without redrying directly from the bag. Flux that has become humid has to be redried for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
40	28	16	5

Basicity (Boniszewski)

Mol.-%	Weight %
1.2	0.9

Typical analysis for wire and weld metal in wt. %:

Designation	C	Si	Mn	Mo	Weld metal classification acc. to EN 756 AWS A 5.17 - SFA 5.17 AWS A 5.23 - SFA 5.23
Union S 1	0.10	0.10	0.50	-	S 35 0 MS S1
Weld metal	0.05	0.65	1.00	-	F6A0-EL12
Union S 2	0.10	0.10	1.00	-	S 35 2 MS S2
Weld metal	0.05	0.65	1.35	-	F7A2-EM12
Union S 2 Mo	0.10	0.10	1.00	0.50	S 46 2 MS S2Mo
Weld metal	0.05	0.65	1.35	0.45	F8A2-EA2-A2
Union S 2 Si	0.10	0.30	1.00	-	S 42 2 MS S2Si
Weld metal	0.05	0.80	1.35	-	F7A2-EM12K

UV 300

Manganese-silicate type

Mechanical properties of the weld metal at different heat treatments:

Wire electrodes used	Heat treatment	0.2%-Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values* ≥ J (CVN) +20 °C	± 0 °C	-20 °C
Union S 1	AW	355	460	25	50	40	28
	SR	300	420	25	60	50	28
Union S 2	AW	355	480	25	60	60	28
	SR	310	480	25	80	80	34
Union S 2 Mo	AW	470	550	22	60	50	34
Union S 2 Si	AW	420	500	25	60	60	28
	SR	355	480	25	80	60	34

AW = as welded
SR = stress relieved: 580 °C (1076 °F) / 5 h / air

* Average values from 3 tests

UV 305

Aluminate-rutile type

Classifications

EN 760
SA AR 1 76 AC H5

Characteristics and field of use

UV 305 is an agglomerated flux of aluminate-rutile type for joining and surface welding. Suited for direct and alternating current. The flux is suited for butt welding in two-run technique and for sheet thickness up to 10 mm for fillet welding.
It is especially suited for welding tube walls.
Suited sub-arc wires:
Union S 1, S 2, S 2 Si, S 2 Mo and for boiler walls also.
Union S 2 CrMo, S 1 CrMo 2, Union S P23, Union S P24.
It has outstanding good slag detachability (even in narrow grooves) and allows high welding speed.

Grain size

EN 760: 4 - 14 (0.4 - 1.4 mm), Tyler 12 x 42

Packaging

25 kg plastic bag
If requested: steel drum – content 200 kg

Advice

If stored properly the flux can be used without redrying directly from the bag. Flux that has become humid should be redried for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	Al_2O_3+MnO	$CaF_2 + CaO + MgO$
26	55	8

Basicity (Boniszewski)

Mol.-%	Weight-%
0.7	0.6

UV 306

Aluminate-rutile type

Classifications

EN 760

SA AR 1 77 AC H5

Characteristics and field of use

UV 306 is an agglomerated flux designed for joining applications on general-purpose structural and pipe steels. Suitable for use on DC and AC. For single- and multi-wire welding with high welding speed using the two-run technique as well as for fillet welding. Very good slag removability.

Grain size

EN 760: 3 - 16 (0.3 - 1.6 mm)

Packaging

25 kg plastic bag (200 kg steel drum)

Advice

If stored properly the flux can be used without redrying directly from the bag. Flux that has become humid should be redried for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	Al_2O_3+MnO	CaF_2+CaO+MgO
24	50	16

Basicity (Boniszewski)

Mol.-%	Weight %
0.8	0.6

Typical analysis for wire and weld metal in wt. %:

Designation	C	Si	Mn	Mo	Weld metal classification acc. to EN 756 AWS A 5.17 - SFA 5.17 AWS A 5.23 - SFA 5.23
Union S 1	0.10	0.10	0.50	-	S 35 2 AR S1
Weld metal	0.06	0.60	0.90	-	F6A0-EL12
Union S 2	0.10	0.10	1.00	-	S 42 3 AR S2
Weld metal	0.06	0.60	1.40	-	F7A2-EM12
Union S 2 Mo	0.10	0.10	1.00	0.50	S 46 2 AR S2Mo
Weld metal	0.06	0.60	1.40	0.45	F8A2-EA2-A2
Union S 2 Si	0.10	0.30	1.00	-	S 42 2 AR S2Si
Weld metal	0.06	0.75	1.60	-	F7A2-EM12K
Union S 3	0.12	0.10	1.50	-	S 42 3 AR S3
Weld metal	0.07	0.60	1.60	-	F7A2-EH10K

UV 306

Aluminate-rutile type

Mechanical properties of the weld metal, as welded:

Wire electrodes used	0.2%-Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values* ≥ J (CVN) +20 °C	± 0 °C	-20 °C	-30 °C
Union S 1	360	460	22	80	60	47	28
Union S 2	420	530	22	80	60	47	47
Union S 2 Mo	470	550	22	70	60	47	28
Union S 2 Si	420	540	22	70	50	47	28
Union S 3	420	520	22	80	60	47	47

* Average values from 3 tests

Approvals	TÜV	DB	ABS	GL	LR	DNV	Controlas
Union S 1		51.132.04					
Union S 2	2590	51.132.04	2M/2YM	3YTM	2M/2YM	IIIYMT	0268
Union S 2 Mo	7739						

UV 309 P

Aluminate basic type

Classifications

EN 760

SA AB 1 65 AC H5

Characteristics and field of use

UV 309 P is an agglomerated flux of the aluminate basic type with neutral metallurgical behaviour. It is especially suited for welding single and multi wire (DC and AC) when manufacturing longitudinal and spiral-seam pipes with two-run technique.
For the two-run welding of pipe steels of API Grade A 25, A, B, X 42, X 46, X 52, X 56, X 60, X 65, X 70, X 90 and according to EN 10208-2 L290MB up to L555MB if welded in combination with corresponding sub arc wires such as
Union S 2, Union S 2 Mo, Union S 4 Mo, Union S 2 NiMo1, Union S 3 NiMo, Union S 3 NiMo 1, Union S 1 Mo 1,2.

Note:
The mechanical-technological behaviour of the weld metal produced by the two-run technique (mainly the toughness) is not only influenced by the wire-/flux-combination but by many other factors such as:

- the influence of chemical composition of the parent metal due to the high dilution (60 up to 70%)
- the influence of the relative long cooling time $t^{8/5}$ from the welding heat by:
  - welding parameter (heat input)
  - wall thickness (two resp. three dimensional heat flow)
  - preheat and interpass temperature

Grain size

EN 760: 3 - 20 (0.3 - 2.0 mm)

Packaging

25 kg plastic bag, 200 kg steel drum,
500 kg and 1000 kg Big-Bag

Advice

If transported and stored properly the flux can be used without redrying directly from the bag. Flux that has become humid should be redried for about 2 h at 350-400 °C (662-752 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
22	24	28	18

Basicity (Boniszewski)

Mol.-%	Weight %
2.0	1.4

UV 310 D

Fluoride basic type

Classifications

EN 760

SA FB 1 55 DC H5

Characteristics and field of use

UV 310 D is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour. It is suitable for single electrode (DC+), twin electrodes (DC+) and tandem electrodes (DC+ and AC) welding.
UV 310 D can especially be used in combination with suitable wire electrodes (for example: Union S 2, S 3 Si, S 2 Mo, S 3 Mo, S 4 Mo, S 2 NiMo1, S 3 NiMo, S 3 NiMo1) for double joint welding of pipe steels acc. to API 5L Gr. X42 to X80 and also for other multilayer welded joints at mild and high tensile steels. Very good impact toughness of weld metal at low temperatures.

Remark:
The mechanical properties of the joint depend on the weld preparation, wall thickness, base metal composition and dilution with the base metal.

Grain size

EN 760: 3 - 16 (0.3 - 1.6 mm); Tyler Mesh: 10 x 48

Packaging

30 kg steel container

Advice

If stored properly, the flux can be used directly from the container. Flux that has picked up moisture should be redried for about 2 h at 350 ± 25 °C (662 ± 77 °F).

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
16	36	19	27

Basicity (Boniszewski)

Mol.-%	Gew.-%
3.7	2.7

Weld metal with	AWS A5.17/A5.23	EN 756 / EN 14295
Union S 3	F7A6-EH10K	S 42 4 FB S3
Union S 3 Si	F7A6-EH12K	S 46 4 FB S3Si
Union S 2 Mo	F8A6-EA2-A2	S 46 2 FB S2Mo
Union S 4 Mo	F9A6-EA3-A3	S 50 4 FB S4Mo
Union S 2 NiMo1	F8A10-ENi1-Ni1	S 50 6 FB SZ2Ni1
Union S 3 NiMo1	F8A8-EG-F3	S 55 6 FB S3Ni1Mo

UV 400

Aluminate basic type

Classifications

EN 760

SA AB 1 67 AC H5

Characteristics and field of use

UV 400 is an agglomerated flux of aluminate basic type designed for joining and surfacing applications with general-purpose structural steels, fine grained structural steels, boiler and pipe steels. The flux is characterized by its low silicon and moderate manganese pickup. It can be used on DC and AC. Its good welding characteristics and the technological properties of the weld metal produced with different wires permit universal use.

Grain size

EN 760: 3 - 20 (0.3 - 2.0 mm)

Packaging

25 kg plastic bag (200 kg steel drum)

Advice

If stored properly the flux can be used without redrying directly from the bag. Flux that has become humid should be redried for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
20	30	26	16

Basicity (Boniszewski)

Mol.-%	Weight %
2.3	1.7

Typical analysis for wire and weld metal in wt. %:

Designation	C	Si	Mn	Mo	Weld metal classification acc. to EN 756 AWS A 5.17 - SFA 5.17 AWS A 5.23 - SFA 5.23
Union S 1	0.10	0.10	0.50	-	S 35 3 AB S1
Weld metal	0.06	0.35	0.90	-	F7A4-EL12
Union S 2	0.10	0.10	1.00	-	S 38 4 AB S2
Weld metal	0.06	0.35	1.35	-	F7A4-EM12
Union S 2 Mo	0.10	0.10	1.00	0.50	S 46 4 AB S2Mo
Weld metal	0.06	0.35	1.35	0.45	F8A4-EA2-A2
Union S 2 Si	0.10	0.30	1.00	-	S 42 4 AB S2Si
Weld metal	0.06	0.35	1.50	-	F7A4-EM12K
Union S 3	0.12	0.10	1.50	-	S 42 4 AB S3
Weld metal	0.07	0.35	1.60	-	F7A4-EH10K

UV 400

Aluminate basic type

Mechanical properties of the weld metal for different treatments:

Wire electrodes used	Con-dition	0.2%-Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values* ≥ J (CVN) +20 °C	± 0 °C	-20 °C	-40 °C
Union S 1	u	355	460	22	100	100	47	28
	s	330	420	25	110	120	80	28
Union S 2	u	400	480	22	120	100	60	47
	s	355	480	25	140	120	100	47
	n	290	460	22	80	60	47	-
Union S 2 Mo	u	470	550	22	100	90	47	47
	s	470	550	22	100	100	60	47
Union S 2 Si	u	420	500	22	100	80	47	47
	s	355	480	25	140	120	80	47
Union S 3	u	420	500	22	120	120	60	47
	s	380	500	25	140	120	100	47

* Average values from 3 tests

AW = as welded
SR = stress relieved: 580 °C (1076 °F) / 5 h / air
N = normalized: 920 °C (1688 °F) / 1 h / air

Approvals	TÜV	DB	ABS	BV	GL	LR	DNV	Controlas
Union S 2	6170	51.132.03	3YTM	4Y40TM	3YTM	3YTM	IIIYTM	1266
Union S 2 Mo	6233	51.132.03	3YT/4YM	4Y40TM	3YT/4YM	3YTM	IIIYT/IVYM	1370

UV 418 TT

Fluoride basic type

Classifications

EN 760

SA FB 1 55 AC H5

Characteristics and field of use

UV 418 TT is an agglomerated flux of fluoride basic type for joining and surfacing and applications with dissimilar steels. Mainly for high strength and cryogenic fine grained structural steels. The Si and Mn pick-ups and burn-off rates are neutral because of its metallurgical behaviour.
The flux is weldable with almost every wire electrode.
When used in combination with Union S 3 Si wire electrode, the weld metal has high toughness properties up to –60 °C (–76 °F) and very good CTOD values up to –30 °C (–22 °F), so that this combination is outstandingly suited for offshore constructions.
The flux can be used for tandem and multi wire welding with DC and AC.
Very good slag detachability.

Grain size

EN 760: 3 - 20 (0.3 - 2.0 mm)

Packaging

25 kg plastic bag

Advice

It is advisable to redry the welding flux for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
15	35	20	25

Basicity (Boniszewski)

Mol.-%	Weight %
3.5	2.6

UV 418 TT

Fluoride basic type

Typical analysis for wire and weld metal in wt. %:

Designation	C	Si	Mn	Cr	Mo	Ni	Weld metal classification acc. to EN 756 AWS A 5.17 - SFA 5.17 AWS A 5.23 - SFA 5.23
Union S 2	0.10	0.10	1.00				S 35 4 FB S2
Weld metal	0.07	0.20	0.95				F7A5-EM12
Union S 2 Mo	0.10	0.10	1.00		0.50		S 46 4 FB S2Mo
Weld metal	0.07	0.20	0.95		0.45		F8A6-EA2-A2
Union S 2 Ni 2,5	0.10	0.10	1.00			2.30	S 42 8 FB S2Ni2
Weld metal	0.07	0.20	0.95			2.20	F8A10-ENi2-Ni2
Union S 2 Ni 3,5	0.09	0.15	0.90			3.30	S 46 8 FB S2Ni3
Weld metal	0.06	0.20	0.85			3.20	F8A15-ENi3-Ni3
Union S 2 Ni 370	0.08	0.10	1.00			1.30	S 42 6 FB S2Ni1,5
Weld metal	0.06	0.25	1.30			1.20	F7A8-EG-G
Union S 2 NiMo1	0.11	0.10	1.00		0.25	0.90	S 50 6 FB SZ2Ni1
Weld metal	0.07	0.20	0.95		0.23	0.85	F8A8-ENi1-Ni1
Union S 2 Si	0.10	0.30	1.10				S 42 5 FB S2Si
Weld metal	0.08	0.30	1.10				F7A6-EM12K
Union S 3	0.12	0.10	1.50				S 38 4 FB S3
Weld metal	0.08	0.20	1.35				F7A6-EH10K
Union S 3 Mo	0.12	0.10	1.50		0.50		S 46 4 FB S3Mo
Weld metal	0.08	0.20	1.35		0.45		F8A5-EA4-A4
Union S 3 NiMo	0.08	0.10	1.50		0.45	1.50	S 50 6 FB S3Ni1,5Mo
Weld metal	0.06	0.20	1.40		0.40	1.40	F9A8-EG-F1
Union S 3 NiMo 1	0.12	0.10	1.60		0.60	0.95	S 50 6 FB S3Ni1Mo
Weld metal	0.08	0.25	1.55		0.55	0.90	F9A8-EG-F3
Union S 3 NiMoCr	0.14	0.10	1.75	0.35	0.60	2.10	• S 69 6 FB SZ3Ni2,5CrMo
Weld metal	0.08	0.20	1.50	0.32	0.58	2.00	F11A8-EG-F6
Union S 3 Si	0.10	0.30	1.70				S 46 6 FB S3Si
Weld metal	0.08	0.30	1.55				F7A8-EH12K
Union S 4 Mo	0.12	0.10	2.00		0.50		S 50 4 FB S4Mo
Weld metal	0.08	0.20	1.65		0.45		F8P6-EA3-A3

UV 418 TT

Fluoride basic type

Mechanical properties of the weld metal, as welded:

Wire electrodes used	0.2%-Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values* ≥ J (CVN) +20 °C	±0 °C	-20 °C	-40 °C	-60 °C	-80 °C
Union S 2	400	480	26	160	140	100	47		
Union S 2 Mo	470	550	25	160	140	100	47		
Union S 2 Ni 2,5	420	520	25	160	140	120	100	80	47
Union S 2 Ni 3,5	470	560	25	160	140	120	100	80	47
Union S 2 Ni 370	420	530	25	160	140	100	70	47	
Union S 2 NiMo 1	500	560	25	180	160	120	100	80	27
Union S 2 Si	420	520	26	160	140	100	60	47	
Union S 3	400	510	26	160	140	100	47	27	
Union S 3 Mo	470	550	25	160	140	100	47		
Union S 3 NiMo	550	620	22	160	140	120	80	47	27
Union S 3 NiMo 1	550	640	22	160	140	110	70	47	
Union S 3 NiMoCr	690	760	17	120	100	80	47	27	
Union S 3 Si	460	550	26	160	140	120	70	47	
Union S 4 Mo	550	620	18	140	100	60	47		

* Average values from 3 tests

Approvals	TÜV	DB	C	DNV	GL	LR	BV
Union S 3 Si	7276	51.132.05	1379	VY42 (H5)	6Y42M	5Y42H5 5Y42SR	5Y46

UV 420 TT / UV 420 TT-LH

Fluoride basic type

Classifications

EN 760

SA FB 1 65 DC / SA FB 1 65 DC H5

Characteristics and field of use

UV 420 TT/ UV 420 TT-LH is an agglomerated flux of fluoride basic type for joining and surfacing applications with general purpose structural steels, fine grained structural steels and creep resistant steels. It is characterized by its neutral metallurgical behaviour. When used in combination with suitable wire electrodes the weld metal has high toughness properties at subzero temperatures.
It is suited for single wire and tandem welding.

Grain size

EN 760: 3 - 20 (0.3 - 2.0 mm); 3 - 25 (0.3 - 2.5 mm)

Packaging

25 kg plastic bag (200 kg steel drum)

Advice

It is advisable to redry the welding flux for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
15	35	21	25

Basicity (Boniszewski)

Mol.-%	Weight %
3.4	2.5

Typical analysis for wire and weld metal in wt. %:

Designation	C	Si	Mn	Cr	Mo	Ni	V	W	Cu	Weld metal classification acc. to EN 756 AWS A 5.17 - SFA-5.17 AWS A 5.23 - SFA-5.23
Union S 2	0.10	0.10	1.00							S 35 4 FB S2
Weld metal	0.07	0.25	1.05							F7A4-EM12
Union S 2 Mo	0.10	0.10	1.00		0.50					S 46 4 FB S2Mo
Weld metal	0.07	0.25	1.05		0.45					F8A4-EA2-A2
Union S 3	0.12	0.10	1.50							S 38 4 FB S3
Weld metal	0.08	0.25	1.50							F7A4-EH10K
Union S 3 Mo	0.12	0.10	1.50		0.50					S 46 4 FB S3Mo
Weld metal	0.08	0.25	1.50		0.45					F8A4-EA4-A4
Union S 4 Mo	0.12	0.10	2.00		0.50					S 50 4 FB S4Mo
Weld metal	0.08	0.25	1.80		0.45					F8P4-EA3-A3

UV 420 TT / UV 420 TT-LH

Fluoride basic type

Typical analysis for wire and weld metal in wt. %:

Designation	C	Si	Mn	Cr	Mo	Ni	V	W	Cu	Weld metal classification acc. to EN 756 / •EN 14295 AWS A 5.17 - SFA-5.17 AWS A 5.23 - SFA-5.23
Thermanit MTS 4	0.25	0.30	1.00	11.5	1.00	0.50	0.30	0.50		-
Weld metal	0.15	0.40	1.05	10.5	0.95	0.40	0.25	0.45		F9PZ-EG-G
Union Patinax U	0.11	0.10	0.85			0.75			0.50	S 42 2 FB SO
Weld metal	0.08	0.25	0.95			0.70			0.45	F7A2-EG-G
Union S 1 CrMo 2	0.10	0.10	0.50	2.40	1.00					-
Weld metal	0.07	0.25	0.75	2.25	0.95					F9P0-EB3R-B3
Union S 1 CrMo 5	0.08	0.30	0.50	5.80	0.60					-
Weld metal	0.06	0.30	0.75	5.50	0.55					F8PZ-EB6-B6
Union S 2 CrMo	0.12	0.10	0.80	1.20	0.50					-
Weld metal	0.08	0.25	0.95	1.10	0.45					F8P0-EB2R-B2
Union S 2 Ni 2,5	0.10	0.10	1.00			2.50				S 46 6 FB S2Ni2
Weld metal	0.07	0.25	1.05			2.40				F8A8-ENi2-Ni2
Union S 2 Ni 370	0.08	0.10	0.95			1.30				S 42 5 FB S2Ni1,5
Weld metal	0.06	0.25	1.00			1.25				F7A6-EG-G
Union S 3 NiMo	0.08	0.10	1.50		0.45	1.50				S 50 6 FB S3Ni1,5Mo
Weld metal	0.06	0.25	1.50		0.40	1.40				F9A8-EG-F1
Union S 3 NiMo 1*	0.12	0.10	1.60		0.60	0.95				S 50 6 FB S3Ni1Mo
Weld metal	0.08	0.25	1.55		0.55	0.90				F9A8-EG-F3
Union S 3 NiMoCr	0.14	0.10	1.70	0.35	0.60	2.10				• S 69 4 FB SZ3Ni2,5CrMo
Weld metal	0.08	0.25	1.55	0.32	0.58	2.00				F11A6-EG-F6

* Tramp elements Co and Ta, in conformidity with regulations on reactor construction

UV 420 TT / UV 420 TT-LH

Fluoride basic type

Mechanical properties of the weld metal, as welded:

Wire electrodes used	0.2%-Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values* ≥ J (CVN) +20 °C	± 0 °C	-20 °C	-40 °C
Union Patinax U	400	510	24	100	100	60	47
Union S 2	400	510	26	160	140	100	47
Union S 2 Mo	470	550	24	140	120	80	47
Union S 2 Ni 2,5	470	550	24	160	140	100	47
Union S 2 Ni 370	420	510	24	160	140	80	47
Union S 3	400	510	26	160	140	100	47
Union S 3 Mo	470	550	24	140	120	80	47
Union S 3 NiMo	560	620	22	160	140	80	47
Union S 3 NiMo 1	560	620	20	160	140	80	47
Union S 3 NiMoCr	690	760	17	100	80	60	47

* Average values from 3 tests

Approvals:	TÜV	CONTROLAS	DB	FT
Thermanit MTS 4	4675			
Union Patinax U	1799		51.132.09	
Union S 1 CrMo 2	5209		51.132.02	EV19H
Union S 2	3358		51.132.02	
Union S 2 CrMo	1794			EV18H
Union S 2 Mo	1793	0179		EV17H
Union S 3	1795			
Union S 3 Mo	1796			
Union S 3 NiMo	1797			
Union S 3 NiMo 1	3020	0189		
Union S 3 NiMoCr	2206			

Mechanical properties of weld metal for different heat treatments and test temperatures:

Wire electrodes used	Heat treatment	Test temperature 20 °C (68 °F)*			
		0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values ≥ J (CVN)
Thermanit MTS 4	A**	550	660	15	≥ 49 Joule/cm² (DVM)
Union S 1 CrMo 2	A*	460	560	24	120
Union S 1 CrMo 5	740 °C/4 h	500	620	18	47
Union S 2 CrMo	A*	460	550	24	140
	N + A*	330	480	30	120
Union S 2 Mo	SR	470	550	24	165
	N + A	280	440	26	125
Union S 3 Mo	SR	470	560	24	140
	N + A	320	510	26	130
Union S 3 NiMo	SR	560	600	22	150
	N + A	380	530	24	120
Union S 3 NiMo 1	SR	560	620	22	140
	SO	500	620	24	150
Union S 4 Mo	SR	520	600	22	140
	N + A	360	540	26	130

A = tempered, 580 - 620 °C (1076 - 1148 °F) / air
A* = tempered, 670 - 720 °C (1238 - 1328 °F)
A** = Special heat treatment, please ask for report

SR = stress relieved, 580 - 620 °C (1076 - 1148 °F)
SO = 60 h 550 °C (1022 °F) + 40 h 620 °C (1148 °F) / air
N = normalized, 920 °C (1688 °F) / air

* = Average values from 3 tests

UV 420 TT / UV 420 TT-LH

Fluoride basic type

Mechanical properties of the weld metal at different heat treatments and test temperatures:

Wire electrodes used	Heat treatment	Test temperature 350°C (662 °F)*			Test temp. 550°C (1022 °F)*		
		0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %
Thermanit MTS 4	A**	450+	500+	15+	-	-	-
Union S 1 CrMo 2	A*	380	500	20	270	360	26
Union S 1 CrMo 5	740 °C/4 h	360+	450+	18+	-	-	-
Union S 2 CrMo	A*	380	540	22	280	420	26
	N + A*	200	440	19	180	340	24
Union S 2 Mo	S	370	570	24	280	380	26
	N + A	190	420	25	170	210	30
Union S 3 Mo	S	400	590	23	290	410	24
	N + A	260	470	20	190	330	30
Union S 3 NiMo	S	450	600	20	320	410	24
	N + A	320	510	25	220	350	28
Union S 3 NiMo 1	S	420++	600++	24++	-	-	-
	SO	420++	580++	24++	-	-	-
Union S 4 Mo	S	450	580	22	330	420	22
	N + A	270	510	22	210	360	30

A = tempered, 580 - 620 °C (1076 - 1148 °F) / air
A* = tempered, 670 - 720 °C (1238 - 1328 °F)
A** = Special heat treatment, please ask for report

SR = stress relieved, 580 - 620 °C (1076 - 1148 °F)
SO = 60 h 550 °C (1022 °F) + 40 h 620 °C (1148 °F) / air
N = normalized, 920 °C (1688 °F) / air

* = Average values from 3 tests
\+ = Values at test temperature 450 °C (842 °F)
++ = Values at test temperature 400 °C (752 °F)

UV 420 TTR / UV 420 TTR-W

Fluoride basic type

Classifications

EN 760

SA FB 1 65 DC / SA FB 1 65 AC

Characteristics and field of use

UV 420 TTR is an agglomerated flux of fluoride basic type, mainly for joining and surfacing applications with creep resistant steels.
It displays neutral metallurgical behaviour and is characterised by a high degree of purity. It is particularly suitable for welding hydrocrackers because of the low P pick-up of 0.004 % max. When used in combination with wire electrodes Union S 2 CrMo and Union S 1 CrMo 2 it is possible to meet the most stringent toughness requirements at subzero temperatures even after step-cooling treatment.

UV 420 TTR-W permits sound welding on AC, by this achieving a higher level of toughness when welding with CrMo-alloyed sub arc wires.

Grain size

EN 760: 3 - 20 (0.3 - 2.0 mm); 3 - 16 (0.3 - 1.6 mm)

Packaging

25 kg plastic bag (200 kg steel drum)

Advice

It is advisable to redry the welding flux for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
15	35	21	26

Basicity (Boniszewski)

Mol.-%	Weight %
3.4	2.5

UV 420 TTR / UV 420 TTR-W

Fluoride basic type

Typical analysis for wire and weld metal in wt. %:

Designation	C	Si	Mn	Cr	Mo	Ni	Weld metal classification acc. to EN 756 AWS A 5.23 - SFA-5.23
Union S 1 CrMo 2	0.10	0.10	0.50	2.40	1.00	-	-
Weld metal	0.07	0.20	0.75	2.25	0.95	-	F9P2-EB3R-B3R
Union S 2 CrMo	0.12	0.10	0.80	1.20	0.50	-	-
Weld metal	0.08	0.20	1.00	1.10	0.45	-	F8P2-EB2R-B2
Union S 2 Mo	0.10	0.10	1.00	-	0.50	-	S 46 4 FB S2Mo
Weld metal	0.07	0.20	1.05	-	0.45	-	F8A4-EA2-A2
Union S 3 NiMo	0.08	0.10	1.50	-	0.45	1.50	S 50 6 FB S3Ni1,5Mo
Weld metal	0.05	0.20	1.50	-	0.40	1.40	F9A8-EG-F1
Union S 3 NiMo 1	0.12	0.10	1.60	-	0.60	0.95	S 50 4 FB S3Ni1Mo
Weld metal	0.08	0.20	1.55	-	0.55	0.90	F9A6-EG-F3-N
Union S 4 Mo	0.12	0.10	2.00	-	0.50	-	S 50 3 FB S4Mo
Weld metal	0.08	0.20	1.85	-	0.45	-	F8P4-EA3-A3

Mechanical properties of the weld metal, as welded:

Wire electrodes used	0.2% Yield strength ≥N/mm²	Tensile strength ≥N/mm²	Elongation $l_0=5d_0$ ≥%	Impact values* ≥ J (CVN)				
				+20 °C	±0 °C	-20 °C	-40 °C	-60 °C
Union S 2 Mo	470	550	25	140	120	100	47	–
Union S 3 NiMo	560	660	22	140	120	100	47	47
Union S 3 NiMo 1	560	680	22	140	120	100	47	27
Union S 4 Mo	550	630	18	120	100	80	47	–

* Average values from 3 tests

UV 420 TTR / UV 420 TTR-W

Fluoride basic type

Mechanical properties of the weld metal at different heat treatments and test temperatures:

Wire electrodes used	Heat treatment	Test temperature 20 °C (68 °F)*			
		0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values ≥ J (CVN)
Union S 1 CrMo 2	A*	460	560	22	140
Union S 2 CrMo	A*	470	550	24	140
	N + A*	330	480	26	120
Union S 2 Mo	S	470	550	24	165
	N + A	290	440	26	120
Union S 3 NiMo	S	560	660	22	150
	N + A	420	540	24	120
Union S 3 NiMo 1	S	560	660	22	140
	SO	500	620	24	140
Union S 4 Mo	S	500	600	24	140
	N + A	355	510	26	110

A = tempered, 580 - 620 °C (1076 - 1148 °F) / air
A* = tempered, 670 - 720 °C (1238 - 1328 °F)
A** = Special heat treatment, please ask for report

SR = stress relieved, 580 - 620 °C (1076 - 1148 °F)
SO = 60 h 550 °C (1022 °F) + 40 h 620 °C (1148 °F) / air
N = normalized, 920 °C (1688 °F) / air

* = Average values from 3 tests

UV 420 TTR / UV 420 TTR-W

Fluoride basic type

Mechanical properties of the weld metal of different heat treatments and test temperatures:

Wire electrodes used	Heat treatment	Test temperature 350°C (662 °F)*			Test temp. 550°C (1022 °F)*		
		0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %
Union S 1 CrMo 2	A*	380+	500+	20+	270	360	26
Union S 2 CrMo	A*	380	540	22	280	420	26
	N + A*	200	440	19	180	340	24
Union S 2 Mo	S	370	570	24	280	380	26
	N + A	220	420	25	170	310	30
Union S 3 NiMo	S	450	600	20	320	410	24
	N + A	320	510	25	220	350	28
Union S 3 NiMo 1	S	420++	590++	24++	290	410	25
	SO	420++	580++	24++	190	330	32
Union S 4 Mo	S	400	590	23	290	410	24
	N + A	280	470	20	190	330	30

A = tempered, 580 - 620 °C (1076 - 1148 °F) / air
A* = tempered, 670 - 720 °C (1238 - 1328 °F)
A** = Special heat treatment, please ask for report

SR = stress relieved, 580 - 620 °C (1076 - 1148 °F)
SO = 60 h 550 °C (1022 °F) + 40 h 620 °C (1148 °F) / air
N = normalized, 920 °C (1688 °F) / air

* = Average values from 3 tests
\+ = Values at test temperature 450 °C (842 °F)
++ = Values at test temperature 400 °C (752 °F)

Approvals:	TÜV	Controlas
Union S 1 CrMo 2*	6541	
Union S 1 CrMo 2	2734	0167
Union S 2	3437	
Union S 2 CrMo	3439	0162
Union S 2 Mo	3438	
Union S 3	3440	
Union S 3 Mo	3441	
Union S 3 NiMo	3442	
Union S 3 NiMo 1	3021 / 8015	
Union S 3 NiMoCr	3443	

* with UV 420 TTR-W, all others only with UV 420 TTR.

UV 420 TTRC

Fluoride basic type

Classifications

EN 760
SA FB 1 65 DC

Characteristics and field of use

UV 420 TTRC is an agglomerated fluoride-basic flux with high basicity and neutral metallurgical behaviour.
UV 420 TTRC is a special variant of flux UV 420 TTR. It supports the C-content of the wire electrode when DC-welding. In comparison with UV 420 TTR the C-content in the all weld metal is about 0.03-0.04 % higher. It is suitable for multipass welding, for single- and tandem-wire systems.
UV 420 TTRC has prime importance for SAW of the high-temperature resistant steel, for joining and surfacing applications.

Grain size

EN 760: 3 - 20 (0.3 - 2.0 mm); Tyler Mesh: 8 x 48

Packaging

25 kg or 40 kg plastic bag, 200 kg steel drum

Advice

Prior to use the flux should be redried for around 2 h at 300-350 °C (572-662 °F).

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
15	35	21	26

Basicity (Boniszewski)

Mol.-%	Weight-%
3.4	2.5

Weld metal with	AWS A5.23	EN 14295
Union S 3 NiMo1	F10A6-EG-F3	S 62 6 FB S3Ni1Mo

UV 421 TT

Fluoridbasischer Typ

Classifications

EN 760
SA FB 1 65 DC H5

Characteristics and field of use

Agglomerated fluoride basic flux with high basicity and neutral metallurgical behaviour.
It is suitable for single (DC) and tandem (DC and AC) welding.
Very good slag detachability. Excellent for narrow gap welding.
UV 421 TT can be used in combination with suitable sub arc wires for joint welding of mild, medium alloyed and high tensile steels.
Very good impact toughness of weld metal at low temperatures.

Grain size

EN 760: 3 - 20 (0.3 - 2.0 mm)

Packaging

25 kg plastic bag

Advice

Prior to use the flux should be redried for about 2 h at 300-350 °C (572-662 °F).

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
16	34	21	26

Basicity (Boniszewski)

Mol.-%	Weight-%
3.3	2.5

UV 421 TT

Fluoride basic type

Typical analysis for wire and weld metal in wt. %:

Designation	C	Si	Mn	Cr	Mo	Ni	Weld metal classification acc. to EN 756 / EN 14295 AWS A 5.17 - SFA 5.17 AWS A 5.23 - SFA-5.23
Union S 2	0.10	0.10	1.00	-	-	-	S 35 4 FB S2
Weld metal	0.07	0.20	1.05	-	-	-	F7A6-EM12
Union S 2 Mo	0.10	0.10	1.00	-	0.50	-	S 46 4 FB S2Mo
Weld metal	0.07	0.20	1.05	-	0.47	-	F8A4-EA2-A2
Union S 2 Ni 370	0.08	0.10	0.95	-	-	1.30	S 42 6 FB S2Ni1,5
Weld metal	0.06	0.20	1.00	-	-	1.25	F7A8-EG-G
Union S 2 Ni 2,5	0.10	0.10	1.00	-	-	2.30	S 46 8 FB S2Ni2
Weld metal	0.07	0.20	1.05	-	-	2.20	F8A10-ENi2-Ni2
Union S 2 Ni 3,5	0.09	0.15	0.90	-	-	3.30	S 46 8 FB S2Ni3
Weld metal	0.06	0.20	0.90	-	-	3.20	F8A15-ENi3-Ni3
Union S 2 NiMo 1	0.11	0.10	1.00	-	0.25	0.90	S 50 6 FB SZ2Ni1
Weld metal	0.08	0.20	1.05	-	0.22	0.85	F8A8-ENi1-Ni1
Union S 3	0.12	0.15	1.50	-	-	-	S 38 5 FB S3
Weld metal	0.08	0.25	1.50	-	-	-	F7A6-EH10K
Union S 3 NiMo	0.08	0.10	1.50	-	0.45	1.50	S 55 6 FB S3Ni1,5Mo
Weld metal	0.06	0.20	1.50	-	0.42	1.45	F9A8-EG-F1
Union S 3 NiMo 1	0.12	0.10	1.60	-	0.60	0.95	S 55 6 FB S3Ni1Mo
Weld metal	0.08	0.20	1.55	-	0.55	0.90	F9A8-EG-F3
Union S 3 NiMoCr	0.14	0.10	1.75	0.35	0.60	2.10	• S 69 6 FB SZ3Ni2,5CrMo
Weld metal	0.08	0.20	1.60	0.32	0.58	2.00	F11A8-EG-F6
Union S 3 Si	0.10	0.30	1.70	-	-	-	S 46 5 FB S3Si
Weld metal	0.08	0.30	1.55	-	-	-	F7A8-EH12K
Union S 4 Mo	0.12	0.10	2.00	-	0.50	-	S 50 4 FB S4Mo
Weld metal	0.08	0.20	1.85	-	0.47	-	F9A4-EA3-A3

UV 421 TT

Fluoride basic type

Mechanical properties of the weld metal, as welded:

Wire electrodes used	0.2%Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values* ≥ Joule (CVN)				
				+20 °C	±0 °C	-20 °C	-40 °C	-60 °C
Union S 2	400	510	26	150	130	100	47	27
Union S 2 Mo	470	560	24	140	120	100	47	-
Union S 2 Ni 2,5	470	550	24	160	140	120	80	60
Union S 2 Ni 3,5	470	560	25	160	140	120	100	47
Union S 2 Ni 370	420	530	24	150	130	100	60	47
Union S 2 NiMo 1	500	560	24	160	140	120	100	47
Union S 3	420	530	26	150	150	120	60	27
Union S 3 NiMo	560	620	22	140	120	100	80	47
Union S 3 NiMo1	560	640	22	140	120	100	70	47
Union S 3 NiMoCr	690	780	17	120	100	80	60	47
Union S 3 Si	460	550	26	150	120	80	60	47
Union S 4 Mo	560	620	22	140	120	80	47	-

* Average values from 3 tests

UV 421 TT

Fluoride basic type

Mechanical properties of the weld metal, annealed (annealing temperature 580 °C (1076 °F)):

Wire electrodes used	0.2%Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values* ≥ Joule (CVN)				
				+20 °C	±0 °C	-20 °C	-40 °C	-60 °C
Union S 2	360	480	26	160	140	120	60	47
Union S 2 Mo	460	560	24	140	120	100	47	-
Union S 2 Ni 2,5**	460	560	24	160	150	130	100	60
Union S 2 Ni 3,5**	440	560	25	160	150	120	100	60
Union S 2 Ni 370	420	520	24	160	140	120	80	47
Union S 2 NiMo 1	480	560	24	160	140	120	100	47
Union S 3	400	510	26	160	150	130	80	47
Union S 3 NiMo	560	620	22	140	120	110	80	47
Union S 3 NiMo1	560	640	22	140	120	100	70	47
Union S 3 NiMoCr	690	780	18	100	80	60	47	-
Union S 3 Si	420	510	22	140	120	100	80	47
Union S 4 Mo	560	620	22	140	120	80	47	-

* Average values from 3 tests ** (–100 °C (–148 °F) > 27 J)

Approvals:	TÜV	ABS	BV	WIWEB	GL	LR	DNV	Controlas	DB
Union S 2	3285					4Y40			51.132.06
Union S 2 Mo	3344								51.132.06
Union S 2 Ni 2,5	2213	Ni2	5Y50UM		7YM	3M/ 5Y40M	VYM	0064	51.132.06
Union S 2 Ni 370	5210 8010								51.132.06
Union S 3	5498								51.132.06
Union S 3 Si	461				5Y46	5Y46	IVY46		51.132.06
Union S 3 NiMo				for HY80	5Y55M				
Union S 3 NiMo1	460				5Y50	5Y50	VY50		
Union S 3 NiMoCr	5063		4Y69M	for HY100	5Y69M				51.132.06

UV 430 TTR-W

Fluoride basic type

Classifications

EN 760

SA FB 1 55 AC

Characteristics and field of use

UV 430 TTR-W is an agglomerated fluoride basic welding flux displaying neutral metallurgical behaviour.
It is suited for single (AC) and tandem (DC and AC) welding.
Especially suited for creep resistant steel of type 2 1/4 % Cr - 1 % Mo - 0,25 % V.
Very good impact toughness of weld metal at subzero temperatures, even after step-cooling.

Grain size

EN 760: 3 - 16 (0.3 - 1.6 mm)

Packaging

25 kg plastic bag

Advice

It is advisable to redry the welding flux for about 2 h at 300-350 C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
15	35	21	26

Basicity (Boniszewski)

Mol.-%	Weight %
3.6	2.6

UV 430 TTR-W

Fluoride basic type

Typical analysis for wire electrodes and weld metal* in wt. %:

Designation	C	Si	Mn	Cr	Mo	V	Nb	W
Union S 1 CrMo 2 V	0.12	0.10	0.60	2.45	1.00	0.30	0.020	–
Weld metal	0.09	0.15	0.85	2.35	0.98	0.27	0.016	–
Union S P 23	0.07	0.30	0.50	2.20	–	0.22	0.05	1.70
Weld metal	0.06	0.35	0.65	2.10	–	0.18	0.04	1.60
Union S P 24	0.06	0.20	0.50	2.40	1.00	0.24	0.05	–
Weld metal	0.05	0.30	0.65	2.30	0.95	0.20	0.04	–

Mechanical properties of the weld metal:

Designation	Heat treatment	Test-temp. °C	Yield strength ≥N/mm²	Tensile strength ≥N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact values ≥ Joule (CVN) -20°C	-30°C
Union S 1 CrMo 2 V*	705 °C / 10 h	RT	530	620	18	100	54
		482	450	500	16		
	705 °C / 30 h	RT	500	600	20	100	54
		482	380	450	16		
Union S P 23	740 °C / 2 h	RT	500	600	15	54 (RT)	
	740 °C / 15 h	RT	450	550	18	70 (RT)	
		600	300	320	16		
Union S P 24	740 °C / 2 h	RT	450	590	15	54 (RT)	
	740 °C / 15 h	RT	450	590	15	70 (RT)	
		600	300	330	15		

*) Single wire welding on AC

Sub arc wires and fluxes (high alloyed)

	Page
Summary	358-359
Wires for submerged welding high alloyed and creep resistant steels and nickel base alloys	316-317, 360-369
Fluxes for submerged welding high alloyed and creep resistant steels and nickel base alloys	324-325, 370-379

Summary
Sub arc wires and fluxes (high alloyed)

Page	Brand name	Material No.	EN / •EN ISO	AWS	Page
for submerged arc welding high alloyed and creep resistant steels and nickel base alloys					
Wires					
360-361	Thermanit A	1.4576	12072 S 19 12 3 Nb	A 5.9 ER318	360-361
360-361	Thermanit ATS 4	1.4948	12072 S 19 9 H	A 5.9 ER19-10H	360-361
360-361	Thermanit GE-316L	1.4430	12072 S 19 12 3 L	A 5.9 ER316L	360-361
360-361	Thermanit H-347	1.4551	12072 S 19 9 Nb	A 5.9 ER347	360-361
360-361	Thermanit JE-308L	1.4316	12072 S 19 9 L	A 5.9 ER308L	360-361
362-363	Thermanit L	1.4820	12072 S 25 4	– –	362-363
316-317	Thermanit MTS 3	1.4903	12070 S CrMo91	A 5.23 EB 9	316-317
316-317	Thermanit MTS 4	1.4936	12070 S CrMoWV12	A 5.23 EG	316-317
316-317	Thermanit MTS 616	–	12070 S ZCrMoWVNb 9 0,5 1,5	A 5.23 EG [B9 (mod.)]	316-317
316-317	Thermanit MTS 911	1.4905	12070 S ZCrMoWVNb 9 1 1	A 5.23 EG [B9 (mod.)]	316-317
362-363	Thermanit Nicro 82	2.4806	•18274 S Ni 6082 (NiCr20Mn3Nb)	A 5.14 ERNiCr-3	362-363
362-363	Thermanit Nimo C	2.4839	•18274 S Ni 6452 (NiCr20Mo15)	A 5.14 ERNiCrMo-7 (mod.)	362-363
362-363	Thermanit X	1.4370	12072 S 18 8 Mn	A 5.9 ER307 (mod.)	362-363
362-363	Thermanit 13/04	1.4351	12072 S 13 4	A 5.9 ER410NiMo (mod.)	362-363
364-365	Thermanit 17	1.4015	12072 S 17	A 5.9 ER430 (mod.)	364-365
364-365	Thermanit 17/06	1.4405	12072 S Z17 6	A 5.9 ER630 (mod.)	364-365
364-365	Thermanit 17/15 TT	–	12072 S Z17 15 Mn W	– –	364-365
364-365	Thermanit 1720	1.4115	12072 S Z17 Mo	– –	364-365
364-365	Thermanit 1740	1.4122	12072 S Z17 Mo H	– –	364-365
364-365	Thermanit 18/17 E	≈ 1.4440	12072 S 18 16 5 N L	A 5.9 ER317L (mod.)	364-365
364-365	Thermanit 19/15	1.4455	12072 S 20 16 3 Mn N L	A 5.9 ER316L (mod.)	364-365
366-367	Thermanit 20/10	1.4431	12072 S 20 10 3	A 5.9 ER308Mo (mod.)	366-367
366-367	Thermanit 20/25 Cu	1.4519	12072 S 20 25 5 Cu L	A 5.9 ER385	366-367
366-367	Thermanit 22/09	≈ 1.4462	12072 S 22 9 3 N L	A 5.9 ER2209	366-367
366-367	Thermanit 25/14 E-309L	1.4332	12072 S 23 12 L	A 5.9 ER309L	366-367
368-369	Thermanit 25/22 H	1.4465	12072 S 25 22 2 N L	A 5.9 ER310 (mod.)	368-369
368-369	Thermanit 617	2.4627	•18274 S Ni 6617 (NiCr22Co12Mo9)	A 5.14 ERNiCrCoMo-1	368-369
368-369	Thermanit 625	2.4831	•18274 S Ni 6625 (NiCr22Mo9Nb)	A 5.14 ERNiCrMo-3	368-369
Fluxes					
370-373	Marathon 104	–	760 SA FB 2 55 AC	– –	370-373
374-375	Marathon 213	–	760 SF CS 2 63 DC	– –	374-375
376-377	Marathon 431	–	760 SA FB 2 64 DC	– –	376-377
378-379	Marathon 444	–	760 SA FB 2 AC	– –	378-379
324-325	Marathon 543	–	760 SA FB 2 55 DC	– –	324-325

Wire	Classifications	Typical analysis of the wire electrode (%)									Field of use / Materials	Flux
	EN 12072 / • EN ISO 18274 AWS A 5.9 / • A 5.14	C	Si	Mn	Cr	Mo		Ni	Nb	others		
Thermanit	Material No.	≤	≤									Marathon
A	S 19 12 3 Nb ER318 1.4576	0.05	0.6	1.7	19.5	2.8		11.5	12xC		Joints and surfacing with matching stabilized and non stabilized CrNiMo steels such as 1.4571; 1.4583; AISI 316, 316L, 316Ti, 316 Cb	431/213 431
ATS 4	S 19 9 H ER19-10H 1.4948	0.06	0.5	1.6	18.8			9.3			Joints and surfacing with matching high temperature resistant steels such as 1.4948; AISI 304H, 321H, 347H	104
GE-316L	S 19 12 3 L ER316L 1.4430	0.02	0.6	1.7	18.5	2.8		12.2		N 0.04	Joints and surfacing with matching CrNiMo steels such as 1.4404; 1.4541; 1.4435; UNS S31653; AISI 316, 316L, 316Ti, 316Cb	431/213
H-347	S 19 9 Nb ER347 1.4551	0.06	0.6	1.8	19.5			9.5	≥ 12xC		Joints and surfacing with matching stabilized and non stabilized austenitic steels such as 1.4301; 1.4541; AISI 347, 321, 304, 304L, 304LN; ASTM A296 Gr. CF 8 C, A157 Gr. C9; A320 Gr. B8C or D	431/213
JE-308L	S 19 9 L ER308L 1.4316	0.025	0.6	1.8	20.0			9.8			Joints and surfacing with matching stabilized and non stabilized steels such as 1.4301; 1.4306; 1.4311; AISI 304, 304L, 304LN, 302, 321, 347; ASTM A 157 Gr. C9; A320 Gr. B8C or D	431/213 431

Wires and fluxes (high alloyed) for submerged arc welding
high alloyed and creep resistant steels and nickel base alloys

Wire	Classifications	Typical analysis of the wire electrode (%)									Field of use / Materials	Flux
	EN 12072 / • EN ISO 18274 AWS A 5.9 / • A 5.14	C	Si	Mn	Cr	Mo		Ni	Nb	others		
Thermanit	Material No.	≤	≤									Marathon
L	S 25 4 – 1.4820	0,10	0,9	1,2	26,0			4,5			Joints and surfacing with matching stainless heat resistant CrNi steels such as 1.4340; 1.4821	213
Nicro 82	• S Ni 6082 (NiCr20Mn3Nb) • ERNiCr-3 2.4806	0,02	0,2	3,2	20,5			Bal.	2,6	Fe ≤ 2	Austenite ferrite joints; joints of stainless, heat resistant, creep resistant and cryogenic steels	444/104
Nimo C	• S Ni 6452 (NiCr20Mo15) • ERNiCrMo-7 (mod.) 2.4839	0,010	0,1	0,9	20,0	15,0		Bal.		Fe ≤1,5 V ≤0,4	Joints and surfacings on matching and similar alloys and cast alloys	444/104
X	S 18 8 Mn ER307 (mod.) 1.4370	0,10	1,0	7,0	19,0			9,0			Joints and surfacings on high tensile, unalloyed and alloyed structural, quenched and tempered, and armur steels, same parent metal or in combination; unalloyed and alloyed boiler or structural steels with highalloyed Cr and CrNi steels; heat resistant steels up to 850 °C (1562 °F); austenitic high manganese steel with matching and other steels. Cryogenic sheet metals and pipe steels in combination with austenitic parent metals.	104
13/04	S 13 4 ER410NiMo (mod.) 1.4351	0,02	0,2	0,6	12,2	0,5		4,7			Joints and surfacings on matching 13 % Cr steels such as 1.4313; 1.4002; ACI Gr. CA 6 NM	104/UV 420 TT

Wire	**Classifications**	**Typical analysis of the wire electrode (%)**									**Field of use / Materials**	**Flux**
Thermanit	EN 12072 / • EN ISO 18274 AWS A 5.9 / • A 5.14 Material No.	C ≤	Si ≤	Mn	Cr	Mo		Ni	Nb	others		Marathon
17	S 17 ER430 (mod.) 1.4015	0,08	0,8	0,6	17,5						Surfacings of sealing faces on fittings made of low alloyed steels	213/UA 600
17/06	S Z17 6 ER630 (mod.) 1.4405	0,03	0,6	0,7	17,0	0,9		5,5			Joints and surfacings on matching 13 - 17 % CrNi(Mo) steels such as 1.4313; 1.4405	213/UA 600
17/15 TT	S Z17 15 Mn W – –	0,22	0,5	10,5	17,5			14,0		W 3,5	Joints on cryogenic-austenitic Ni steels, suitable for quenching and tempering such as 1.5662; 1.6903	104
1720	S Z17 Mo – 1.4115	0,22	0,8	0,40	17,0	1,1		0,40			Joints on matching steels; surfacings of sealing faces on fittings made of low alloyed steels	UA 600
1740	S Z17 Mo H – 1.4122	0,43	0,8	0,6	16,5	1,1		0,40			Joints on matching steels; surfacings of sealing faces on fittings made of low alloyed steels	UA 600
18/17 E	S 18 16 5 N L ER317L (mod.) 1.4440	0,02	0,4	3,7	18,5	4,2		17,5		N 0,15	Joints and surfacings on matching steels such as 1.4415; 1.4429; 1.4439; AISI 316CB, 316L, 317LN, 317L; UNS S31726	104
19/15	S 20 16 3 Mn N L ER316L (mod.) 1.4455	0,02	0,6	7,5	20,5	3,0		15,5		N 0,18	Joints and surfacings on matching steels such as non magnetic and cryogenic; 1.3965; 1.4404; 1.5662	104/213

Wire	**Classifications**	**Typical analysis of the wire electrode (%)**									**Field of use / Materials**	**Flux**
Thermanit	EN 12072 / • EN ISO 18274 AWS A 5.9 / • A 5.14 Material No.	C ≤	Si ≤	Mn	Cr	Mo		Ni	Nb	others		Marathon
20/10	S 20 10 3 ER308Mo (mod.) 1.4431	0,07	0,8	1,3	20,0	3,3		10,0			Joints on stainless CrNiMo steels and of dissimilar materials	431/213
20/25 Cu	S 20 25 5 Cu L ER385 1.4519	0,020	0,2	2,3	21,0	4,9		25,0		Cu 1,5	Joints and surfacings on matching austenitic CrNiMoCu steels/cast steel grades; N 08904	431/104
22/09	S 22 9 3 N L ER2209 ≈1.4462	0,02	0,5	1,6	23,0	3,2		8,8		N 0,15	Joints on matching Duplex steels such as 1.4462; UNS S31803, S32205	431
25/14 E-309L	S 23 12 L ER309L 1.4332	0,02	0,6	1,8	24,0			13,2			Joinings: of and between high-tensile, unalloyed and alloyed quenched and tempered steels, stainless, ferritic Cr and austenitic CrNi steels, high manganese steels. Weld claddings: for first layer of chemical resistant claddings on ferritic-pearlitic steels up to fine grained steel S500N used in steam boiler and pressure boiler construction, moreover for creep resistant fine grained structural steels 22NiMoCr4-7 acc. to leaflet “SEW-Werkstoffblatt” No. 365, 366, 20MnM0Ni5-5 and G18NiMoCr3-7.	431/213

Wire	**Classifications**	**Typical analysis of the wire electrode (%)**									**Field of use / Materials**	**Flux**
Thermanit	EN 12072 / • EN ISO 18274 AWS A 5.9 / • A 5.14 Material No.	C ≤	Si ≤	Mn	Cr	Mo		Ni	Nb	others		Marathon
25/22 H	S 25 22 2 N L ER310 (mod.) 1.4465	0,025	0,2	6,0	25,0	2,2		22,5		N 0,12	Joints and surfacings on matching steels such as 1.4465; especially suited for urea synthesis plants	431/104
617	• S Ni 6617 (NiCr22Co12Mo9) • ERNiCrCoMo-1 2.4627	0,07	0,2	0,2	20,5	8,8		Bal.		Co 10,4 Fe ≤ 2	Joints of high temperature resistant steels such as 1.4876 and NiCr23Cu12Mo-, NiCrMo alloys	444
625	• S Ni 6625 (NiCr22Mo9Nb) • ERNiCrMo-3 2.4831	0,03	0,3	0,20	22,0	9,0		Bal.	3,6	Fe ≤ 1,5	Austenite ferrite joints; joints of stainless, heat resistant, high temperature resistant and cryogenic steels	444

Marathon 104

Fluoride basic type

Classifications

EN 760
SA FB 2 55 AC

Characteristics and field of use

Marathon 104 is an agglomerated fluoride basic flux for welding of stainless and heat resistant steels and for Ni base alloys. This flux is – above all – recommended for highest demands on crack resistance and the mechanical technological properties of the weld metal, especially with heavy wall thickness. The flux is without Cr support. Its metallurgical behaviour in regard of carbon, silicon and manganese is neutral.

Grain size

EN 760: 2 - 20 (0.2 - 2.0 mm)

Packaging

25 kg plastic bag

Advice

It is advisable to redry the welding flux for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
15	36	20	25

Basicity (Boniszewski)

Mol.-%
2.7

Approvals	TÜV	DNV	GL	LR
Thermanit A	6086			
Thermanit ATS 4	7371			
Thermanit GE-316L	6085			
Thermanit H-347	6084			
Thermanit JE-308L	6083			
Thermanit 17/15 TT	9361	NV5Ni		
Thermanit 18/17 E	6480			ftV4R-12
Thermanit 19/15	3911	NV5Ni		
Thermanit 20/25 Cu	7213			
Thermanit 22/09			4462M	

Typical analysis for wire and weld metal in wt. %:

Brand name	C	Si	Mn	Cr	Mo	Ni	Nb	W	N	others
Thermanit A	0.040	0.50	1.7	19.5	2.8	11.5	0.65	-	-	-
Weld metal	0.042	0.60	1.4	19.2	2.8	11.5	0.50	-	-	-
Thermanit ATS 4	0.048	0.40	1.6	18.8	-	9.3	-	-	-	-
Weld metal	0.048	0.50	1.3	18.5	-	9.3	-	-	-	-
Thermanit GE-316L	0.012	0.50	1.7	18.5	2.8	12.2	-	-	0.04	-
Weld metal	0.018	0.60	1.4	18.2	2.8	12.2	-	-	0.04	-
Thermanit H-347	0.040	0.50	1.8	19.5	-	9.5	0.65	-	-	-
Weld metal	0.042	0.60	1.5	19.2	-	9.5	0.50	-	-	-
Thermanit JE-308L	0.016	0.50	1.8	20.0	-	9.8	-	-	-	-
Weld metal	0.018	0.60	1.5	19.8	-	9.8	-	-	-	-
Thermanit Nicro 82	0.010	0.20	3.2	20.5	-	Bal.	2.6	-	-	Fe <2.0
Weld metal	0.020	0.30	3.0	20.2	-	Bal.	2.4	-	-	Fe <2.0
Thermanit Nimo C	0.007	0.04	0.9	20.0	15.0	Bal.	-	-	-	Fe <1.5
Weld metal	0.015	0.20	0.7	19.7	15.0	Bal.	-	-	-	Fe <1.5
Thermanit 13/04	0.010	0.10	0.6	12.2	0.5	4.7	-	-	-	-
Weld metal	0.020	0.25	0.4	12.0	0.5	4.7	-	-	-	-
Thermanit 17/15 TT	0.20	0.40	10.5	17.5	-	14.0	-	3.50	-	-
Weld metal	0.18	0.50	9.3	17.2	-	14.0	-	3.40	-	-
Thermanit 18/17 E	0.011	0.30	3.7	18.5	4.2	17.5	-	-	0.15	-
Weld metal	0.016	0.40	2.8	18.2	4.2	17.5	-	-	0.15	-
Thermanit 19/15	0.016	0.50	7.5	20.5	3.0	15.5	-	-	0.18	-
Weld metal	0.019	0.60	6.9	20.2	3.0	15.5	-	-	0.18	-
Thermanit 20/25 Cu	0.009	0.10	2.3	21.0	4.9	25.0	-	-	-	Cu 1.50
Weld metal	0.019	0.25	1.8	20.7	4.9	25.0	-	-	-	Cu 1.50
Thermanit 22/09	0.015	0.40	1.6	23.0	3.2	8.8	-	-	0.15	-
Weld metal	0.020	0.50	1.3	22.7	3.2	8.8	-	-	0.15	-
Thermanit 25/14 E-309L	0.013	0.50	1.8	24.0	-	13.2	-	-	-	-
Weld metal	0.019	0.65	1.5	23.7	-	13.2	-	-	-	-
Thermanit 25/22 H	0.011	0.10	6.0	25.0	2.2	22.5	-	-	0.12	-
Weld metal	0.020	0.25	5.2	24.7	2.2	22.5	-	-	0.12	-
Thermanit 625	0.010	0.10	0.2	22.0	9.0	Bal.	3.60	-	-	Fe <1.5
Weld metal	0.020	0.30	0.2	21.7	9.0	Bal.	3.20	-	-	Fe <1.5

Marathon 104

Fluoride basic type

Mechanical properties of the weld metal (as welded):

Designation	0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact value at RT ≥ J (CVN)
Thermanit A	350	550	30	65
Thermanit ATS 4	320	550	35	80
Thermanit GE-316L	320	550	35	70
Thermanit H-347	350	550	30	65
Thermanit JE-308L	320	550	35	70
Thermanit Nicro 82	350	600	35	100
Thermanit Nimo C	420	700	35	70
Thermanit 13/04*	550	800	15	50
Thermanit 17/15 TT	430	620	30	80
Thermanit 18/17 E	320	550	34	80
Thermanit 19/15	400	620	35	80
Thermanit 20/25 Cu	320	550	35	80
Thermanit 22/09	450	680	25	80
Thermanit 25/14 E-309L	350	550	35	80
Thermanit 25/22 H	320	580	35	80
Thermanit 625	420	720	35	80

*) after heat treatment 600 °C (1112°F) / 8 h / furnace cooling

Examples of application:

Material specification	Material No.	Designation
X4CrNi13-4	1.4313	Thermanit 13/04
X8Ni9	1.5662	Thermanit 17/15 TT
X2CrNiMoN13-5	1.4439	Thermanit 18/17 E / Thermanit 19/15 / Thermanit 625
X2CrNiMoN17-12-2	1.4406	Thermanit 19/15
X10CrNiMoNb18-12	1.4583	Thermanit 19/15
X2NiCrMoCu25-20-5	1.4539	Thermanit 20/25 Cu
X2CrNiMoN22-5	1.4462	Thermanit 22/09
X1CrNiMoN25-25-2	1.4465	Thermanit 25/22 H
NiCr22Mo9Nb	2.4856	Thermanit 625
X10CrNiMoNb18-12	1.4583	Thermanit A/Thermanit GE-316L
X12CrNiTi18-9	1.4878	Thermanit ATS 4
X2CrNiMo18-10	1.4404	Thermanit GE-316L
X5CrNiNb18-10	1.4550	Thermanit H-347
X2CrNi19-11	1.4306	Thermanit JE-308L
Alloy 800 (H)	1.4876	Thermanit Nicro 82
NiMo16Cr16Ti	2.4610	Thermanit Nimo C

Marathon 213

Calcium silicate type

Classifications

EN 760

SF CS 2 63 DC

Characteristics and field of use

Marathon 213 is a fused calcium silicate welding flux for joining and surfacing creep resistant, stainless and heat resistant steels and dissimilar steels as well as for austenite ferrite joints.
In combination with wire Thermanit JE-308L and Thermanit 19/15 cold toughness up to –196 °C (–321 °F) has been proved.
Good slag detachability.

Grain size

EN 760: 1 - 16 (0.1 - 1.6 mm)

Packaging

25 kg plastic bag

Advice

It is advisable to redry the welding flux for about 2 h at 250-300 °C (482-572 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	CaO+MgO	Al_2O_3+MnO	CaF_2
30	35	5	20

Basicity (Boniszewski)

Mol.-%
1.3

Typical analysis for wire and weld metal in wt. %:

Brand name	C	Si	Mn	Cr	Mo	Ni	N	Nb
Thermanit A	0.040	0.50	1.7	19.5	2.8	11.5	-	0.65
Weld metal	0.041	0.70	1.1	19.0	2.8	11.5	-	0.50
Thermanit GE-316L	0.012	0.50	1.7	18.5	2.8	12.2	0.04	-
Weld metal	0.012	0.70	1.1	18.0	2.8	12.2	0.04	-
Thermanit H-347	0.040	0.50	1.8	19.5	-	9.5	-	0.65
Weld metal	0.041	0.70	1.2	19.0	-	9.5	-	0.50
Thermanit JE-308L	0.016	0.50	1.8	20.0	-	9.8	-	-
Weld metal	0.016	0.70	1.2	19.5	-	9.8	-	-
Thermanit 19/15	0.016	0.50	7.5	20.5	3.0	15.5	0.18	-
Weld metal	0.021	0.70	6.5	20.0	3.0	15.5	0.18	-
Thermanit 25/14 E-309L	0.014	0.50	1.8	24.0	-	13.2	-	-
Weld metal	0.021	0.70	1.4	23.5	-	13.2	-	-

Mechanical properties of the weld metal (as welded):

Designation	0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact value at RT ≥ J (CVN)
Thermanit A	400	600	30	70
Thermanit GE-316L	380	560	30	70
Thermanit H-347	350	550	30	70
Thermanit JE-308L	320	350	35	70
Thermanit 19/15	360	600	30	80
Thermanit 25/14 E-309L	380	580	30	80

Examples of application:

Material specification	Mat. No.	Designation
X4CrNiMnMoN19-13-8	1.3948	Thermanit 19/15
X2CrNiMoN17-12-2	1.4406	
X8Ni9	1.5662	
X5CrMnNiN18-9	1.6909	
X6CrNiMoTi17-12-2	1.4571	Thermanit A
X10CrNiMoNb18-12	1.4583	
X2CrNiMo17-13-2	1.4404	Thermanit GE-316L
X2CrNiMoN17-12-2	1.4406	
X2CrNiMo18-14-3	1.4435	
X6CrNiTi18-10	1.4541	Thermanit H-347
X6CrNiTi18-10	1.4550	
X2CrNi19-11	1.4306	Thermanit JE-308L
X5CrNi18-8	1.4301	
X2CrNiN18-10	1.4311	
Buffer layers for claddings; Claddings and joints of unalloyed and medium alloyed steels with high alloyed steels		Thermanit 25/14 E-309L

Approvals	TÜV	GL	LR
Thermanit A	9616		
Thermanit GE-316L	9615	4429M	ftV7P-12
Thermanit H-347			
Thermanit JE-308L	9612		
Thermanit 19/15		4429M	
Thermanit 24/14 E-309L	9617		

Marathon 431

Fluoride basic type

Classifications

EN 760

SA FB 2 64 DC

Characteristics and field of use

Marathon 431 is an agglomerated basic welding flux for welding stainless high alloyed CrNi(Mo) steels.
The weld seams are smooth and finely rippled without any slag residues.
Besides the good slag detachability the flux also provides good fillet weld properties.
The weld metals show high degree of purity and good mechanical properties.

Grain size

EN 760: 3 - 14 (0.3 - 1.4 mm)

Advice

It is advisable to redry the welding flux for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2	Al_2O_3	CaF_2
10	38	50

Basicity (Boniszewski)

Mol.-%
2.3

Typical analysis for wire and weld metal in wt. %:

Brand name	C	Si	Mn	Cr	Mo	Ni	Nb	N
Thermanit A	0.040	0.50	1.7	19.5	2.8	11.5	0.65	-
Weld metal	0.038	0.60	1.2	19.0	2.8	11.5	0.50	-
Thermanit GE-316L	0.012	0.50	1.7	18.5	2.8	12.2	-	-
Weld metal	0.012	0.60	1.2	18.0	2.8	12.2	-	-
Thermanit H-347	0.040	0.50	1.8	19.5	-	9.5	0.65	-
Weld metal	0.038	0.60	1.3	19.0	-	9.5	0.50	-
Thermanit JE-308L	0.016	0.50	1.8	20.0	-	9.8	-	-
Weld metal	0.015	0.60	1.3	19.5	-	9.8	-	-
Thermanit 20/10	0.055	0.70	1.3	20.0	3.3	10.0	-	-
Weld metal	0.040	0.80	1.0	19.5	3.3	10.0	-	-
Thermanit 22/09	0.015	0.40	1.6	23.0	3.2	8.8	-	0.15
Weld metal	0.013	0.50	1.1	22.5	3.2	8.8	-	0.15
Thermanit 25/14 E-309L	0.014	0.50	1.8	24.0	-	13.2	-	-
Weld metal	0.013	0.60	1.3	23.8	-	13.2	-	-

Mechanical properties of the weld metal (as welded):

Designation	0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact value at RT ≥ J (CVN)
Thermanit A	320	550	35	70
Thermanit GE-316L	320	550	35	70
Thermanit H-347	350	550	30	65
Thermanit JE-308L	350	550	30	65
Thermanit 20/10	450	650	30	80
Thermanit 22/09	480	690	25	80
Thermanit 25/14 E-309L	350	600	35	100

Examples of application:

Material specification	Material No.	Designation
X10CrNiMoNb18-12 / HII	1.4583 / 1.0425	Thermanit 20/10
X2CrNiMoN22-5	1.4462	Thermanit 22/09
X6CrNiMoTi17-12-2	1.4571	Thermanit A
X2CrNiMo17-13-2	1.4404	Thermanit GE-316L
X6CrNiNb18-9	1.4550	Thermanit H-347
X2CrNi19-11	1.4306	Thermanit JE-308L

Approvals	TÜV	Controlas	DNV	GL	LR
Thermanit A	6985				
Thermanit GE-316L	6113	1372			
Thermanit H-347	6479				
Thermanit JE-308L	6114	1428			
Thermanit 20/10	7801				
Thermanit 22/09	6112		Duplex CM2	4462TM	4462TM

Marathon 444

Fluoride basic type

Classifications

EN 760
SA FB 2 AC

Characteristics and field of use

Marathon 444 is an agglomerated fluoride basic welding flux with high basic slag characteristics.
For welding Ni base alloys and special metals if the use of wire electrodes with high Ni content is requested. The weld metals show excellent mechanical properties with high hot cracking resistance.
It is applicable for chemical apparatus construction on high temperature metals as well as in low temperature sections up to –196 °C (–321 °F).

Grain size

EN 760: 3 - 16 (0.3 - 1.6 mm)

Packaging

25 kg plastic bag

Advice

It is advisable to redry the welding flux for about 2 h at 300-350 °C (572-662 °F) prior to use.

Main constituents in %

SiO_2+TiO_2	Al_2O_3+MnO	CaO+MgO	CaF_2
7	30	40	20

Basicity (Boniszewski)

Mol.-%
4,5

Typical analysis for wire and weld metal in wt. %:

Marke	C	Si	Mn	Cr	Mo	Ni	Nb	Fe
Thermanit Nicro 82	0.010	0.15	3.2	20.5	-	Bal.	2.6	<2.0
Weld metal	0.012	0.25	3.0	20.2	-	Bal.	2.4	<2.0
Thermanit Nimo C	0.007	0.04	0.9	20.0	15.0	Bal.	-	<1.5
Weld metal	0.011	0.16	0.7	19.7	15.0	Bal.	-	<1.5
Thermanit 625	0.010	0.10	0.2	22.0	9.0	Bal.	3.6	<1.5
Weld metal	0.012	0.16	0.2	21.7	9.0	Bal.	3.2	<1.5

Mechanical properties of the weld metal (as welded):

Designation	0.2% Yield strength ≥ N/mm²	Tensile strength ≥ N/mm²	Elongation $l_0=5d_0$ ≥ %	Impact value at RT ≥ J (CVN)
Thermanit Nicro 82	380	580	35	80
Thermanit Nimo C	400	700	35	60
Thermanit 625	420	700	40	80

Examples of application:

Material specification	Mat. No.	Designation
heat resistant alloys		
NiCr15Fe	2.4816	Thermanit Nicro 82
X10NiCr32-20	1.4861	Thermanit Nicro 82
X10NiCrAlTi32-20	1.4876	Thermanit Nicro 82
high temperature alloys		
X3CrNiMoN17-13	1.4910	Thermanit Nicro 82
NiCr20Ti	2.4630	Thermanit Nicro 82
NiCr15Fe	2.4815	Thermanit Nicro 82
NiCr23Fe	2.4851	Thermanit Nicro 82
NiCr22Mo9Nb	2.4856	Thermanit 625
cryogenic steels		
10Ni14	1.5637	Thermanit Nicro 82
X8Ni9	1.5662	Thermanit Nicro 82 Thermanit 625

Approvals	TÜV
Thermanit Nicro 82	7767
Thermanit 625	391

Flux cored wires (low, medium and high alloyed)

	Page
Summary	382-383
for the welding of low and medium alloyed steels	406-407, 411-423
for the welding of creep resistant steels	408-410
for the welding of high alloyed steels	386-395, 398-405
for the welding of Duplex stainless steels	384-385, 396-397

Summary
Flux cored wires
(low, medium and high alloyed)

Page	Designation	EN	Material No.	AWS	Page
for the welding of low and medium alloyed steels					
406	Union BA 70	758 T 42 4 B M 3 H5/T 42 4 B C 3 H5	–	A 5.20 E70T-5MH4/E70T-5	406
407	Union MV 70	758 T 46 4 M M 2 H5/T 42 3 M C 2 H5	–	A 5.18 E70C-6MH4	407
411	Union RV 71	758 T 42 2 P M 1 H5/T 42 2 P C 1 H5	–	A 5.20 E71T-1MJH4/E71T-1H4	411
412-413	Union TG 50 B	758 T 42 5 B M 1 H5/T 42 4 B C 1 H5	–	A 5.20 E71T-5MJH4/E71T-5H4	412-413
414-415	Union TG 50 M	758 T 46 3 P M 1 H10/T 42 2 P C 1 H5	–	A 5.20 E71T-12MH8/E71T-1H8	414-415
416-417	Union TG 50 Ni	758 T 46 5 1 Ni P M 1 H5	–	A 5.29 E81T1-Ni1MH4	416-417
418-419	Union TG 55 Fe	758 T 46 4 M M 1 H5	–	A 5.18 E70C-6MH4	418-419
420-421	Union TG 55 M	758 T 46 4 P M 1 H10 / T 42 2 P C 1 H5	–	A 5.20 E71T-1MJH8/E71T-JH8	420-421
422-423	Union TG 55 Ni	758 T 50 5 1 Ni P M 1 H5	–	A 5.29 E81T1-Ni1MH8	422-423
for the welding of creep resistant steels					
408	Union MV CrMo	12071 T CrMo1 M M 2 H5		A 5.28 E80C-B2H4	408
409	Union MV CrMo 910	12071 T CrMo2 M M 2 H5	–	A 5.28 E90C-B3H4	409
410	Union MV Mo	758/12071 T 46 2 Mo M M 2 H5/T Mo M M 2 H5	–	A 5.28 E80C-GH4	410
for the welding of high alloyed steels					
386	Thermanit TG 307	12073 T 18 8 Mn RM3/T 18 8 Mn RC3	–	A 5.22 E307-T0-G	386
		14700 T Fe 10			
387	Thermanit TG 308 L	12073 T 19 9 LRM3/T 19 9 LRC3	1.4316	A 5.22 E308LT0-4/E308LT0-1	387
388-389	Thermanit TG 309 L	12073 T 23 12 LRM3/T 23 12 LRC3	1.4332	A 5.22 E309LT0-4/E309LT0-1	388-389
390-391	Thermanit TG 309 Mo L	12073 T 23 12 2 LRM3/T 23 12 2 LRC3	1.4459	A 5.22 E309LMoT0-4/E309LMoT0-1	390-391
392-393	Thermanit TG 316 L	12073 T 19 12 3 LRM3/T 19 12 3 LRC3	1.4430	A 5.22 E316LT0-4/E316LT0-1	392-393
394	Thermanit TG 317 L	12073 T 19 13 4 LRM3	≈1.4440	A 5.22 E317LT0-4	394
395	Thermanit TG 347	12073 T 19 9 Nb RM3/T 19 9 Nb RC3	1.4551	A 5.22 E347T0-4/E347T0-1	395
398-399	Thermanit 308 L-PW	12073 T 19 9 LPM1/T 19 9 LPC1	1.4316	A 5.22 E308LT1-4/E308LT1-1	398-399
400-401	Thermanit 309 L-PW	12073 T 23 12 LPM1/T 23 12 LPC1	1.4332	A 5.22 E309LT1-4/E309LT1-1	400-401
402-403	Thermanit 309 Mo L-PW	12073 T 23 12 2 LPM1/T 23 12 2 LPC1	1.4459	A 5.22 E309LMoT1-4/E309LMoT1-1	402-403
404-405	Thermanit 316 L-PW	12073 T 19 12 3 LPM1/T 19 12 3 LPC1	1.4430	A 5.22 E316LT1-4/E316LT1-1	404-405
for the welding of Duplex stainless steels					
384-385	Thermanit TG 22/09	12073 T 22 9 3 N LRM 3/T 22 9 3 N LRC3	1.4462	A 5.22 E2209LT0-4/E2209LT0-1	384-385
396-397	Thermanit 22/09-PW	12073 T 22 9 3 N LPM 1/T 22 9 3 N LPC1	1.4462	A 5.22 E2209LT1-4/E2209LT1-1	396-397

Thermanit TG 22/09

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 22 9 3 N LRM3	E2209LT0-4	1.4462
T 22 9 3 N LRC3	E2209LT0-1	

Characteristics and field of use

Thermanit TG 22/09 is an austenitic-ferritic CrNiMo flux cored wire with rutile slag characteristic. It is suited for GMAW welding of duplex steels with mixed gas M21 and C1 (acc. to EN 439). It is appropriate for joining and surfacing (cladding) applications on matching and similar austenitic/ferritic steels/cast steel grades. The weld metal is resistant to intercrystalline corrosion (wet corrosion up to 250 °C (482 °F)) and provides a good resistance to pitting corrosion and stress corrosion cracking in chloride bearing environment. Suitable for use in chemical apparatus and plant construction, in chemical tank and general construction and on/offshore industry.
The flux cored wire is also suited for mixed structures of different steels (“black”/“white”) with high resistance to hot cracking. Thermanit TG 22/09 provides almost spatter free welding behaviour and due to the very slow freezing rutile slag, the weld metal shows very fine and smooth weld pattern.
Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle.
Root welding is proved on ceramic backing bar.

Materials

X2CrNiMoN22-5-3 (1.4462), GX6CrNiMo24-8-2 (1.4463), X2CrNiMoSi19-5 (1.4417), and similar alloyed ferritic-austenitic materials with higher strength and combinations between mentioned steels and ferritic steels such as P235GH - P295GH, S255N - S355N, 16Mo3,
shipbuilding steels grade A - E, AH32 - EH36, A40 - F40
and steels corresponding to X10CrNiMoTi18-12 (1.4583).
UNS S31803, S32205.

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N	Gas
0,03	0,8	0,9	22,7	3,2	9,0	0,13	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT, Shielding gas: M21)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN		
						-20°C	-40°C
AW	600	650	800	25	60	50	32

Structure

Austenite/Ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption: 15 - 18 l/min.

Approvals

TÜV (Certificate No. 7656)
ABS
DNV
GL
LR
UDT

Packaging, weights and amperages

Diam. (mm)	Spool	kg / pack	Amperage	Volts
1.2	B300	15	130-220	22-30

Thermanit TG 307

Flux cored wire

Classifications

EN 12073	AWS A 5.22	EN 14700
T18 8 Mn RM3	E307-T0-G	T Fe 10
T18 8 Mn RC3		

Characteristics and field of use

Thermanit TG 307 is an austenitic CrNiMn flux cored wire with rutile slag characteristic. This rutile flux cored wire operates with a very stable, spatter free arc producing a bright, smooth weld bead surface and self-releasing slag. It is suitable for GMAW welding with mixed gas M21 and C1 (acc. to EN 439) for joining and cladding. Joinings on steels, which are difficult to weld, high manganese steels as well as dissimilar steels (austenite/ferrite) – max. application temperature is 300 °C (572 °F). For large-area cladding/surfacing applications with machine parts, which are work hardened during use, due to impact and pressure affection. Usable for tough stress-compensating buffer layers when hardfacing, fill layers for deep wear stiffening, repair work on rails, crossing frogs, casters, stirring shovels and pump traversing wheels. For repair welding of damages due to cavitation on water turbines and sealing surfaces to fittings (acid mine water).
The weld metal is tough, work hardening, wear resistand and heat resistant (resistant to scaling up to 850 °C (1562 °F)).

Materials

High strength, unalloyed and alloyed steels for quenching and tempering, hard field steels, corrosion and heat resistant ferritic stainless steels.

Typical analysis in %

C	Si	Mn	Cr	Ni		Gas
0.1	0.8	6.8	19.0	9.0		M21

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -100 °C		Shielding gas
AW	420	450	630	40	70	32	M21

Hardenes approx. 175-225 HB – approx. 400 HB (work hardened)

Structure

Austenite with part ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption: 15 - 18 l/min.

Approvals

upon request

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	140-280	23-35
1.6	B300	15	200-350	26-38

Thermanit TG 308 L

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T19 9 LRM3	E308LT0-4	1.4316
T19 9 LRC3	E308LT0-1	

Characteristics and field of use

Thermanit TG 308 L is an austenitic CrNi flux cored wire with rutile slag characteristic. It is suited for GMAW welding with mixed gas M21 and C1 (acc. to EN 439) on matching and similar, non stabilized and stabilized corrosion resistant CrNi(N) steels/cast steel grades. The weld metal is stainless and provides good resistance to nitric acid, resistance to intercrystalline corrosion – wet corrosion up to 350 °C (662 °F), cold toughness to –196 °C (–320 °F) and resistance to scaling up to 800 °C (1472 °F). Weldable almost spatter free and due to the very slow freezing rutile slag the weld metals shows very fine and smooth weld pattern. Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle.
The root welding is proved on ceramic backing bar.

Materials

X5CrNi18-10 (1.4301), X2CrNi19-11 (1.4306),
GX6CrNi18-9 (1.4308), X2CrNiN18-10 (1.4311)*,
X6CrNiTi18-10 (1.4541), X6CrNiNb18-10 (1.4550),
GX5CrNiNb18-9 (1.4552), X6CrNi18-11 (1.4948).
AISI 304, 304L, 304LN, 302, 321, 347;
ASTM A157 Gr. C9; A320 Gr. B8C or D.
*Material No. 1.4311 certified only with shielding gas M21

Typical analysis in %

C	Si	Mn	Cr	Ni		Gas
0,03	0,7	1,5	19,8	10,2		M21

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -196 °C**		Shielding gas
AW	350	380	560	35	47	32	M21

**only with shielding gas M21 acc. to EN 439

Structure

Austenite with part ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption : 15 - 20 l/min.

Approvals

TÜV (Certificate No. 7538) DB (Certificate No. 43.132.15)
GL, Controlas, UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Ampereage	Volts
0.9	B300	12.5	100-180	18-29
1.2	B300	15	120-280	20-30
1.6	B300	15	180-350	22-32

Thermanit TG 309 L

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 23 12 LRM3	E309LT0-4	1.4332
T 23 12 LRC3	E309LT0-1	

Characteristics and field of use

Thermanit TG 309 L is an austenitic CrNi flux cored wire with rutile slag characteristic. It is suited for GMAW welding with mixed gas M21 and C1 (acc. to EN 439).
For joint welding of high-alloyed CrNi(Mo, N) steels/cast steel grades with unalloyed/low alloyed steels (austenite ferrite joints) with a maximum application temperature of 300 °C (572 °F).
It is also suited for joint welding of high alloyed CrNi(Mo, N) steels/cast steel grades with stainless and heat-resistant Cr steels/cast steel grades. For intermediate layers when welding the clad side of plates and cast materials clad with non stabilized and stabilized CrNi(Mo, N) austenitic metal. The weld metal is stainless (wet corrosion up to 350 °C / 662 °F).
Weldable almost spatter-free and due to the very slow freezing slag the weld metal shows fine and smooth weld pattern. Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle.
Root welding is proved on ceramic backing bar.

Materials

Combinations between X10CrNiMoNb18-12 (1.4583), X5CrNi18-10 (1.4301), GX6CrNi18-9 (1.4308), X2CrNiMo17-13-2 (1.4404), X2CrNiMo18-14 (1.4435), X6CrNiTi18-10 (1.4541), GX5CrNiNb18-9 (1.4552), X6CrNiMoTi17-12-2 (1.4571), X6CrNiMoNb17-12-2 (1.4580), X6CrNi18-11 (1.4948), X2CrNiMoN17-13-3 (1.4429), X2CrNiN18-10 (1.4311), X2CrNiMoN17-12-2 (1.4406) and ferritic steels P265GH - P295GH, S255N - S355N; shipbuilding steels grade A - E, AH32 - EH36; A40 - F40.
Joining of high strength, mild steel and alloyed temper steel grades, stainless and ferritic Cr-steels and austenitic CrNi steels, austenitic manganese steel, as well as cladding operations: In the first layer (buttering) of chemical resistant cladding of steam and other pressure vessels in ferritic perlitic steels up to S500N, and heat resistant fine grain steel 22NiMoCr4-7 according to SEW 365, 366, 20MnMoNi5-5 and G18NiMoCr3-7.

Typical analysis in %

C	Si	Mn	Cr	Ni	Gas
0,03	0,7	1,4	22.8	12.5	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -60 °C		Shielding gas
AW	380	400	540	35	47	32	M21

Structure

Austenite with part ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption: 15 - 20 l/min.

Approvals

TÜV (Certificate No. 7540)
DB (Certificate No. 43.132.14)
GL
Controlas
UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
0.9	B300	12.5	100-180	18-29
1.2	B300	15	120-280	20-30
1.6	B300	15	180-350	22-32

Thermanit TG 309 Mo L

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 23 12 2 LRM3	E309LMoT0-4	1.4459
T 23 12 2 LRC3	E309LMoT0-1	

Characteristics and field of use

Thermanit TG 309 Mo L is an austenitic CrNiMo flux cored wire with rutile slag characteristic. It is suited for GMAW welding with mixed gas M21 and C1 (acc. to EN 439). It is appropriate for joint welding high alloyed CrNi(Mo, N) steels/cast steel grades with unalloyed/low alloyed steels (austenite ferrite joints) with a maximum application temperature of 300 °C (572 °F). It is also suited for joint welding of high alloyed CrNi(Mo, N) steels/cast steel grades with stainless and heat resistant Cr steels/cast steel grades. For intermediate layers when welding the clad side of plates and cast materials clad with non stabilized and stabilized CrNi(Mo, N) austenitic metal. In the whole field of application this flux cored wire provides high resistance to hot cracking even at high dregree of dilution.
The content of molybdenum provides a better corrision resistance and simultaneously increases the ductility of austenitic joining combinations at higher temperatures. Weldable almost spatter free and due to the very slow freezing slag the weld metal shows fine and smooth weld pattern.
Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle.
Root welding is proved on ceramic backing bar.

Materials

Combinations between X10CrNiMoNb18-12 (1.4583), X5CrNi18-10 (1.4301), GX6CrNi18-9 (1.4308), X2CrNiMo17-13-2 (1.4404), X2CrNiMo18-14 (1.4435), X6CrNiTi18-10 (1.4541), GX5CrNiNb18-9 (1.4552), X6CrNiMoTi17-12-2 (1.4571), X6CrNiMoNb17-12-2 (1.4580), X6CrNi18-11 (1.4948), X2CrNiMoN17-13-3 (1.4429), X2CrNiN18-10 (1.4311), X2CrNiMoN17-12-2 (1.4406) and ferritic steels P265GH - P295GH, S255N - S355N; shipbuilding steels grade A - E, AH32 - EH36; A40 - F40.
For combinations of the following or joining of high strength, mild, and alloyed steels and temper steel grades, or heat resistant steels and Cr, CrNi or CrNiMo steel grades. Ferritic austenitic joints in steam and pressure vessel constructions.
Cladding: First layer (buttering) in chemical resistant cladding on P235GH, P265GH, S255N, P295GH, S355N-S500N.
Also first layer in corrosion resistant cladding an heat resistant tempered fine grain steels according to AD HP0, group 3.

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Gas
0.03	0.6	1.4	22.7	2.7	12.3	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -60 °C	Shielding gas
AW	500	550	700	30	47 32	M21

Structure

Austenite with part ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption: 15 - 20 l/min.

Approvals

TÜV (Certificate No. 7688)
DB (Certificate No. 43.132.17)
ABS
Controlas
DNV
GL
LR
UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
0.9	B300	12.5	100-180	18-29
1.2	B300	15	120-280	20-30
1.6	B300	15	180-350	22-32

Thermanit TG 316 L

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 19 12 3 LRM3	E316LT0-4	1.4430
T 19 12 3 LRC3	E316LT0-1	

Characteristics and field of use

Thermanit TG 316 L is an austenitic CrNiMo flux cored wire with rutile slag characteristic. It is suited for GMAW welding with mixed gas M21 and C1 (acc. to EN 439) for joining of matching and similar, non stabilized and stabilized, corrosion resistant CrNi(N) and CrNiMo(N) steels/cast steel grades.
The weld metal is stainless and resistant to intercrystalline corrosion (wet corrosion up to 400 °C / 752 °F), cold tough to –120 °C (–184 °F) and resistant to scaling up to 800 °C (1472 °F).
Thermanit TG 316 L provides almost spatter free welding behaviour and due to the slow freezing rutile slag, the weld metal shows very fine and smooth weld pattern.
Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle.
Root welding is proved on ceramic backing bar.

Materials

X5CrNi18-10 (1.4301), X2CrNi19-11 (1.4306), GX6CrNi18-9 (1.4308), X5CrNiMo17-12-2 (1.4401), X2CrNiMo17-13-2 (1.4404), GX6CrNiMo18-10 (1.4408), X2CrNiMo18-14 (1.4435), X5CrNiMo17-13-3 (1.4436), X6CrNiTi18-10 (1.4541), X6CrNiNb18-10 (1.4550), GX5CrNiNb18-9 (1.4552), X6CrNiMoTi17-12-2 (1.4571), X10CrNiMoTi18-12 (1.4573), X6CrNiMoNb17-12-2 (1.4580), GXCrNiMoNb18-10 (1.4581), X6CrNi18-11 (1.4948); UNS S31653; AISI 316L, 316Ti, 316Cb.

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Gas
0.03	0.7	1.5	19.0	2.7	12.0	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -120 °C		Shielding gas
AW	350	400	560	35	47	32	M21

Structure

Austenite with part ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption: 15 - 20 l/min.

Approvals

TÜV (Certificate No. 7539)
DB (Certificate No. 43.132.16)
Controlas
GL
UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
0.9	B300	12.5	100-180	18-29
1.2	B300	15	120-280	20-30
1.6	B300	15	180-350	22-32

Thermanit TG 317 L

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 19 13 4 LRM3	E317LT0-4	≈1.4440

Characteristics and field of use

Thermanit TG 317 L is an austenitic CrNiMo flux cored wire with rutile slag characteristic. It is suitable for GMAW welding with mixed gas M21 (acc. to EN 439) for joining of matching and similar, non-stabilized and stabilized, corrosion resistant stainless steels/cast steels with 3 % molybdenum. High Mo-content provides elevated resistance to Cl-bearing environment and pitting corrosion. Thermanit TG 317 L provides almost spatter free welding behaviour and due to the slow freezing rutile slag, the weld metal shows very fine and smooth weld pattern.
Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle.
Root welding is proved on ceramic backing bar.

Materials

CrNiMo-steels with higher Mo-content of type AISi 317L and resp. corrosion resistant claddings on unalloyed steel grades.. 1.4435 X2CrNiMo18-14-3, 1.4429 X2CrNiMoN17-11-2, 1.4438 X2CrNiMo18-15-4; AISi 316L, 317LN

Typical analysis in %

C	Si	Mn	Cr	Ni	Mo
0.03	0.7	1.2	19.9	12.5	3.4

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
						-60 °C
AW	490	520	680	30	47	32

Welding position



Polarity = +
Shielding gas (EN 439) **M21,**
Consumption: 15 - 18 l/min.

Approvals

upon request

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	125-280	20-34

Thermanit TG 347

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 19 9 Nb RM3	E347T0-4	1.4551
T 19 9 Nb RC3	E347T0-1	

Characteristics and field of use

Thermanit TG 347 is an austenitic CrNi-Nb stabilized flux cored wire with rutile slag characteristic. This flux-cored wire finds application in all branches of industry where matching steels as well as ferrite 13 % chromium steels are in process. Typical fields of application are the chemical apparatus engineering and tank construction, the textile and cellulose industry, dye-works enterprises etc. Simple handling of the flux cored wire leads to a high productivity with finely rippled weld pattern, with good side fusion and evenly safe penetration.
The weld metal is cold tough to –120 °C (–184 °F) and resistant to intercrystalline corrosion and wet corrosion up to 400 °C (752 °F). Corrosion resistant similar to matching low-carbon and stabilied 18/8 CrNi(N) steels/cast steel grades. For joining and surfacing applications with matching and similar-stabilized and non-stabilized CrNi(N) steels/cast stell grades. For joining work on steel clad products and for weld cladding on unalloyed/low-alloyed (creep-resistant) steels/cast steel grades: mostly for secont layer (cap pass) on higher-alloyed intermediate layer.
Root welding is proved on ceramic backing bar.

Materials

1.4550 X6CrNiNb18-10, 1.4541 X6CrNiTi18-10,
1.4552 GX5CrNiNb18-10, 1.4301 X5CrNi18-10,
1.4312 GX10CrNi18-8, 1.4546 X5CrNiNb18-10,
1.4311 X2CrNiN18-10, 1.4306 X2CrNi19-11,
AISI 347, 321, 302, 304, 304L, 304LN, ASTM A295 Gr. CF 8 C, A157 Gr. C 9, A320 Gr. BBC or D

Typical analysis in %

C	Si	Mn	Cr	Ni	Nb
0.03	0.7	1.5	19.7	10.2	>12XC

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
						-120 °C
AW	420	450	600	35	47	32

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption: 15 - 18 l/min.

Approvals

Upon request

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	125-280	20-34

Thermanit 22/09-PW

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 22 9 3 N LPM1	E2209LT1-4	1.4462
T 22 9 3 N LPC1	E2209LT1-1	

Characteristics and field of use

Thermanit TG 22/09 is an austenitic-ferritic CrNiMo flux cored wire with rutile slag characteristic. It is suited for GMAW welding of Duplex steels with mixed gas M21 and C1 (acc. to EN 439). It is appropriate for joining and surfacing (cladding) applications on matching and similar austenitic/ferritic steels/cast steel grades. The weld metal is resistant to intercrystalline corrosion (wet corrosion up to 250 °C / 482 °F) and provides a good resistance to pitting corrosion and stress corrosion cracking in chloride bearing environment. Suitable for use in chemical apparatus and plant construction, in chemical tank and general construction and on/offshore industry.
The flux cored wire is also suited for mixed structures of different steels (“black”/“white”) with high resistance to hot cracking.
The supporting effect of the fast solidifying rutile slag to the weld pool of this flux cored wire allows, especially when out of position welding, higher welding performance (deposition rate) in comparison with bar electrodes or solid wire.
Root welding is proved on ceramic backing bar.

Materials

X2CrNiMoN22-5-3 (1.4462), GX6CrNiMo24-8-2 (1.4463), X2CrNiMoSi19-5 (1.4417), X2CrNiN23-4 (1.4362) and similar alloyed ferritic-austenitic materials with higher strength and combinations between mentioned steels and ferritic steels such as P235GH - P295GH, S255N - S355N, 16Mo3, shipbuilding steels grade A - E, AH32 - EH36; A40-F40 and steels corresponding to X10CrNiMoTi18-12 (1.4583)

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	N	Gas
0.03	0.7	1.0	22.7	3.2	9.0	0.13	M21

Mechanical properties of the weld metal according to EN 1597-1

(min. values at RT, Shielding gas: M21)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation ($L_0=5d_0$) %	Impact values in J CVN		
						-20°C	-40°C
AW	600	650	800	25	60	45	32

Structure

Austenite/ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption : 15 - 18 l/min.

Approvals

TÜV (Certificate No. 9106)
ABS
DNV
GL
LR
UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	130-220	22-30

Thermanit 308 L-PW

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 19 9 LPM1	E308LT1-4	1.4316
T 19 9 LPC1	E308LT1-1	

Characteristics and field of use

Thermanit 308 L-PW is an austenitic CrNi flux cored wire with rutile fast freezing slag. It is suited for GMAW welding with mixed gas M21 and C1 (acc. to EN 439) in all positions, on matching and similar, non stabilized and stabilized, corrosion resistant CrNi(N) steels/cast steel grades.
The weld metal is stainless and provides good resistance to nitric acid, resistance to intercrystalline corrosion – wet corrosion up to 350 °C (662 °F), cold toughness to –196 °C (–320 °F) and resistance to scaling up to 800 °C (1472 °F).
Thermanit 308 L-PW provides very fine and smooth weld pattern and almost spatter free welding behaviour. Very good slag detachability and notch free, clean seams with low annealing colouring, easy to clean and pickle. Root welding is proved on ceramic backing bar.

Materials

X5CrNi18-10 (1.4301), X2CrNi19-11 (1.4306),
GX6CrNi18-9 (1.4308), X2CrNiN18-10 (1.4311),
X6CrNiTi18-10 (1.4541), X6CrNiNb18-10 (1.4550),
GX5CrNiNb18-9 (1.4552), X6CrNi18-11 (1.4948)
and also covered materials acc. to VdTÜV-Kennblatt 1000.26;
AISI 304, 304L, 304LN, 302, 321, 347;
ASTM A157 Gr. C9; A320 Gr. B8C or D.

Typical analysis in %

C	Si	Mn	Cr	Ni	Gas
0.03	0.7	1.5	19.8	10.2	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN		Shielding gas
						-196 °C	
AW	350	380	560	35	70	32	M21

Structure

Austenite with part ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption : 15 - 20 l/min.

Approvals

TÜV (Certificate No. 9770) UDT
DB (Certificate No. 43.132.23

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	120-250	22-28

Thermanit 309 L-PW

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 23 12 LPM1	E309LT1-4	1.4332
T 23 12 LPC1	E309LT1-1	

Characteristics and field of use

Thermanit 309 L-PW is an austenitic CrNi flux cored wire with rutile, fast freezing slag. It is suited for all-position GMAW welding with mixed gas M21 and C1. It is appropriate for joint welding of high alloyed CrNi(Mo) steels/cast steel grades with unalloyed/low alloyed steels (austenite ferrite joints) with a maximum application temperature of 300 °C (572 °F). For joint welding of high alloyed CrNi(Mo, N) steels/cast steel grades with stainless and heat resistant Cr steels/cast steel grades.
For intermediate layers when welding the clad side of plates and cast materials clad with non stabilized and stabilized CrNi(Mo, N) austenitic metals. The weld metal is stainless (wet corrosion up to 300 °C / 572 °F).
Thermanit 309 L-PW provides very fine and smooth weld pattern and almost spatter free welding behaviour. Very good slag detachability and notch free, clean seams with low annealing colouring, easy to clean and pickle. Root welding is proved on ceramic backing bar.

Materials

Combinations between X5CrNi18-10 (1.4301), X2CrNi19-11 (1.4306), GX6CrNi18-9 (1.4308), X5CrNiMo17-12-2 (1.4401), X2CrNiMo17-13-2 (1.4404), GX6CrNiMo (1.4408), X2CrNiMo18-14-3 (1.4435), X5CrNiMo17-13-3 (1.4436), X6CrNiTi18-10 (1.4541), X6CrNiNb18-10 (1.4550), GX5CrNiNb18-9 (1.4552), X6CrNiMoTi17-12-2 (1.4571), X6CrNiMoNb17-12-2 (1.4580), GXCrNiMoNb18-10 (1.4581), X10CrNiMoNb18-12 (1.4583), X6CrNi18-11 (1.4948) or combinations between austenitic and heat resistant steels such as X10CrAl7 (1.4713), X10CrAl13 (1.4724), X10CrAl18 (1.4742), GX40CrNiSi22-9 (1.4826), X15CrNiSi20-12 (1.4828), GX25CrNiSi20-14 (1.4832), GX40CrNiSi25-12 (1.4837) with ferritic steels up to pressure boiler steel P295GH as well as fine grained structural steel up to P355N, shipbuilding steels grade A - E, AH 32 - EH 36, A40-F40.

Joints of and between high-tensile, unalloyed and alloyed quenched and tempered steels, stainless, ferritic Cr and austenitic Cr-Ni steels, high manganese steels as well as claddings: for the first layer of chemical resistant weld claddings on ferritic-pearlitic steels up to fine grained structural steels S500N, in steam boiler and pressure boiler construction, as well as creep resistant fine grained structural steels 22NiMoCr4-7 acc. to leaflet “SEW-Werkstoffblatt” No. 365, 366, 20MnMoNi5-5 and G18NiMoCr3-7.

Typical analysis in %

C	Si	Mn	Cr	Ni	Gas
0.03	0.7	1.4	22.8	12.5	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -60 °C		Shielding gas
AW	380	400	540	35	65	32	M21

Structure

Austenite with part ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption: 15 - 18 l/min.

Approvals

TÜV (Certificate No. 9772) UDT
DB (Certificate No. 43.132.22)

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	120-250	22-28

Thermanit 309 Mo L-PW

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 23 12 2 LPM1	E309LMoT1-4	1.4459
T 23 12 2 LPC1	E309LMoT1-1	

Characteristics and field of use

Thermanit 309 Mo L-PW is an austenitic CrNiMo flux cored wire with rutile fast freezing slag. It is suitable for GMAW welding with mixed gas M21 and C1 (acc. to EN 439). It is appropriate for joint welding high alloyed CrNi(Mo, N) steels/cas steel grades with unalloyed/low alloyed steels (austenite ferrite joints) with a maximum temperature of 300 °C (572 °F). It is also suited for service welding of high alloyed stainless steels/cas steel grades.
For intermediate layers when welding the clad side of plates and cast materials clad with non stabilized and stabilized CrNi(Mo, N) austenitic steels. This flux cored wire provides high resistance to hot cracking even at high dilutions. The content of molybdenum provides a better corrosion resistance and simultaneously increases the ductility of austenitic joining combinations of higher temperatures. Very good slag detachability and notch free seams with low annealing colouring, easy to clean and pickle.
Root welding is proved on ceramic backing bar.

Materials

Joinings and combinations between austenitic steels like:
X5CrNi18-10 (1.4301), X2CrNi19-11 (1.4306), GX6CrNi18-9 (1.4308), X5CrNiMo17-12-2 (1.4401), X2CrNiMo17-13-2 (1.4404), GX6CrNiMo (1.4408), X2CrNiMo18-14-3 (1.4435), X5CrNiMo17-13-3 (1.4436), X6CrNiTi18-10 (1.4541), X6CrNiNb18-10 (1.4550), G-X5CrNiNb18-9 (1.4552), X6CrNiMoTi17-12-2 (1.4571), X6CrNiMoNb17-12-2 (1.4580), GXCrNiMoNb18-10 (1.4581), X10CrNiMoNb18-12 (1.4583), X6CrNi18-11 (1.4948)
or combinations between austenitic and heat resistant steels X10CrAl7 (1.4713), X10CrAl13 (1.4724), X10CrAl18 (1.4742), GX40CrNiSi22-9 (1.4826), X15CrNiSi20-12 (1.4828), GX25CrNiSi20-14 (1.4832), GX40CrNiSi25-12 (1.4837)
with ferritic steels up to P295GH as well as fine grained steels up to P355N and shipbuilding steels grade A - E, AH 32 - EH 36, A40 - F40.

Typical analysis in %

C	Si	Mn	Cr	Ni	Mo	Gas
0.03	0.7	1.4	22.7	12.5	2.8	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN –60 °C	Shielding gas
AW	530	580	720	32	47 32	M21

Structure

Austenite with part ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption: 15 - 18 l/min.

Approvals

TÜV (Certificate No. 9773)
UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	120-250	22-28

Thermanit 316 L-PW

Flux cored wire

Classifications

EN 12073	AWS A 5.22	Mat. No.
T 19 12 3 LPM1	E316LT1-4	1.4430
T 19 12 3 LPC1	E316LT1-1	

Characteristics and field of use

Thermanit 316 L-PW is an austenitic CrNiMo flux cored wire with rutile, fast freezing slag. It is suited for all position GMAW welding with mixed gas M21 and C1 for joining of matching and similar, non stabilized and stabilized corrosion resistant CrNi(N) and CrNiMo(N) steels/cast steel grades. The weld metal is stainless, resistant to intercrystalline corrosion (wet corrosion up to 400 °C / 752 °F), cold tough to –60 °C (–76 °F) and resistant to scaling up to 800 °C (1472 °F).
Thermanit 316 L-PW shows very fine and smooth weld pattern and almost spatter free welding behaviour. Very good slag detachability and notch free and clean seams with low annealing colouring, easy to clean and pickle. Root welding is proved on ceramic backing bar.

Materials

X5CrNi18-10 (1.4301), X2CrNi19-11 (1.4306), GX6CrNi18-9 (1.4308), X5CrNiMo17-12-2 (1.4401), X2CrNiMo17-13-2 (1.4404), GX6CrNiMo18-10 (1.4408), X2CrNiMo18-14 (1.4435), X5CrNiMo17-13-3 (1.4436), X6CrNiTi18-10 (1.4541), X6CrNiNb18-10 (1.4550), GX5CrNiNb18-9 (1.4552), X10CrNiMoNb18-12 (1.4583), X6CrNiMoTi17-12-2 (1.4571), X10CrNiMoTi18-12 (1.4573), X6CrNiMoNb17-12-2 (1.4580), GXCrNiMoNb18-10 (1.4581), X6CrNi18-11 (1.4948) and also covered materials acc. to VdTÜV 1000.26. UNS S31653; AISI 316L, 316Ti, 316 Cb.

Typical analysis in %

C	Si	Mn	Cr	Mo	Ni	Gas
0.030	0.7	1.4	19.0	2.7	12.0	M21

Mechanische Gütewerte des Schweißgutes nach EN 1597-1
(Mindestwerte bei RT, Shielding gas: M21)

Heat treatment	Yield strength 0.2 % N/mm²	Yield strength 1.0 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN	
						-120 °C
AW	350	400	560	38	65	32

Structure

Austenite with part ferrite

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption: 15 - 18 l/min.

Approvals

TÜV (Certificate No. 9771) UDT
DB (Certificate No. 43.132.24)

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	120-250	22-28

Union BA 70

Flux cored wire

Classifications

EN 758	AWS A 5.20
T42 4 B M3 H5	E70T-5M H4
T42 4 B C3 H5	E70T-5 H4

Characteristics and field of use

Union BA 70 is a high-basic flux cored wire with very good properties in means of cracking, elongation and toughness. According to covered electrode E7018 it provides high mechanical properties, notch free weld seams and good slag detachability. It is mostly used with mixed gas M21 and C1.
Good root weldability without wall thickness limitation, approved for temperatures to –40 °C (–40 °F).
Root weldability is proved on ceramic backing bar.

Materials

S185, S235JR, S275JR, S355JR, P235GH, P265GH, P295GH, P355GH, S275N - S355N; P275NH - P355NH; P275NL1 - P355NL1; P275NL2 - P355NL2; St 35, St 35.4, St 35.8 - St 45.8; St 52.4; L210 - L360MB; X42 - X52 (API-5 LX); GS-38 - GS-52; 2C10 - 2C35; shipbuilding steels grade A - E, AH32 - EH36, A40 - F40.

Typical analysis in %

C	Si	Mn	P	S	Gas
0.06	0.45	1.5	≤ 0.02	≤ 0.02	M21

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -20°C	-40°C
AW	M21	420	520	24	140	80	47

Welding position



Polarity = +
Shielding gas (EN 439) **M21, M33 and C1,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 7184) DB (Registration No. 42.132.31)
UDT, ABS, Controlas, LR, DNV

Packaging, weights and amperages

Diameter (mm)	Spool	Weight (kg)	Amperage	Volts
1.2	B300	16.0	120-350	18-32
1.4	B300	16.0	150-400	18-33
1.6	B300	16.0	200-450	20-34

Other diameters and spools upon request

Union MV 70

Flux cored wire

Classifications

EN 758	AWS A 5.18
T 46 4 M M 2 H5	E70C-6MH4
T 42 3 M C 2 H5	

Characteristics and field of use

Union MV 70 is a high-efficiency wire, with metal powder filling for welding PA, PF, PC and PB position, according to EN 439, when using mixed gas M21 - M33 and C1.
With stable arc and secure penetration the deposition efficiency comes up to 98% approx. It is furthermore characterized by almost spatter free welding, good side wall wetting, flat and concave weld shape, radiographical soundness and porosity free weld metal.
It is outstandingly suited for single and multilayers as well as for manual and mechanized welding.

Materials

S185, S235JR, S275JR, S355JR, P235GH, P265GH, S275N - S355N, P295GH, P355GH, P275NH - P355NH, L210, L240, L290, L360, X42 - X52 (API-5LX), GS-38 - GS-52; shipbuilding steels grade A - D, AH32 - DH36, A40 - F40.

Typical analysis in %

C	Si	Mn	P	S	Gas
0.05	0.45	1.4	≤ 0.02	≤ 0.02	M21

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN 0°C	-20°C	-40°C
AW	M21	460	560	24	120	100	70	47

Welding position



Polarity = +
Shielding gas (EN 439) **M21 - M33 and C1,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 7187) GL, ABS, Controlas
UDT, LR, DNV DB (Certificate No. 42.132.33)

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.0	B300	16	90-280	16-30
1.2	B300	16	120-350	17-32
1.4	B300	16	150-400	18-33
1.6	B300	16	200-450	20-34

Other diameters and spools upon request

Union MV CrMo

Flux cored wire

Classifications

EN 12071	AWS A 5.28
T CrMo1 M M 2 H5	E80C-B2 H4

Characteristics and field of use

Union MV CrMo is a chromium-molybdenum alloyed wire with metal powder filling. It is suited for welding on CrMo alloyed boiler, pressure vessel and pipe steels with high creep and stress strength up to 500 °C (932 °F).
It is applicable in position PA, PC, PF, PB according to EN 439, when using mixed gas M21. It provides very low oxide build-up, stable and smooth arc, smooth droplet transfer and safe penetration. It is excellent suited for manual and mechanized single and multilayer welding.

Materials

Pressure vessel and pipe steels 13CrMo4-5, 15CrMo4, 13CrMoV42;
cast steel G17CrMo5-5, GS-22CrMo5, GS-22CrMoV32, G22CrMo54

Typical analysis in %

C	Si	Mn	P	S	Cr	Mo	Gas
0.07	0.35	1.0	<0.015	<0.015	1.0	0.5	M21

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -10°C
680 °C / 15 h	M21	470	560	22	100 47

Welding position



Polarity = +
Shielding gas (EN 439) **M21,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 7192) UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	16	120-300	17-32
1.4	B300	16	140-350	18-33
1.6	B300	16	200-400	20-34

Union MV CrMo 910

Flux cored wire

Classifications

EN 12071	AWS A 5.28
T CrMo2 M M 2 H5	E90C-B3 H4

Characteristics and field of use

Union MV CrMo 910 is a gas shielded metal cored wire for welding of CrMo and CrMoV alloyed creep resistant steels used in steam and chemical plant production. It deposits nominally 2.2 % Cr – 1 % Mo weld metal and is suitable for applications in steam generating plant operating at elevated temperatures up to 550 °C (1,022 °F). A preheat and interpass temperature of 150 to 250 °C (302 to 482 °F) is necessary. Recommended stress relieving is done at 670-700 °C (1,238-1,292 °F). The weld metal hydrogen content falls within class H5 for all parameters (typical value with Mixed gas M21: 3.0 ml/100 g).

Materials

G18CrMo9-10, 10CrMo9-10, 10CrSiMoV7, 12CrSiMo8
and covering base materials of group 7
acc. to VdTÜV-Kennblatt 1000.

Typical analysis in %

C	Si	Mn	P	S	Cr	Mo
0.07	0.35	0.90	≤0.015	≤0.015	2.2	1.0

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -10°C
720 °C / 1 h	M21	≥540	≥620	≥18	80-120
690 °C / 15 h	M21	≥460	≥570	≥20	90-130 50-90

Welding position



Polarity = +
Shielding gas (EN 439) **M21,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 09628) UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	16	120-300	17-31

Other diameters and forms of supply on request.

Union MV Mo

Flux cored wire

Classifications

EN 758	EN 12071	AWS A 5.28
T 46 2 Mo M M 2 H 5	T Mo M M 2 H5	E80C-G H4

Characteristics and field of use

Union MV MO is a molybdenum-alloyed wire with metal powder filling, suited for welding on creep resistant boiler, pressure vessel and pipe steels with high creep and stress strength up to 500 °C (932 °F).
It is applicable in positions PA, PC, PF, PB, when using mixed gas M21 according to EN 439. It provides very low oxide build-up, stable and smooth arc, smooth droplet transfer and safe penetration. It is excellent suited for manual and mechanized, single and multilayer welding.

Materials

Pressure vessel steels P235GH, P265GH, P295GH, P355GH, P460NH, 16Mo3 and corresponding TM-grades;
X52, cast steel GS-52, G20Mo5 and others,
fine-grained structural steels up to S460N;
pipe steels L210 - L450MB
(X42-X65) and according TM steels up to 445.7TM

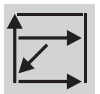
Typical analysis in %

C	Si	Mn	P	S	Mo	Gas
0.06	0.35	1.0	<0.015	<0.015	0.5	M21

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -10°C
AW	M21	490	560	22	100 47
620°C/15h	M21	480	550	22	100 47

Welding position



Polarity = +
Shielding gas (EN 439) **M21,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 7838) UDT
DB (Certificate No. 42.132.36)

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	16	120-300	17-32
1.6	B300	16	200-400	20-34

Union RV 71

Flux cored wire

Classifications

EN 758	AWS A 5.20
T 42 2 P M 1 H5	E71T-1MJH4
T 42 2 P C 1 H5	E71T-1H4

Characteristics and field of use

Union RV 71 is a rutile flux cored wire with fast freezing slag for all-position welding, according to EN 439, when using mixed gas M21, M33 and C1. It shows good mechanical-technological properties. The outstanding welding properties are a stable arc, good modelling characteristic, very low spatter proportion, finely rippled and notch free weld interface, and good slag detachability.
Due to the fast freezing slag out-of-position welding with increased current is possible for manual as well as for mechanized welding. Root weldability is proved on ceramic backing bar.

Materials

S185, S235JR, S275JR, S355JR, P235GH, P265GH, P295GH, P355GH, S275N - S355N; P275NH - P355NH; L210 - L360; X 42 - X 52 (API-5 LX); GS-38 - GS-52; shipbuilding steels grade A - E, AH32 - EH36, A40 - F40.

Typical analysis in %

C	Si	Mn	P	S	Gas
0.06	0.5	1.4	≤ 0.025	≤ 0.025	M21

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN 0°C	-20°C	-40°C
AW	M21	420	520	24	140	110	47	27

Welding position



Polarity = +
Shielding gas (EN 439) **M21, M33 and C1,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 7185) DB (Certificate No. 42.132.32)
GL, ABS, Controlas, UDT, LR, DNV

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.0	B300	16	130-270	21-30
1.2	B300	16	150-300	22-32
1.4	B300	16	150-350	23-32
1.6	B300	16	180-375	24-33

Other diameters and spools upon request

Union TG 50 B

Flux cored wire

Classifications

EN 758	AWS A 5.20
T 42 5 B M1 H5	E71T-5MJ H4
T 42 4 B C1 H5	E71T-5 H4

Characteristics and field of use

Union TG 50 B is a basic flux cored wire and according to covered electrode E7018-1 the weld metal provides good properties in means of cracking, elongation and toughness. It is applicable for joint welding in all positions in diameter range 1.2 up to 1.6 mm when using mixed gas M21. It shows outstanding high mechanical properties even in annealed condition, notch free weld seams and good slag detachability. Root weldability is proved for all positions and on ceramic backing bar.
In out-of-position work it is advisable to use the negative pole. The flux cored wire is proved for temperatures to –50 °C (–58 °F) in as welded and annealed condition without wall thickness limitation.

Materials

S185 - S355J, P235GH - P265GH, P295GH - P355GH,
S275N - P355NL2, P275NH - P355NH;
L210 - L360MB; X42 - X52 (API-5LX);
GS-38 - GS-52; 2C10 - 2C35;
ship building steels grade A - E, AH32 - EH36, A40 - F40.

Typical analysis in %

C	Si	Mn	P	S	Gas
0.06	0.5	1.4	≤ 0.02	≤ 0.015	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -20°C	-40°C	-50°C
AW	M21	420	520	24	140	100	70	47
580°C/15h	M21	400	500	26	150	110	80	47

Welding position



Polarity = + / = –
Shielding gas (EN 439) **M21 and C1,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 6623)
Controlas
GL
DNV
DB (Certificate No. 42.132.27)
LR
UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	100-350	18-32
1.6	B300	15	160-450	20-34

Other diameters and spools upon request

Union TG 50 M

Flux cored wire

Classifications

EN 758	AWS A 5.20
T 46 3 P M 1 H10	E71T-12M H8
T 42 2 P C 1 H5	E71T-1 H8

Characteristics and field of use

Union TG 50 M is a rutile flux cored wire with fast freezing slag for all-position welding, when using mixed gas M21 according to EN 439.
The flux cored wire shows very good mechanical-technological properties in as welded condition as well as in annealed condition. The outstanding welding properties are the stable arc, the good modelling characteristic, the low spatter proportion, finely rippled and notch free weld interface and good slag detachability.
Root weldability is proved on ceramic backing bar.
Due to the fast freezing slag, out-of-position welding with increased current is possible for manual as well as for mechanized welding.

Materials

S185, S235J2G3, S275J2G3, S355K2G3, E295,
P235GH - P265GH, P295GH - P355GH, S275N - S420NL,
P275NH, P355NH, P460NH, P275NL1, P355NL1, P460NL1,
L210, L240, L290, L360MB, L415MB; X42 - X65 (API-5 LX),
GS-38 - GS-52;
shipbuilding steels grade A - E, AH32 - EH36, A40 - F40.

Typical analysis in %

C	Si	Mn	P	S	Gas
0.05	0.5	1.25	≤ 0.02	≤ 0.02	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation ($L_0=5d_0$) %	Impact values in J CVN		
						-20°C	-30°C
AW	M21	460	560	24	140	120	47
520°C/15h	M21	420	500	26	140	47	–

Welding position



Polarity = +
Shielding gas (EN 439) **M21,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 6622)	DB (Certificate No. 42.132.28)
Controlas	LR
GL	ABS
UDT	DNV

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
0.9	B300/S200	15/4.5	70-180	21-30
1.2	B300/S200	15/4.5	150-300	22-32
1.6	B300/S200	15/4.5	160-375	32-33

Other diameters and spools upon request

Union TG 50 Ni

Flux cored wire

Classifications

EN 758	AWS A 5.29
T 46 5 1 Ni P M 1 H5	E81T1-Ni1 M H4

Characteristics and field of use

Union TG 50 Ni is a rutile-basic flux cored wire for GMAW welding of cryogenic steels, for all position welding, when using mixed gas M21. The flux cored wire shows excellent mechanical properties in as welded condition as well as in annealed condition. It also provides low spatter proportion, smooth and notch free weld interfaces, good slag detachability and radiographically soundness. Analogous to E8018-C3 (covered electrode) the nickel-alloyed weld metal is applicable in petrochemical plants and in offshore technique.
Due to the fast freezing slag, out-of-position welding with increased current is possible for manual as well as for mechanized welding.
Root weldability is proved for all positions on ceramic backing bar.

Materials

S185, S235J2G3, S275J2G3, S355K2G3, E295,
P235GH - P265GH, P295GH - P355GH, S275N - S420NL,
P275NH, P355NH, P460NH, P275NL1, P355NL1, P460NL1;
L210, L240, L290, L360MB; L415MB; X42 - X65 (API-5 LX);
GS-38 - GS-52;
shipbuilding steels grade A - E, AH32 - EH36, A40 - F40.

Typical analysis in %

C	Si	Mn	Ni	P	S	Gas
0.05	0.4	1.4	0.95	≤ 0.02	≤ 0.015	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN -20°C	-40°C	-50°C
AW	M21	460	560	24	150	120	90	47
580°C/2h	M21	460	560	24	120	90	47	–

Welding position



Polarity = +
Shielding gas (EN 439) **M21,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 6624), DB (Certificate No. 42.132.30),
ABS, Controlas, GL, LR, UDT, DNV

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	15	120-300	21-32
1.6	B300	15	160-350	23-33

Other diameters and spools upon request

Union TG 55 Fe

Flux cored wire

Classifications

EN 758	AWS A 5.18
T 46 4 M M 1 H5	E70C-6MH4

Characteristics and field of use

Union TG 55 Fe is a high-efficiency flux cored wire with metal powder filling, for all-position welding, using mixed gas M21.
It features outstanding mechanical properties in temperature range to –40 °C (– 40 °F) with very low fume level and oxide build up. The stable arc, the smooth droplet transfer, the secure penetration, its high burn-off factor in the spray arc range and the high deposition efficiency of 98% approx. are only some of the positive properties of this wire.
It is characterized by almost spatter-free welding with good wall wetting, flat and concave weld shape, radiographical soundness and porosity free weld metal.
It is suited for manual and mechanized welding for single and multilayers.

Materials

S185, S235J2G3, S275J2G3, S355K2G3, E295, P235GH - P265GH, P295GH - P355GH, S275N - S420NL, P275NH, P355NH, P460NH, P275NL1, P355NL1, P460NL1, L210, L240, L290, L360MB, L415MB; X42 - X65 (API-5 LX); GS-38 - GS-52;
shipbuilding steels grade A - E, AH32 - EH36, A40 - F40.
ASTM A27 u. A36 Gr. all; A106 Gr. A, B; A214; A242 Gr. 1-5; A266 Gr. 1, 2, 4; A283 Gr. A, B, C, D; A285 Gr. A, B, C; A299 Gr. A, B; A328; A366; A516 Gr. 60, 65, 70; A516 Gr. 55; A556 Gr. B2A; A570 Gr. 30, 33, 36, 40, 45; A572 Gr. 42, 50; A606 Gr. all; A607 Gr. 45; A656 Gr. 50, 60; A668 Gr. A, B; A907 Gr. 30, 33, 36, 40; A841; A851 Gr. 1, 2; A935 Gr. 45; A936 Gr. 50; API 5L X42 - X60.

Typical analysis in %

C	Si	Mn	P	S	Gas
0.06	0.6	1.4	≤ 0.02	≤ 0.02	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN 0°C	-30°C	-40°C
AW	M21	460	560	24	150	120	80	47
580°C/2h	M21	460	560	24	150	120	80	47

Welding position



Polarity = +
Shielding gas (EN 439) **M21,**
Consumption: 12 - 18 l/min.

Approvals

TÜV (Certificate No. 9930), DB (Certificate No. 42.132.37), Controlas, DNV, GL, LR, BV, UDT

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	16	120-350	18-33
1.4	B300	16	140-400	20-34
1.6	B300	16	170-450	20-34

Other diameters and spools upon request

Union TG 55 M

Flux cored wire

Classifications

EN 758	AWS A 5.20
T 46 4 P M 1 H10	E71T-1MJH8
T 42 2 P C 1 H5	E71T-1JH8

Characteristics and field of use

Union TG 55 M is an all-position flux cored wire that displays exceptional high impact properties in both the as welded and stress relieved conditions when used mixed gas M21 acc. to EN 439. This “welder friendly” wire with its soft, spatter-free arc, always operates in the spray arc mode. It is possible to weld in any position with one diameter (1.2 mm from 160 A to 250 A), so ideal for fit-up work. Deposition rates in vertical-up welding can reach 2.2 - 5.5 kg/h, making it one of the most productive consumables available. Because of spray arc operation, typical positional welding defects like lack of fusion and slag inclusions are avoided. The wire has a high tolerance for poor weld preparations. The slag is easily detached. Good bead appearance with smooth tie-in. Single sided root runs are made economically on ceramic backing. Commercial application include construction, shipbuilding railcar and heavy equipment industries.

Materials

S185, S235J2G3, S275JR, S355J2G3, E295 (P235GH, P265GH, P295GH, P355GH), P275N, P355N, P355NL2, P460N, S275N, S275NL, S355N, S355NL, S460N, L210, L240, L290, L360, L290NB, L360MB, L415MB, X42 – X65, GS-38 – GS-52,
shipbuilding steel grades A - E, AH 32 – EH 36, A40 - F40.

Typical analysis in %

C	Si	Mn	P	S
0.05	0.5	1.35	≤0.015	≤0.015

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Impact values in J CVN		
						-20°C	-40°C
AW	M21	460	560	24	120	100	47
580°C/2h	M21	460	560	24	140	47	

Welding position



Polarity = +
Shielding gas (EN 439) **M21 and C1,**
Consumption approx. 15 - 18 l/min.

Approvals

TÜV (Kennblatt Nr. 9954)	ABS
DB (Certificate No. 42.132.23)	Controlas
LR	GL
UDT	BV

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.0	B300	16	120-230	16-26
1.2	B300	16	150-350	22-32
1.4	B300	16	160-400	23-33
1.6	B300	16	180-450	23-33

Other diameters and spools upon request

Union TG 55 Ni

Flux cored wire

Classifications

EN 758	AWS A 5.29
T 50 5 1 Ni P M 1 H5	E81T1-Ni1MH8

Eigenschaften und Anwendungsgebiet

Union TG 55 Ni is a rutile basic flux cored wire with fast freezing slag characteristic. It is suitable for GMAW welding with mixed gas M21 (acc. to EN 439) for welding structural steels with a nominal tensile strength of 560 N/mm^2 in all positions. The wire displays exceptional high impact properties in both – the as welded and stress relieved – conditions.
This “welder friendly” wire with its soft, spatter-free arc, always operates in spray arc mode. It is possible to weld in any position with one Diameter (1.2 mm from 160 A to 250 A), so ideal for fit-up work. Single sided root runs are made economically on ceramic backing. The nickel alloyed weld metal – corresponding to the stick electrode E8018-C3 – is usable in petrochemical plants and in offshore technology.
Areas of application are primarily in the offshore, structural steel and shipbuilding industries.

Materials

S185, S235J2G3, S275JR, S355J2G3, E295 (P235 GH, P265GH, P295GH, P355GH, P275N, P355N, P355NL2, P460N, S275N, S275NL, S355N, S355NL, S460N, L210, L240, L290, L360, L290NB, L360MB, L415MB, X42 – X65 / (API-5LX), GS-38 – GS-52,
ship building steels grades A – E, AH 32 – EH 36, A40 – F40; ASTM A516 Gr. 65, A572 Gr. 55, 60, 65, A633 Gr. E, A612, A618 Gr. I, A537 Gr. 1-3.

Typical analysis in %

C	Si	Mn	P	S	Ni	Gas
0.05	0.4	1.4	≤ 0,02	≤ 0,015	0,90	M21

Mechanical properties of the weld metal according to EN 1597-1
(min. values at RT)

Heat treatment	Shielding gas	Yield strength 0.2% N/mm^2	Tensile strength N/mm^2	Elongation (L_0=5d_0) %	Impact values in J CVN +20°C	-30°C	-50°C
AW	M21	500	560	24	150	120	47
580°C/2h	M21	500	560	22	150	120	47

Welding position



Polarity = +
Mixed gas (EN 439) **M21,**
prefered M21 (18% CO_2,82% Ar)

Approvals

Controlas, LR
Applied: TÜV, DB, ABS, GL, UDT, DNV

Packaging, weights and amperages

Diam. (mm)	Spool	Weight / kg	Amperage	Volts
1.2	B300	16	120-300	20-32
1.6	B300	16	160-350	23-33

Other diameters and spools upon request

Welding rods / bare wire electrodes (aluminium)

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for the welding of aluminium alloys	430-436

Aluminium and aluminium alloy welding filler metals

There is increasing use of aluminium materials in engineering. Especially in modern vehicle manufacturing the tendency towards lightweight construction is recognizable.

The quality of welds depends upon the fill metals and the auxilary materials used (e.g. shielding gases).

When welding tungsten inert gas (TIG) and metal inert gas (MIG) high quality standards can be achieved if welded competently and the right fill metal is chosen. Increasingly the pulsed MIG welding method is applied. Important informations refering to MIG welding of aluminium are shown on "DVS-Merkblätter”/leaflets 0913, 0933 and 0961".

The shielding gases preferably used are welding-grade argon or argon/helium mixes.

All mentioned welding filler metals conform to EN ISO 18273.
Today the filler materials are designated with numerical codes. Additionally the previously used chemical symbols (according to DIN 1732, part 1, withdrawn) can be added in brackets.

References to registrations of classification societies or inspection companies are shown on the respective data sheet.

Summary
Welding rods / bare wire electrodes (aluminium)

Page	Brand name	EN ISO	AWS	Material No.	Page
for the welding of aluminium alloys					
430	Union Al 99,5	18273 S Al Z (Al 99,5)	A 5.10	ER1100 (mod.)	3.0259	430
431	Union AlMg 2,7 Mn 0,8	18273 S Al 5554 (AlMg2,7Mn)	A 5.10	ER5554	3.3538	431
432	Union AlMg 3	18273 S Al 5754 (AlMg3)	A 5.10	–	3.3536	432
433	Union AlMg 4,5 Mn	18273 S Al 5183 (AlMg4,5Mn0,7(A))	A 5.10	ER5183	3.3548	433
434	Union AlMg 4,5 MnZr	18273 S Al 5087 (AlMg4,5MnZr)	A 5.10	ER5183 (mod.)	3.3546	434
435	Union AlMg 5	18273 S Al 5356 (AlMg5Cr(A))	A 5.10	ER5356	3.3556	435
436	Union AlSi 5	18273 S Al 4043A (AlSi5(A))	A 5.10	ER4043	3.2245	436

Union Al 99,5

Welding rod / bare wire electrode

Classifications

EN 18273	AWS A 5.10	Mat. No.
S Al Z (AR99,5)	ER1100 (mod.)	3.0259

Characteristics and field of use

Welding rods and bare wire electrodes for GTAW and GMAW.

Thorough cleaning of the workpiece bevels is necessary.
Thicker plate materials require preheating to 150 °C (302 °F).

Marks (rods only)

3.0259 / Al 99,5

Materials (EN 753)

EN AW-1200 [Al 99,0]
EN AW-1070A [Al 99,7]
EN AW-1050 A [Al 99,5]
EN AW-1350 [E-Al 99,5]

Typical analysis in %

Al	Others
>99.5	<0.5

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Electrical conductivity Sm/mm²
40	70	25	33

Welding position



Polarity GTAW ~ / GMAW = +
Shielding gas (EN 439) **I**

Packaging and weights

Diam. x Length (mm)	Spool	kg / pack
1.6 x 1000	–	10
2.0 x 1000	–	10
2.4 x 1000	–	10
3.2 x 1000	–	10
4.0 x 1000	–	10
0.8	B300	5
1.0	B300	7
1.2	B300	7
1.6	B300	7

Other spool types upon request

Union AlMg 2,7 Mn 0,8

Welding rod / bare wire electrode

Classifications

EN ISO 18273	AWS A 5.10	Mat. No.
S Al 5554 (AlMg2,7Mn)	ER5554	3.3538

Characteristics and field of use

Welding rods and bare wire electrodes for GTAW and GMAW of AlMg alloys. For producing the needed resistance to intercristalline corrosion the Mg content is limited to 2.7 %.
The weld metal is sea water resistant. For welding almost identically coloured joints on anodically oxidziable materials.

Marks (rods only)

3.3538 / AlMg2,7Mn0,8

Materials (EN 753/1706)

EN AW-5754 [AlMg 3]
EN AW-5454 [AlMg 3 Mn]
EN AW-5005A [AlMg 1 (C)]
EN AW-3004 A [AlMn 1 Mg 1]
EN AW-5251 [AlMg 2]
EN AC-51100

Typical analysis in %

Mg	Mn	Cr	Ti	Al
2.4-2.8	0.5-0.9	0.05-0.20	0.05-0.15	Bal.

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Electrical conductivity Sm/mm²
90	200	17	19-21

Welding position



Polarity GTAW ~ / GMAW = +
Shielding gas (EN 439) **I**

Packaging and weights

Diam. x Length (mm)	Spool	kg / pack	Drum (kg)
1.6 x 1000	–	10	–
2.0 x 1000	–	10	–
2.4 x 1000	–	10	–
3.2 x 1000	–	10	–
4.0 x 1000	–	10	–
0.8	B300	5	–
1.0	B300	7	–
1.2	B300	7	80
1.6	B300	7	80

Other spool types upon request

Union AlMg 3

Welding rod / bare wire electrode

Classifications

EN ISO 18273	Mat. No.
S Al 5754 (AlMg3)	3.3536

Characteristics and field of use

Welding rods and bare wire electrodes for GTAW and GMAW of AlMg alloys containing up to 3 % Mg. Seawater resistant weld metal.

For welding almost identically coloured joints on anodically oxidziable materials.

Thorough cleaning of the workpiece bevels is necessary. Thicker plate materials require preheating to 150 °C (302 °F).

Marks (rods only)

3.3536 / AlMg3

Materials (EN 573/1706)

EN AW-5754 [AlMg 3]
EN AW-5005A [AlMg 1 (C)]
EN AW-5454 [AlMg 3 Mn]
EN AW-5251 [AlMg 2]
EN AW-6060 [AlMgSi]
EN AC-51100

Typical analysis in %

Mg	Mn	Cr	Ti	Al
2.6-3.6	0.10-0.6	<0.3	<0.15	Bal.

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Electrical conductivity Sm/mm²
80	180	18	16-22

Welding position



Polarity GTAW ~ / GMAW = +
Shielding gas (EN 439) **I**

Packaging and weights

Diam. x Length (mm)	Spool	kg / pack
1.6 x 1000	–	10
2.0 x 1000	–	10
2.4 x 1000	–	10
3.2 x 1000	–	10
4.0 x 1000	–	10
0.8	B300	5
1.0	B300	7
1.2	B300	7
1.6	B300	7

Other spool types upon request

Union AlMg 4,5 Mn

Welding rod / bare wire electrode

Classifications

EN ISO 18273	AWS A 5.10	Mat. No.
S Al 5183 (AlMg4,5Mn0,7(A))	ER5183	3.3548

Characteristics and field of use

Welding rods and bare wire electrodes for GTAW and GMAW of AlMg alloys. Seawater resistant weld metal.

Thorough cleaning of the workpiece bevels is necessary. Thicker plate materials require preheating to 150 °C (302 °F).

Marks (rods only)

3.3548 / AlMg4,5Mn

Materials (EN 573/1706)

EN AW-5083 [AlMg 4,5 Mn 0,7]
EN AW-5019 [AlMg 5]
EN AW-6005A [AlSiMg(A)]
EN AW-6061 [AlMg 1 SiCu]
EN AC-51300
EN AW-5086 [AlMg 4]
EN AW-6060 [AlMgSi]
EN AW-6082 [AlSi 1 MgMn]
EN AW-7020 [AlZn 4,5 Mg 1]
EN AC-51400

Typical analysis in %

Mg	Mn	Cr	Ti	Al
4.3-5.2	0.6-1.0	0.05-0.25	<0.15	Bal.

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Electrical conductivity Sm/mm²
125	275	16	15-19

Welding position



Polarity GTAW ~ / GMAW = +
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 2196 [GTAW] and 2195 [GMAW])
DB (Certificate No. 61.132.03 [GTAW and GMAW])
GL [GMAW], DNV [GMAW], WIWEB [GTAW and GMAW], ABS [GMAW], LR [GMAW]

Packaging and weights

Diam. x Length (mm)	Spool	kg / pack	Drum (kg)
1.6 x 1000	–	10	–
2.0 x 1000	–	10	–
2.4 x 1000	–	10	–
3.2 x 1000	–	10	–
4.0 x 1000	–	10	–
0.8	B300	5	–
1.0	B300	7	–
1.2	B300	7	80
1.6	B300	7	80

Other spool types upon request

Union AlMg 4,5 MnZr

Welding rod / bare wire electrode

Classifications

EN ISO 18273	AWS A 5.10	Mat. No.
S Al 5087 (AlMg4,5MnZr)	ER5183 (mod.)	3.3546

Characteristics and field of use

Zirconium micro alloyed welding rods and bare wire electrodes. The weld metal is insusceptible to hot cracking. Particularly advantageous for complicated weldments involving infavourable clamping conditions.

Thorough cleaning of the workpiece bevels is necessary. Thicker plate materials require preheating to 150 °C (302 °F).

Marks (rods only)

3.3546 / AlMg4,5MnZr

Materials (EN 573/1706)

EN AW-5083 [AlMg 4,5 Mn 0,7]
EN AW-5019 [AlMg 5]
EN AW-6005A [AlSiMg(A)]
EN AW-6061 [AlMg 1 SiCu]
EN AC-51300
EN AW-5086 [AlMg 4]
EN AW-6060 [AlMgSi]
EN AW-6082 [AlSi 1 MgMn]
EN AW-7020 [AlZn 4,5 Mg 1]
EN AC-51400

Typical analysis in %

Mg	Mn	Cr	Ti	Zr	Al
4.3-5.2	0.6-1.0	0.05-0.25	<0.15	0.1-0.2	Bal.

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Electrical conductivity Sm/mm²
125	275	16	15-19

Welding position



Polarity GTAW ~ / GMAW = +
Shielding gas (EN 439) **I**

Approvals

DB (Certificate No. 61.132.04 [GMAW and GTAW])
GL [GMAW and GTAW]
WIWEB [GMAW and GTAW]

Packaging and weights

Diam. x Length (mm)	Spool	kg / pack	Drum (kg)
1.6 x 1000	–	10	–
2.0 x 1000	–	10	–
2.4 x 1000	–	10	–
3.2 x 1000	–	10	–
4.0 x 1000	–	10	–
0.8	B300	5	–
1.0	B300	7	–
1.2	B300	7	80
1.6	B300	7	80

Other spool types upon request

Union AlMg 5

Welding rod / bare wire electrode

Classifications

EN ISO 18273	AWS A 5.10	Mat. No.
S Al 5356 (AlMg5Cr(A))	ER5356	3.3556

Characteristics and field of use

Welding rods and bare wire electrodes for GTAW and GMAW of AlMg alloys containing up to 5 % Mg. Seawater resistant weld metal.

Thorough cleaning of the workpiece bevels is necessary. Thicker plate materials require preheating to 150 °C (302 °F).

Marks (nur bei Stäben)

3.3556 / AlMg5

Materials (EN 573/1706)

EN AW-5019 [AlMg 5]
EN AW-5086 [AlMg 4]
EN AW-6005A [AlSiMg(A)]
EN AW-6061 [AlMg 1 SiCu]
EN AW-5454 [AlMg 3 Mn]
EN AC-51400
EN AW-5754 [AlMg 3]
EN AW-6060 [AlMgSi]
EN AW-6082 [AlSi 1 MgMn]
EN AW-7020 [AlZn 4,5 Mg 1]
EN AC-51300
EN AC-51100

Typical analysis in %

Mg	Mn	Cr	Ti	Al
4.5-5.5	0.1-0.5	<0.3	<0.15	Bal.

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Electrical conductivity Sm/mm²
110	235	18	14-19

Welding position



Polarity GTAW ~ / GMAW = +
Shielding gas (EN 439) **I**

Approvals

TÜV (Certificate No. 2198 [GTAW] and 2197 [GMAW])
DB (Certificate No. 61.132.01 [GTAW and GMAW])
GL [GMAW], ABS [GMAW], LR [GMAW]

Packaging and weights

Diam. x Length (mm)	Spool	kg / pack	Drum (kg)
1.6 x 1000	–	10	–
2.0 x 1000	–	10	–
2.4 x 1000	–	10	–
3.2 x 1000	–	10	–
4.0 x 1000	–	10	–
0.8	B300	5	–
1.0	B300	7	–
1.2	B300	7	80
1.6	B300	7	80

Other spool types upon request

Union AlSi 5

Welding rod / bare wire electrode

Classifications

EN ISO 18273	AWS A 5.10	Mat. No.
S Al 4043 A (AlSi5 (A))	ER4043	3.2245

Characteristics and field of use

Welding rods and bare wire electrodes for GTAW and GMAW. Oxyacetylene welding or brazing is possible with suitable fluxes. Very fluid weld pool. The weld metal is not suitable for anodizing for decorative purposes.
Thorough cleaning of the workpiece bevels is necessary.
Thicker plate materials require preheating to 150 °C (302 °F).
Do not use for welding hardenable alloys in high stressed zones.

Marks (rods only)

3.2245 / AlSi5

Materials (EN 573/1706)

EN AW-6060 [AlMgSi]
EN AW-6082 [AlSi 1 MgMn]
EN AC-45000
EN AW-6005A [AlSiMg(A)]
EN AW-6061 [AlMg 1 SiCu]

Typical analysis in %

Si	Al
4.5-5.5	Bal.

Mechanical properties of the weld metal according to EN 1597-1 (min. values at RT)

Yield strength 0.2 % N/mm²	Tensile strength N/mm²	Elongation (L_0=5d_0) %	Electrical conductivity Sm/mm²
70	130	16	15-19

Welding position



Polarity GTAW ~ / GMAW = +
Shielding gas (EN 439) **I**

Approvals

DB (Certificate No. 61.132.02 [GTAW and GMAW])

Packaging and weights

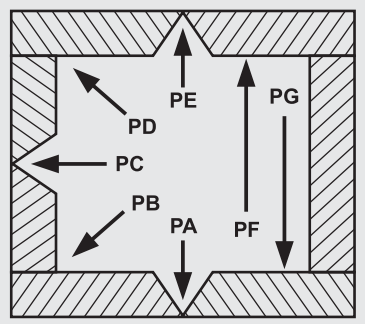
Diam. x Length (mm)	Spool	kg / pack	Drum (kg)
1,6 x 1000	–	10	–
2,0 x 1000	–	10	–
2,4 x 1000	–	10	–
3,2 x 1000	–	10	–
4,0 x 1000	–	10	–
0,8	B300	5	–
1,0	B300	7	–
1,2	B300	7	80
1,6	B300	7	80

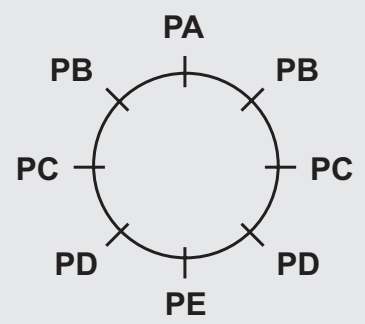
Other spool types upon request

Appendix

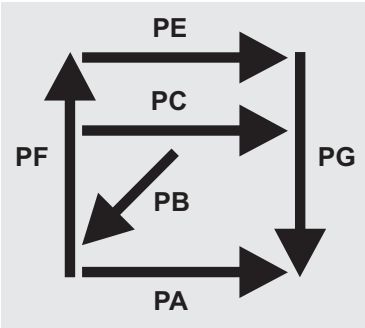
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Key to abbreviations



Welding positions acc. to EN 287 / EN ISO 6947

PA	Horizontal welding of butt weld and fillet weld in flat position
PB	Horizontal welding of fillet weld (downhand position)
PC	Transverse position
PD	Horizontal overhead position
PE	Overhead position
PF	Vertical up position
PG	Vertical down position

Heat treatment

AW	as welded
SR	stress relieved
N	normalised
V	quenched and tempered
A	tempered
RT	room temperature

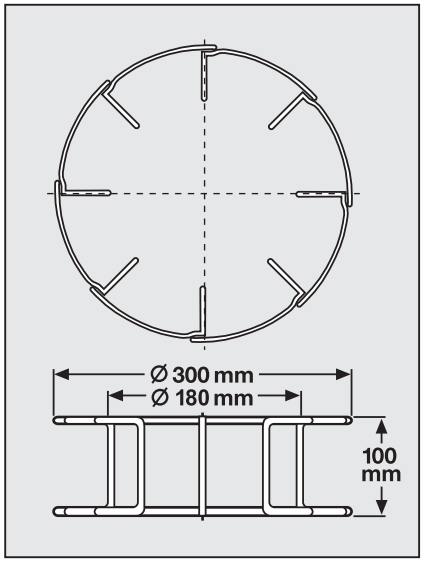
Hardness

HB	Brinell hardness
HRC	Rockwell hardness

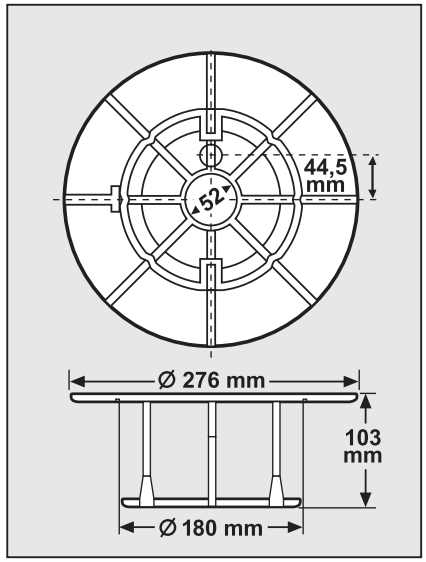
Type of current

= –	DC – direct current (electrode negative)
= +	DC – direct current (electrode positive)
~	AC – alternating current

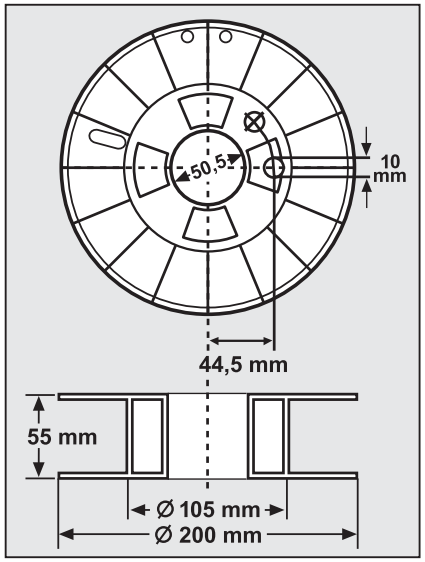
Spools for GMAW-wires (* acc to EN ISO 544)



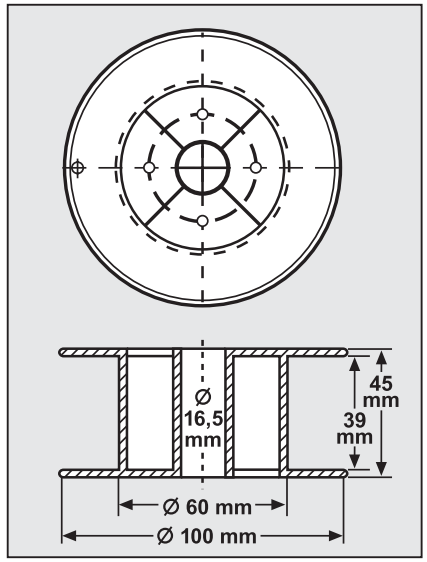
Designation: **B 300***
Material: steel wire
for wire weights of: 12,5 / 15 / 18 / 20 kg



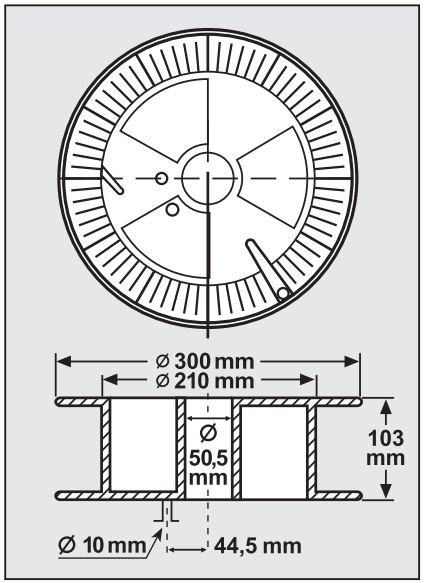
Designation: **Adapter for B 300**
Material: plastic



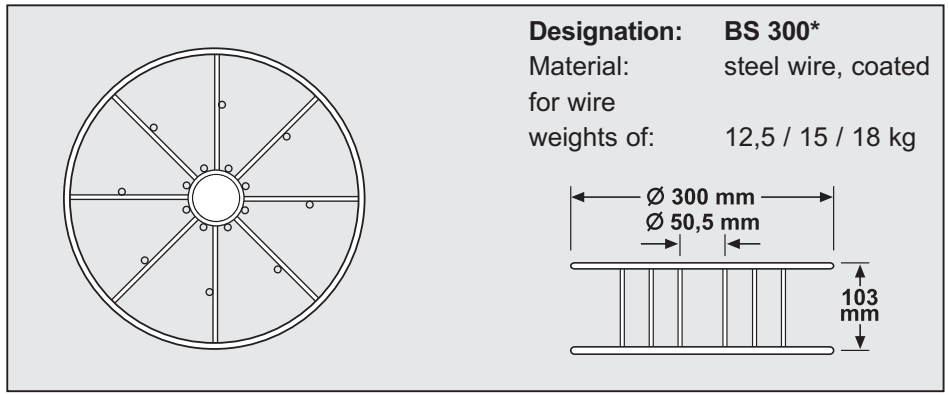
Designation: **S 200***
Material: plastic
for wire weights of: 5 kg



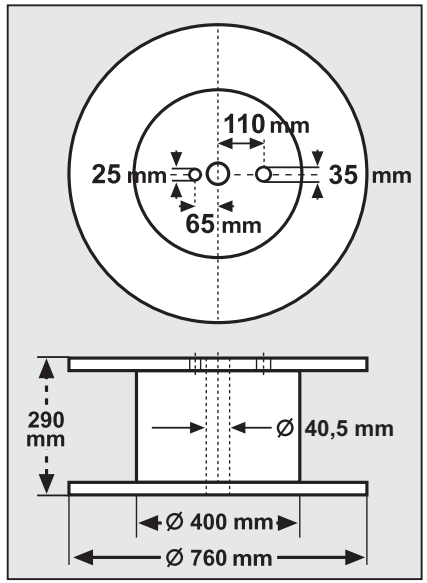
Designation: **S 100***
Material: plastic
for wire weights of: 0,7 kg



Designation: **S 300***
Material: plastic
for wire weights of: 15 kg



Designation: **BS 300***
Material: steel wire, coated
for wire weights of: 12,5 / 15 / 18 kg

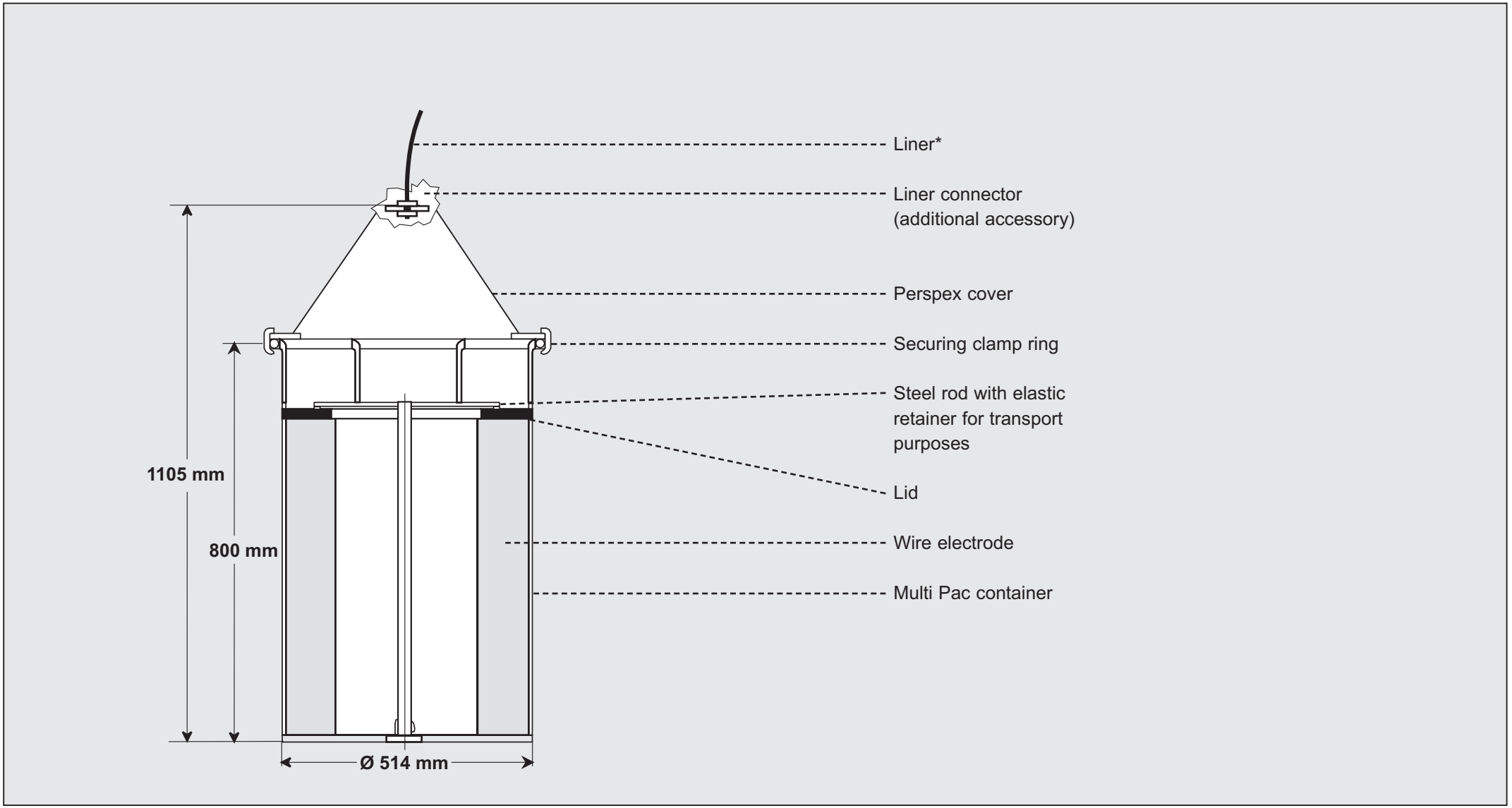


Designation: **S 760***
Material: wood/steel sheet
for wire weights of: 250 / 300 kg

Multi Pac

Wire weight	Height x Diameter
250 kg	800/1105 x 514 mm

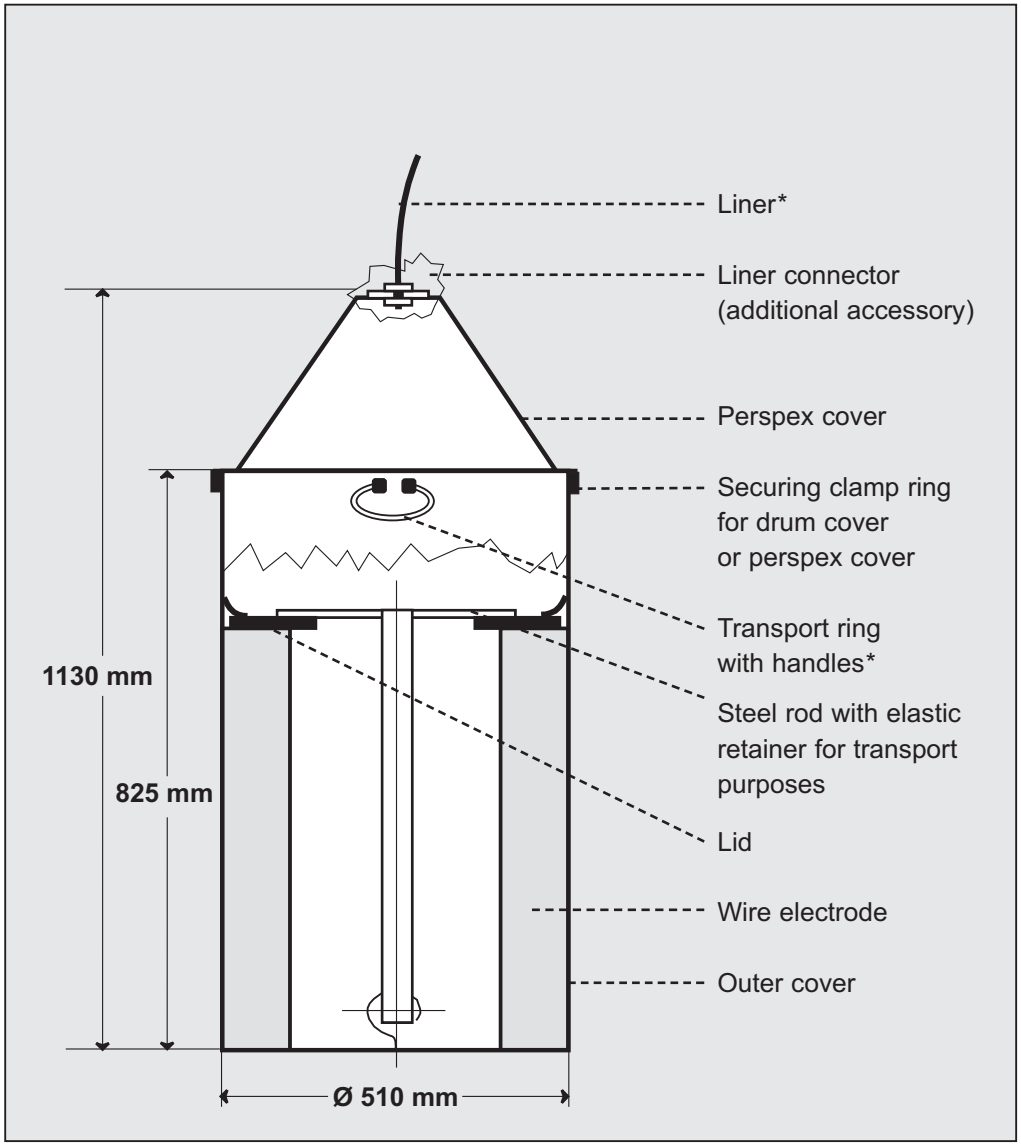
*Please mention liner length when ordering.
Additional accessories on request



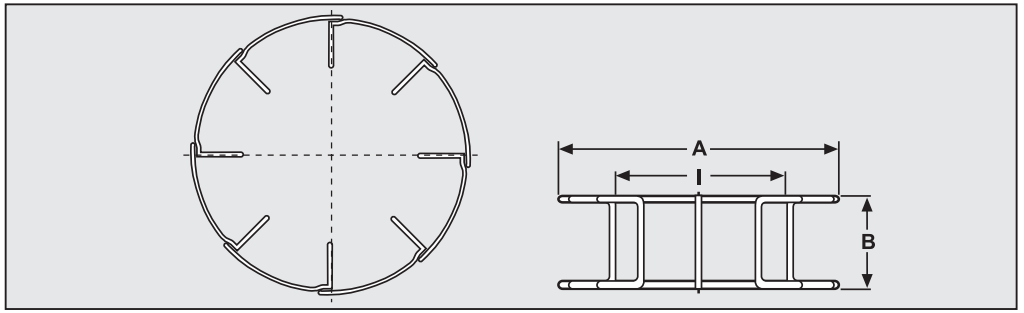
Marathon Pac

Wire weight	Height x Diameter
250 kg	825/1130 x 510 mm

*Please mention liner length when ordering.
Additional accessories on request

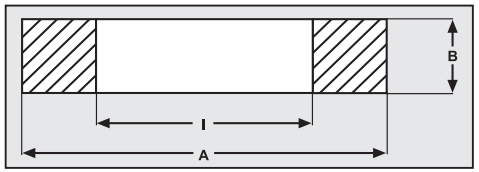


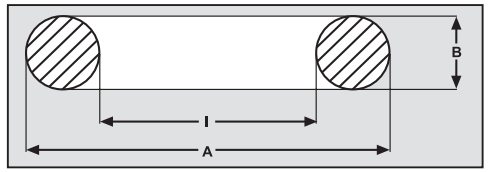
Coil dimensions for sub-arc wires



Spool-designation	Spool types EN ISO 544	Dimensions (mm) A	I	B	Weight (kg)	Material
K 435 - 70 [1]	—-	435	300	70	25	steel wire
K 435 - 100 [1]	wire basket spools B 450	435	300	100	25	steel wire
K 300 - 20 [2]	wire basket spools B 300	300	180	100	20	steel wire

[1] for wire diameter 2.0 - 4.0 mm – [2] for wire diameter 1.2 - 2.0 mm





Coil-designation	Dimensions (mm) A	I	B	Weight (kg)
AA*	770	570	100	100
C	320	220	50	10

*on request

Packing units for sub-arc fluxes

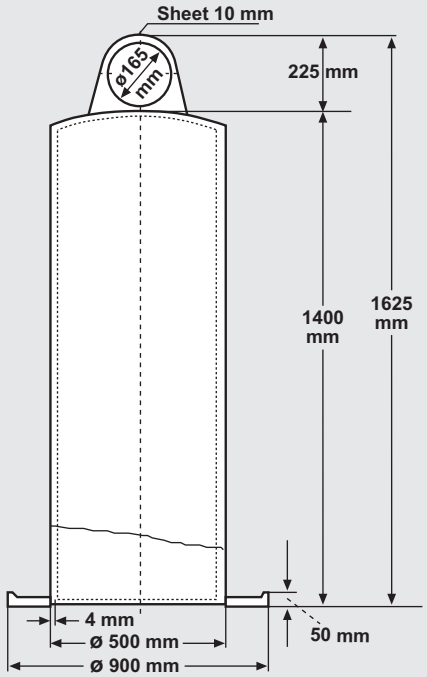
In plastic bags of 25 kg each
In steel drums of 200 kg each
In big bags of 500 / 1000 kg each

Vacuum packagings Extra Dry (covered electrode)

Number of pieces and units of weight on request

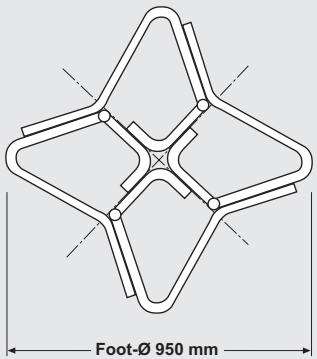
Heavy duty steel dispenser, large size

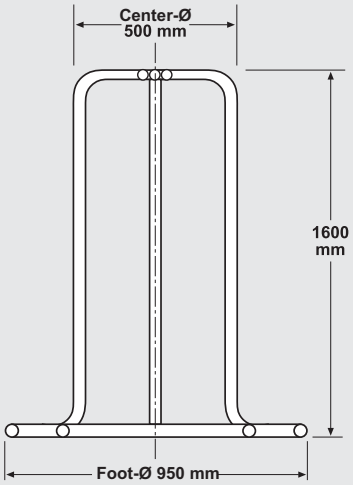
Material: steel sheet
wire weights: 800 kg



Tubular dispenser

Material: steel tubes
wire weight approx. 750 kg

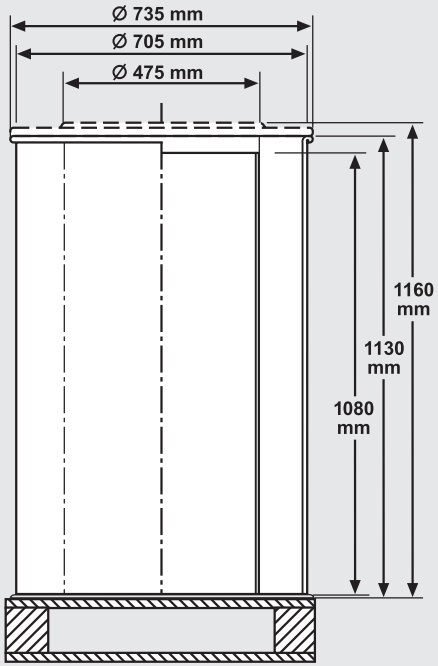




Steel drum*
on wooden pallet
(740 x 740 mm)

Weight:
850 kg max.

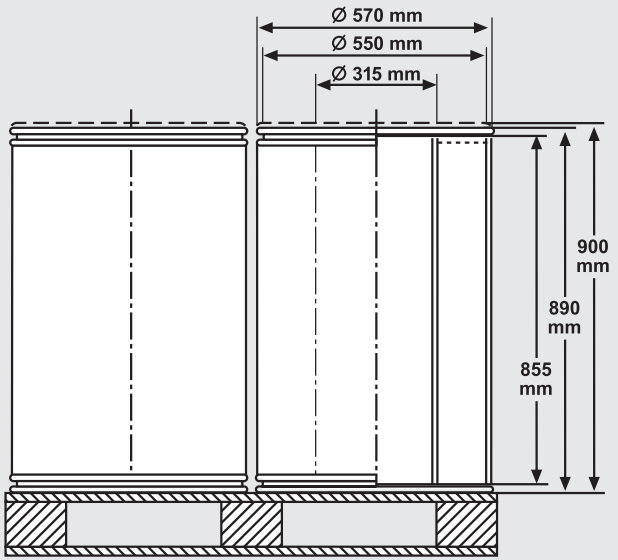
*each pallet one drum



Pay-off-pack*
on wooden pallet
(1200 x 800 mm)

Weight:
350 kg max.

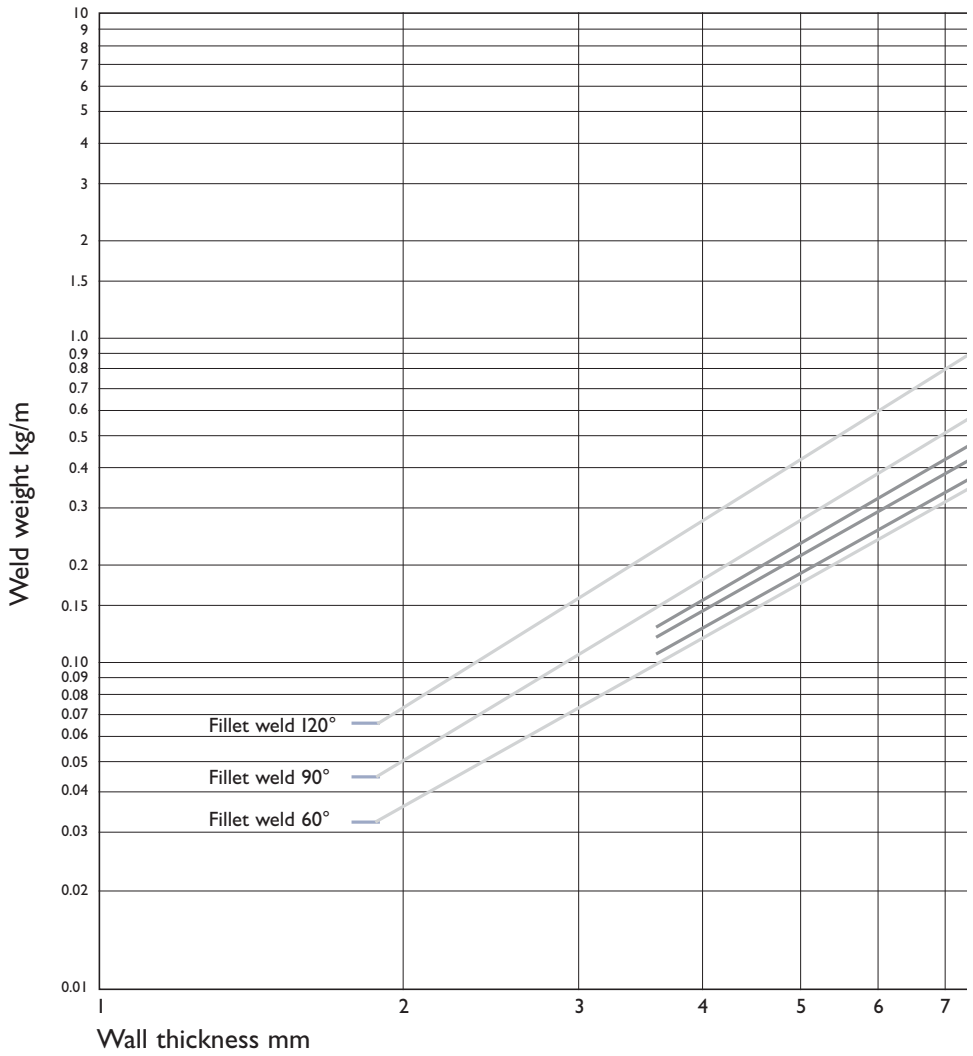
*each pallet two drums

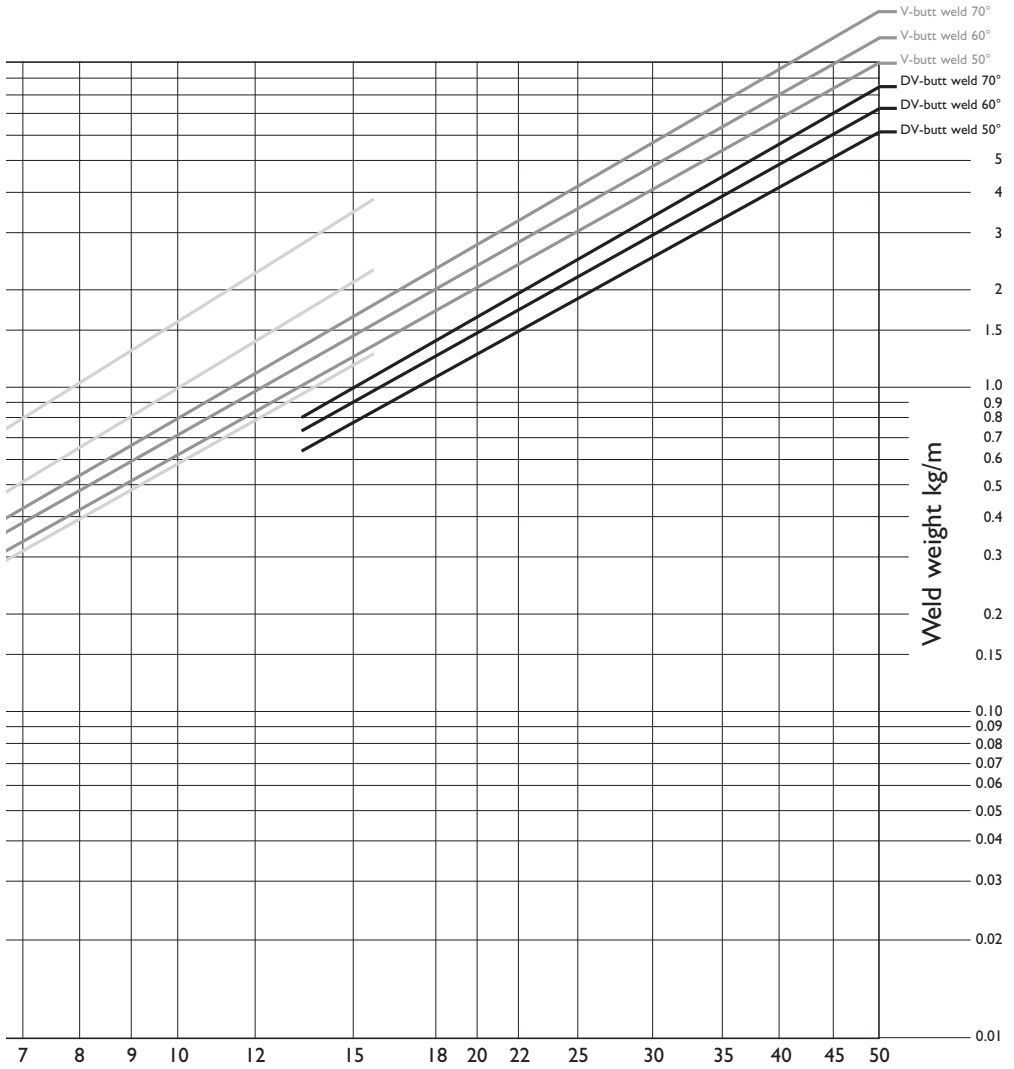


Weights of weld seam of different weld forms

(Guide values)

The values allow a weld reinforcement of 1.5 mm





Recommendations for redrying covered electrodes and welding fluxes

Covered electrodes and welding fluxes can absorb moisture, depending on their coating, grain composition as well as the surrounding atmosphere.

The necessity to redry these filler metals prior to welding is dependent upon the type of coating or flux as well as upon the yield strength and thickness of the steel sheet/plate to be welded. With increasing content of alloys, yield strength of the base material and stress condition of the construction, the risk of hydrogen-induced cracking will increase too.

In general low alloyed basic covered electrodes and basic welding fluxes, which are used predominantly for welding higher-strength steels, should be redried.
For low alloyed basic covered electrodes and welding fluxes used for welding steels with a minimum yield strength of ≤ 355 N/mm, a redrying time of 2 hours at 250 °C (482 °F) is generally sufficient.

Very low H_2 contents of < 5 ml/100 g in the weld deposit of covered electrodes and submerged-arc weld metal, as often required for welding creep resistant steels and fine grained structural steels with yield strengths of ≤ 355 N/mm, can be achieved only by redrying for at least 2 hours at 300 - 350 °C (572 - 662 °F).

Low alloyed iron-oxide, rutile and rutile basic covered electrodes (according to EN 499: A, R, RR, RC, RA, RB) do generally not require any redrying, provided that the covered electrodes are stored dry in undamaged packages. If, as a result of inproper storage, the covering of the aforementioned electrode type has an excessibly high moisture content, which is recognizable by their varying behaviour during welding, redrying can be performed for one hour at 100 - 110 °C (212 - 230 °F).

Cellulose covered electrodes require a defined moisture content to display optimum welding properties. It is for this reason that they are packed mainly in tins.
These electrodes must not be redried.

For security reasons, to avoid any start pores it is advisable to redry high alloyed electrodes for 2 hours at 300 °C (572 °F) ± 25 °C (77 °F). Intermediate storage temperature of the redried consumables should be around 150 °C (302 °F).

Redrying can be repeated several times for all types of electrodes and fluxes (except cellulose electrodes) within a maximum drying time of 10 hours.

Vakuum packaging “EXTRA DRY”

Covered electrodes can also be supplied vacuum-packed upon request.

With this type of packaging the covered electrodes can be used without problems within 8 hours (1 shift) without redrying after opening the packaging.
In this case H_2 contents of < 5 ml/100 g in the deposited weld metal can be achieved.

Electrodes stored in opened packaging a longer time can be regenerated by redrying for 2 hours at 300 - 350 °C (572 - 662 °F).

Joint welding of dissimilar materials

Austenite-ferrite joints

1. Requirements

Most important is the structure of the dilution zone – martensite-free (poor in martensite) and adherence to the strength values of the component.

2. Welding consumables and processes

The most critical point in austenite-ferrite joints is the transition/dilution zone between the ferritic base material (ferrite) and the high alloyed austenitic or austenitic-ferritic welding consumable (austenite). This zone should by no means contain high martensite proportions, as the resulting brittleness of the structure will endanger the welded joint and can lead to cracking.

The following Thermanit welding consumables meet this requirement:

2.1 Austenitic (ferrite-free and ferrite-containing) welding consumables with compositions of which the structure points are favorably located in the Schaeffler-Diagram (see page 457). They are mainly welded by using processes with a low dilution tendency (GTAW and SMAW).
Thermanit X, 20/10, 22/09, 23/11 MoZL, 25/14 E, 30/10.

For Thermanit X also the GMAW process can be used and for Thermanit 20/10 it is possible to use either the GMAW or SAW wire provided that the instructions shown under section B.2.2 are strictly observed.

2.2 The nickel-based welding consumables Thermanit Nicro 82, Nicro 182 and 625.

*Ferritic base material – or in short form ferrite – means the unalloyed and low alloyed and ferritic stainless/heat resistant Cr steels/cast steel grades.

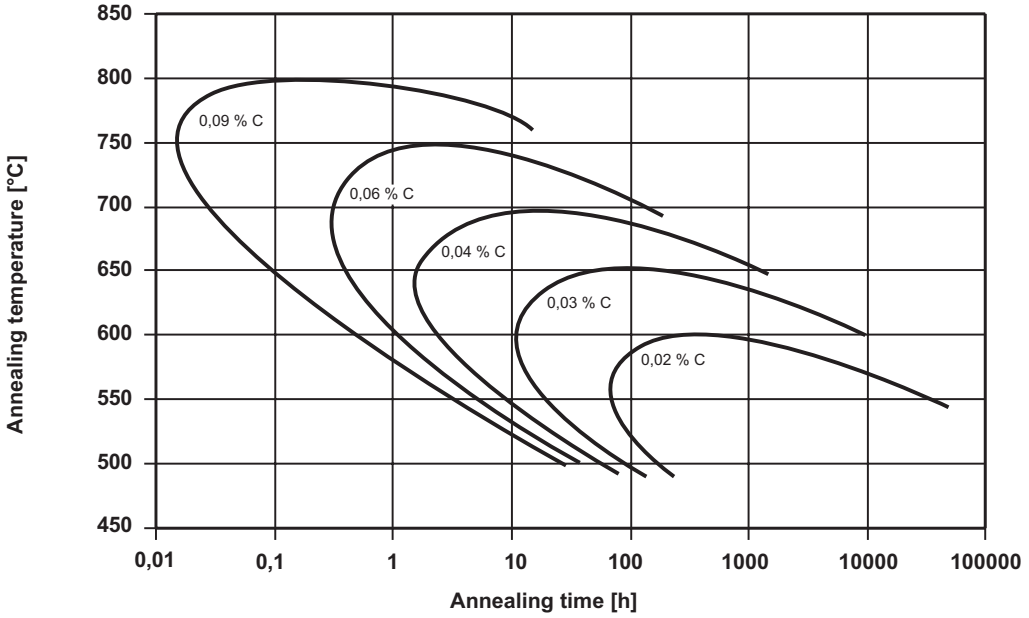
3. Heat treatment

Stress relieving may only be carried out on austenitic or austenitic-ferritic welding consumables at temperatures up to max. 300 °C (572 °F), as at higher temperatures a Cr-carbide zone arises in the transition zone of the weld deposit, dangerously reducing the strength of the joint. Naturally higher (service) temperatures should not occur during use.

4. The special status of Thermianit Nicro 82, 182 and 625

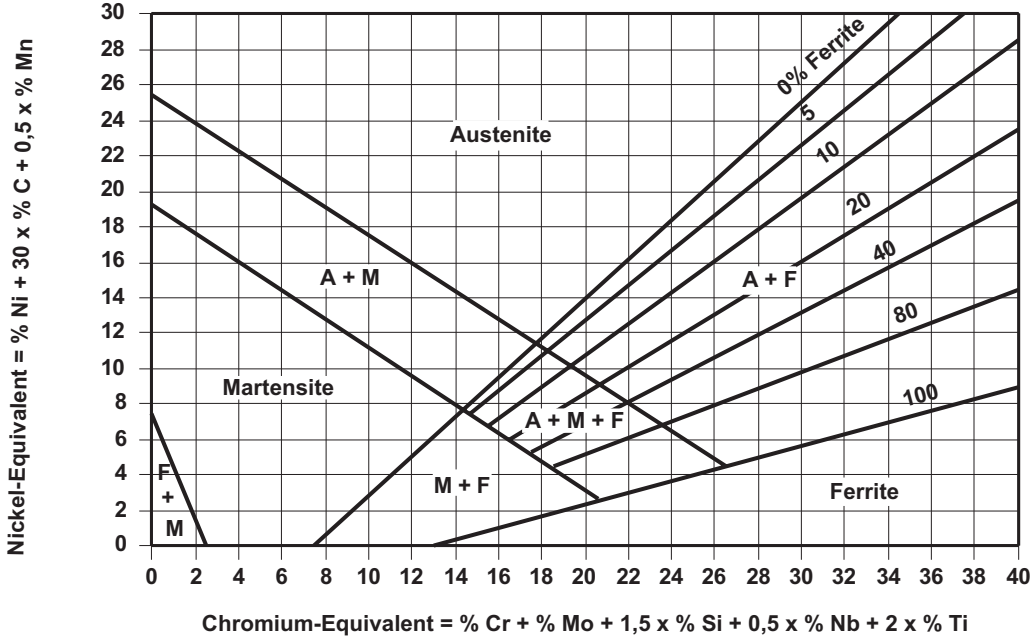
The Ni-based alloys Thermanit Nicro 82, 182 and 625 are much less critical with reference to dilution because of their high alloy content and also allow “proper” stress relieving. However, these welding consumables should not only be used for “intermediate layers”. In the event that the seam is filled up with an austenitic-ferritic welding material, a ferrite-free, fully austenitic zone with a high hot cracking tendence would arise in the transition zone due to Ni-absorption from the Ni-based alloy.

Rocha Intergranular Corrosion Diagram



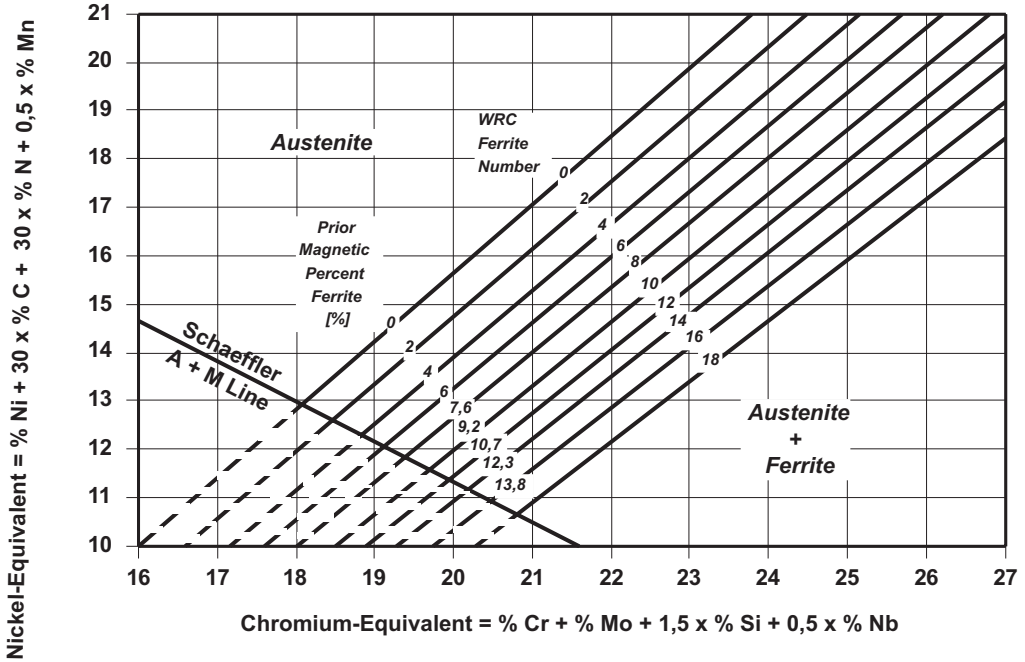
Range of intergranular corrosion for 18/8 chromium-nickel steels in relation to the free carbon content (acc. to H.J. Rocha)

Schaeffler Diagram



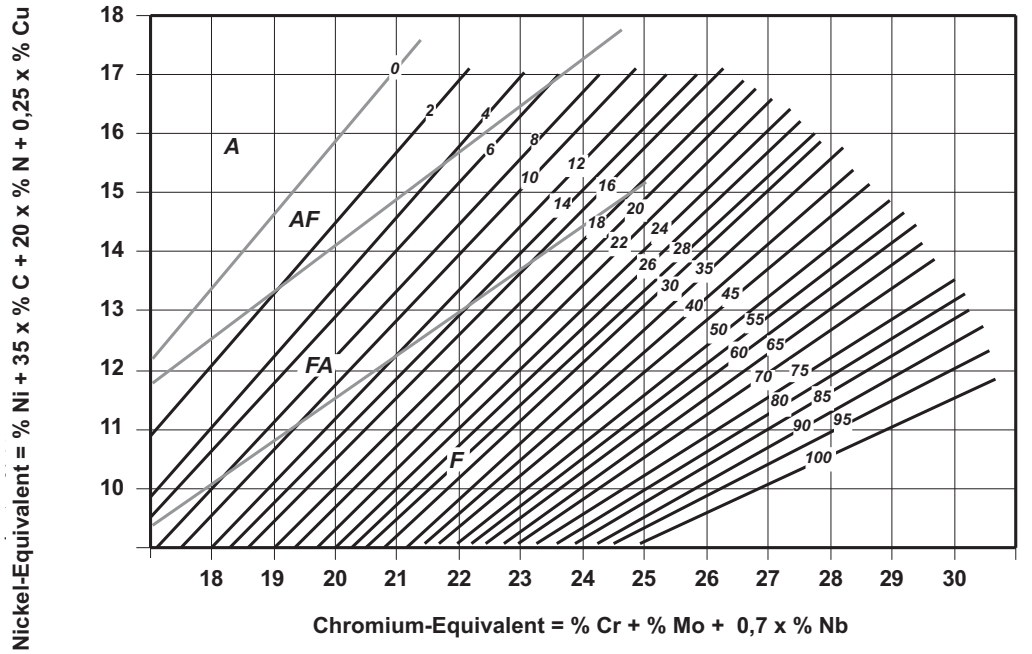
Schaeffler - Diagram
(acc. to A. L. Schaeffler, Metal Progress Nov. 1949, page 680 up to 680-B)

DeLong Diagram



DeLong - Diagram
(acc. to W. T. DeLong, Welding Journal, July 1974, page 273-s up to 286-s)

WRC 92 Diagram



WRC - 92 - Diagram
(acc. to D. J. Kotecki und T. A. Siewert, Welding Journal; May 1992, page 171-s up to 178-s)

The problem of dilution
Recommendations and examples of calculation

A. With regard to three fields of application

- austenite-ferrite joints
- weld claddings
- joints on cladded products

the diluting effect causes problems which strongly resemble each other and thus lead to comparable choice criteria for welding consumables, welding processes and working sequences.

B. Fundamentals

1. Penetration and dilution

1.1 During each welding operation a certain quantity of the surface layer of the base material is melted due to the arc and dilutes with the fluid filler material. In this connection penetration is defined as the depth of melting which e.g. can be measured in mm (metallographic section). In practice, however, this measurable variable is of no importance. In comparison, the dilution which is quantifiable as the percentage of melted base material in the weld deposit is a suitable means to evaluate the properties of the weld deposit. Furthermore, it is relatively simple to determine the degree of dilution: either by means of a chemical analysis of the weld deposit or – even in advance – with sufficient precision by graphic or mathematical determination.

1.2 When welding with a matching filler material, the dilution has no perceptible influence on the weld seam. However, a strong influence can be recognized when welding with austenitic (ferrite-containing) welding consumables on ferritic base materials.
In this case the result is a diluted weld deposit with following characteristics:

- decrease in the Cr, Ni (Mo, ...) alloy-contents
- increase in the C-content and
- structural changes.

The consequences are: a reduced corrosion resistance and possibly even embrittlement and danger of cracking due to martensite formation.

Similar effects occur with regard to hardfacing alloys for surfacing/hard-surfacing and welding consumables for tool steels etc. where the dilution with the low/unalloyed base materials leads to similarly negative property changes of the weld deposit. This can only be compensated by multiple-layer surfacing.

2. Influencing factors

2.1 Dependence on the welding process

As it is well known, the degree of dilution depends on the welding process (acc. to EN 24063). The typical values are as follows:

RES strip (72)	8 - 15 %
SAW strip (122)	15 - 23 %
GTAW rod/wire((141)	15 - 30 %
SMAW covered electrodes (111)	15 - 30 %
GMAW wire (13)	25 - 40 %
SAW wire (121)	roughly 50 %

Thus, the GMAW and SAW wires show the poorest results for the direct use of high alloyed welding consumables on ferritic base materials.

2.2 Influence of the welding parameter

The strongly differing dilution percentages result from the various possible parameter ranges of the individual processes.
In order to achieve acceptable results, especially when using processes with a strong inclination to dilution, it is indispensable to keep the electric heat input low by means of optimum welding conditions (low amperage, stringer bead welding – no weaving, use of welding consumables in small diameters, possibly intermediate cooling and highest possible welding speed). The welding speed is limited by the following conditions:
(a) the arc should prefereably burn on the already deposited weld metal and not on the ferritic base material;
(b) a faultless fusion should be guaranteed.

3. The choice of welding processes

Taking into account the special conditions and requirements and based on the values as per section 2.1, it is possible to derive for the three applications the following recommendations with regard to the respectively most suitable welding processes.

3.1 Austenite-ferrite joints:
Covered electrodes, GTAW rod/wire,
GMAW and SAW wire only with especially suitable alloyed welding consumables.

3.2 Weld cladding:
RES strip, SAW strip, covered electrodes, GTAW rod/wire.

3.3 Joints on clad products:

Single-layer welding:	RES strip, SAW strip, covered electrodes, GTAW rod/wire.
Multiple-layer welding:	1st or intermediate layers: Covered electrodes, GTAW rod/wire, (possibly RES strip or SAW strip).
	Top-layer(s): RES strip, SAW strip, covered electrodes, GTAW rod/wire, GMAW wire.

C. Graphic and mathematical determination of the structure and the chemical composition of the weld deposit

1. The structure

1.1 The **Schaeffler Diagram** (see page 457) offers the possibility to read off structures – in most cases with sufficient precision – and to easily determine base metal, welding material and weld deposit structure graphically. It is, therefore, necessary to know the chemical composition of the materials in question.
The structure points are calculated from the chemical composition of the welding materials with the help of the formulas for the so-called Cr- and Ni-equivalents which are indicated on the abscisse and ordinate. When joining these points in the diagram, the “dilution straight line” is obtained from where it is possible to read off the structure for any percentage of dilution whatsoever.
In order to obtain the point for the required mixed structure, the length of the straight line is equated to 100 % and – from the welding material - base material – the percentage of dilution for the used welding process (e.g. the average value of the ranges mentioned in section **B 2.1**) is laid off.
According to the location of this point in the diagram it is possible to estimate the suitability of the chosen conditions (welding materials, processes and parameter) with regard to the requirements the seam has to meet.

1.2 The **DeLong Diagram** (see page 458), a further development of the Schaeffler-Diagram, additionally considers the austenitzing effect of nitrogen. Thus, a more precise structure determination in the austenite-ferrite range is possible. As this diagram only comprises a small section, it is in most cases not or only seldom suitable for the estimation of mixed joints as these are generally not in this range.

1.3 For the determination of ferrite-contents (> 18 FN) for Duplex and Superduplex stainless steels the **WRC Diagram** developed in 1992 (see page 459) can be used.

2. The composition

The chemical composition can only be estimated very roughly from the coordinates of the mixed structure point in the **Schaeffler Diagram** as it is very difficult to convert the Cr- and Ni-equivalents to Cr-,Ni- (Mo, ...) contents. In particular, it is impossible to determine the C-content which is of importance for the corrosion behaviour.

On the other hand, it is possible to determine all alloy constituents with sufficient precision by means of a simple “dilution calculation”. In this connection, the dilution factor M = percentage of Dilution : 100 is used. As the diluted weld deposit consists to M parts of base material and to (1 – M) parts of welding material, the consequence is:

Alloy constituents of the base material x M
\+ Alloy constituents of the welding material x (1 – M)
= Alloy constituents of the diluted weld deposit

Example:

1. Ferritic parent material: 19 Mn 5
2. Overlaying with covered electrode: Thermanit 25/14 EW 309L-17

Dilution 25 % so that M = 0.25

Alloy contents	C	Si	Mn	Cr	Ni	Factor
1.	0.20	0.50	1.2	-	-	0.25 (= 1a)
2.	0.04	0.90	0.8	24.5	13	0.75 (= 2a)
1a	0.05	0.13	0.3	-	-	
2a	0.03	0.68	0.6	18.4	9.8	
1a + 2a *)	0.08	0.81	0.9	18.4	9.8	
Cr-equivalent	-	1.2	-	18.4	-	= 19.6
Ni-equivalent	2.4	-	0.5	-	9.8	= 12.7

Result:
Structure according to Schaeffler-Diagram: austenite with approximately 3 % ferrite.

*) Chemical composition of the mixed structure: 0.08 C, 0.81 Si, 0.9 Mn, 18.4 Cr, 9.8 Ni

Besides explosive and roll cladding a likewise important manufacturing process is the weld cladding. This procedure is universally applicable as it renders the production of high alloyed claddings on all kinds of base materials (steels and cast steels) possible without any restrictions regarding sizes or constructional forms.

1. Requirements

1.1 Corrosion

With regard to all applications it is necessary to adhere to a stipulated clad surface composition (more precisely: a certain layer thickness of the surface).

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1.2 Mechanical-technological values

Usually, the base material is the structural wall part. The strength values of the cladding material are, therefore, only to be considered by means of choosing welding consumables with higher strength values if the static calculation requires this.
In both cases, however, the cladding combination has to meet the ductility requirements. Consequently, neither hard martensitic structure proportions or Cr-carbide precipitations in the transition zone nor an embrittlement of the weld deposit should arise.

2. Heat treatment

Heat treatments (annealing time and temperature, heating and cooling speed) have to be stipulated in such a manner that the aforementioned conditions are observed. The following has to be considered: the tempering curve of the base material, resistance to intercrystalline corrosion and the embrittlement behaviour of the austenitic cladding (see also the **Intergranular Corrosion Diagram** acc. to H. J. Rocha, page 456). In case of multiple-layer cladding, stress relieving may possibly be carried out before welding the last layer.

3. Welding consumables and processes

Due to the diluting effect, the welding consumables for single-pass surfacing or for welding of intermediate layers (multiple-layer welding) have to be accordingly overalloyed. Only welding processes which result in low dilution come into consideration. Determination of required number of layers can be calculated by (repeating) the “dilution calculation” according to page 464.

Joints on cladded products

General hints

The following advice and recommendations for the welding of high alloyed claddings are – independent of the manufacturing process – valid for all products manufactured either by roll, explosive or weld cladding.
The tables P1 (page 474) and P2 (page 475) only show the Thermanit welding consumables and processes for the claddings, but not for the ferritic base materials.

A. Clad plates / material combinations

Clad plates are to be understood as clad products made of boiler structural and fine-grained structual steels as base material and with claddings of high alloyed stainless or heat-resistant steels or Ni-based alloys in any desired combinations. See the following tables.

Usual base materials and cladding materials

Base materials		Cladding materials (material No.)	
P235GH	StE 255, WStE 255, TStE 255	1.4000	1.4439
P265GH	P275N, P275NH, P275NL	1.4002	1.4462
H III	StE 315	1.4301	1.4539
P295GH	P355N	1.4306	1.4571
19 Mn 5	StE 380	1.4311	1.4573
16Mo3	S420N	1.4541	1.4580
16 Mo 5	15MnNi6-3	1.4550	1.4876
13CrMo4-5	20MnMoNi4-5	1.4404	2.4816
10CrMo9-10	20MnMoNi5-5	1.4429	2.4856
		1.4435	2.4858
		1.4438	2.4610

B. Requirements for joint weldings

Generally, two requirements should be observed:

1. Corrosion resistance

The side of the welded joint subject to corrosion attack must fulfil the same requirements for corrosion resistance as the cladding material.

2. Mechanical values

The mechanical-technological values of the welded joint may not impair the strength of the component.

When joining the overlaying materials of claddings, “austenite-ferrite” fusions are unavoidable. In order to prevent a critical “dilution” of the alloy constituents as well as a brittle martensitic structure in the transition zone due to dilution, it is necessary to work with optimum welding conditions (welding processes and parameter) and to use the highest possible alloyed welding consumables for single layer joints and for the first or intermediate layer when multiple-layer welding.

The second requirement regarding the strength is almost only valid for which seams are only accessible on one side (page 471) and less for those accessible on both sides. The base material is usually the structural wall part and the clad layer is not considered. In both cases, however, the ductility values have to be adhered to.

C. Welding consumables

Austenitic (ferrite-containing) clad layers

When evaluating the suitability of welding consumables for joining clad layer materials, the various weld shapes have to be considered separately.

1. Seams accessible on both sides

Where weld seams are accessible on both sides, the base material should first be welded with a matching or similar welding consumable. The clad side is then welded with the corresponding welding consumable.

Under no circumstances should low or unalloyed welding consumables be welded on to the cladding material or the matching or higher alloyed welding metal, as this will certainly lead to formation of non-permissible martensitic mixed zones which are hard and difficult to form.

See “groove preparation” section F 1 and “ working sequence” section G.

1.1 Single-layer welding

Only welding consumables are to be used which are alloyed as high as possible (higher than the cladding layer). Corresponding Thermanit welding consumables are mentioned in table P1 (page 474). They have to be welded by means of the indicated processes which cause low dilution. Of course, attention should additionally be paid to optimum welding parameters. For further details regarding these welding consumables see the corresponding Thermanit data sheets

1.2 Multiple-layer welding

1.2.1 First layer / interpass layer

Preferably, only very high alloyed welding consumables are to be used. Basically, however, only austenitic (ferrite-containing) welding consumables should be applied, but never Ni-based consumables such as e.g. Thermanit Nicro 82/182. Due to the Ni-pickup from the weld deposit of such a consumable the ferritic top layer would become fully austenitic and susceptible to hot cracking. When welding Ni-base claddings, the intermediate layer should be welded with Ni-base consumables.

Thermanit welding consumables best suited for intermediate layers are described in the data sheets. For further information on the application ranges see table P2 (page 475).

1.2.2 Top layer(s)

All Thermanit welding consumables which correspond to the cladding material. See table P2 and the relevant data sheets Thermanit.

2. Seams only accesssible from the base material side

2.1 Welding the cladded side

When welding the layer material side, any dilution with the base material must be avoided. Normaly the welding can only be done by GTAW with matching or in special cases higher alloyed consumables, whilst protecting the root with shielding gas at the same time.

2.2 Welding the base material side

For welding the base material side the recommendations of dissimilar materials are to be observed.
When choosing the welding consumable, care must of course, be taken to ensure that the mechanical-technological values of the seam are sufficient for the component.
See section B.

Groove preparation according to section F2.

Note:

The **“Schaeffler-Diagram”** as well as the “dilution calculation” give a sufficiently safe idea of the structure occuring in the austenite-ferrite interface and of the composition of the diluted weld deposit.

Ferritic chromium steel clad layers

For **“ferritic”** chromium steel clad layers, the clad sides can usually be welded completely with austentitic welding consumables – if not ruled out for chemical corrosion reasons, e.g. sulphur-containing environment. For this application we can especially recommend Thermanit CM. Thermanit Nicro 82 and 182 can also be used.
For atmospheres containing sulphur with service temperatures above 450 °C (842 °F), we recommend Thermanit 17 for welding the layer material.

D. Welding processes

Covered electrodes are suitable for all single and multiple-layer finishes and for seams which are only accessible from the base material side.

As far as Rutile-covered electrodes are available within the delivery programme, these are to be preferred due to the lower penetration.

The **GTAW process** is mainly used for welding the roots of seams which are only accessible from the base material side.

This process is also very suitable for the welding of clad sides, particularly of low-C-types. Because of the low C-content of the welding rods (max. 0.025 %) a few welding layers are sufficient to adhere to the low C-specification (max. 0.04 % in the weld deposit).

Calculation of the required number of layers by means of the repeated “dilution calculation” as per page 464.

The **GMAW** process, however, should not be used for welding the 1st layer on the base material in case of single-layer finishes or as intermediate layer in case of multiple-layer finishes. The welding of the top layer on a sufficiently alloyed intermediate layer is possible with optimized welding parameters.

SAW (especially suitable for welding thick base materials) is **completely unsuitable** for welding the clad side due to the high diluting effects (martensite formation, carburization, “dilution of the alloy contents”).

E. Heat treatment

If a heat treatment is necessary, the properties of all the materials “involved” must be observed (in order to meet the aforementioned requirements) when considering annealing temperature and time, heating and cooling rates. This includes the tempering temperature of the base material and its welding consumables, the sensibility, the suceptibility to intercrystalline corrosion (see Intergranular Corrosion Diagram acc. to H. J. Rocha, page 456) and the tendency towards embrittlement of the clad material and the relevant welding consumable.

See also AD-Data sheet W 8.

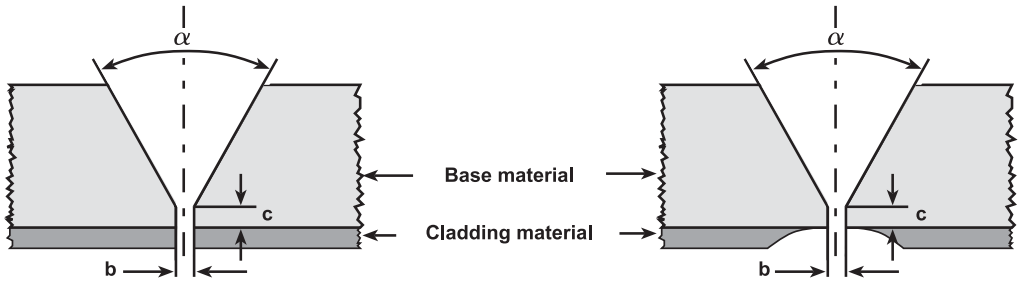
F. Groove preparation

For the base material side the grooves are prepared, according to choice, in a V or U form. The included angle α on the single V-joint is approximately 60°, the angle of slope on the U-joint approximately 10°. The following sketches only show the preparation for the single V-joint.

1) Seams accessible on both sides

Finish A
any clad material thickness

Finish B
clad material thickness ≥ 2,5 mm

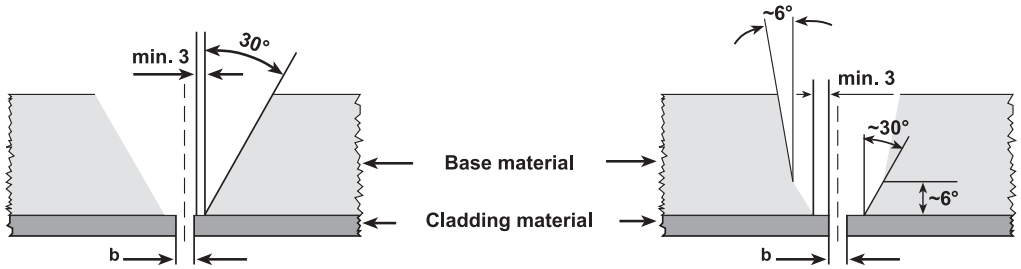


Size b can be up to 2 mm. Size c is aligned in accordance with the chosen weld process. For finish B the cladding material should be machined only so far on the side edge of root face that cladding material will definitely not be melted by the consumable for the base material.

2) Seams only accessible on the base material side

Finish A – single V-joint

Finish B – V-joint upon V-root



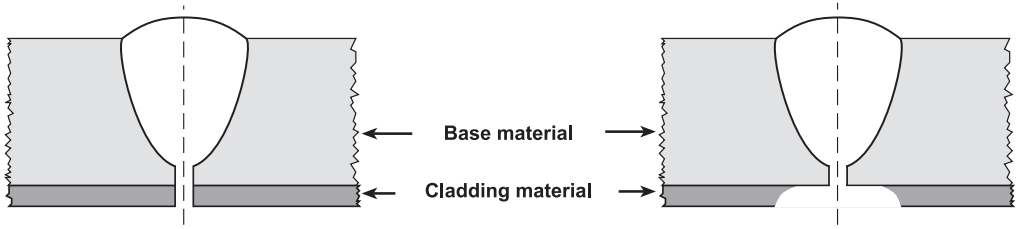
The safety distance of min. 3 mm is indispensable for both finishes in order to avoid that the dilution of the weld deposit with the base material affects the clad joint.
Size b is aligned in accordance with the chosen weld process.
Welding of the seam: the whole seam is welded with the consumable for the cladding material.

G. Work sequences during welding of seams accessible on both sides

The following sketches show the work sequences for the single V-joint finishes F. 1A and F. 1B.

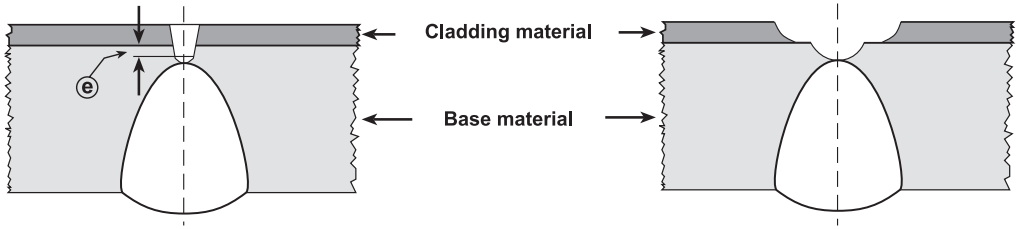
1) Welding of parent material

Finish A **Finish B**



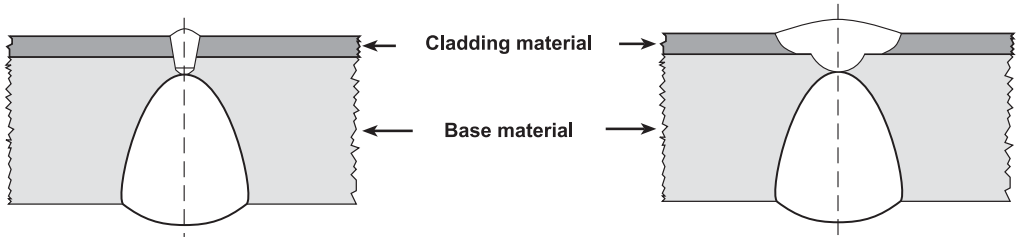
The parent material is welded with suitable matching or similar consumable. The cladding must not be melted by the root layer.

2) Preparation on the clad side and welding of cap pass



The root is machined out until perfect weld deposit of the parent material is achieved. Basically the cap pass for both finishes can be welded with a high alloyed consumable sufficient for the cladding (as long as the strength of the joint is not adversely affected) as well as with the consumable for the parent material. If the cap pass for finish A is welded with the chosen consumable for the parent material, then a safety distance e is necessary, in order to avoid melting the cladding material.

3) Welding of cladding



Finish welding of the joint on the clad side with a consumable matching to or higher alloyed than the cladding, which is sufficient to meet the demands made on the cladding with regard to durability.

Welding of clad plates
Single-layer finishes – table P1

Layer materials				
Mat. No.	Short name	AISI/SAE UNS/Alloy	Welding consumables Thermanit	Welding process
1.4000 1.4002	X6Cr13 X6CrAl13	403 405	CM Nicro 82 Nicro 182 14 K	111 111, 141 111 111, 141
1.4301	X5CrNi18-10	304	25/14 E	111, 141
1.4306 1.4311	X2CrNi19-11 X2CrNiN18-10	304L 304LN	25/14 E	111, 141
1.4401	X5CrNiMo17-12-2	316	18/17 E	111, 141
1.4404 1.4429 1.4435	X2CrNiMo17-12-2 X2CrNiMoN17-13-3 X2CrNiMo18-14-3	316L 316LN 316L	19/15 1)	111, 141
1.4438 1.4439	X2CrNiMo18-15-4 X2CrNiMoN17-13-5	317L S31726	30/40 E 625	111, 141
1.4571 1.4573 1.4580	X6CrNiMoTi17-12-2 X10CrNiMoTi18-12 X6CrNiMoNb17-12-2	316 Ti 316 Ti 316 Cb	18/17 E 1)	111, 141
2.4610	NiMo16Cr16Ti	C-4	Nimo C	111, 141
2.4816	NiCr15Fe	600	Nicro 82 Nicro 182	111, 141 111
2.4856	NiCr22Mo9Nb	625	625	111, 141
2.4858	NiCr21Mo	825	30/40 E	111, 141
1.4876	X10NiCrAlTi32-20	800 (H)	21/33 (So) Nicro 82 Nicro 182 617 625	111, 141 111, 141 111 111, 141 111, 141

Heat treatment: Mostly none. If necessary, see section E.

1) Service temperatures up to max. 300 °C (572 °F) – due to C-pickup from the parent material.

Welding process according to EN24063: 111 = SMAW
141 = GTAW

Welding of clad plates
Multiple-layer finishes – table P 2

Layer materials	1st layer or intermediate layer		Top layer	
Mat. No.	Welding consumables Thermanit	Welding process	Welding consumables Thermanit	Welding process
1.4000 1.4002	CM Nicro 82 Nicro 182 14 K	111 111, 141 111 111, 141	CM Nicro 82 Nicro 182 14 K	111 111, 131, 141 111 111
1.4301	25/14 E	111, 141	H, HE	111, 135, 141
1.4306 1.4311	25/14 E	111, 141	JE, H, HE	111, 135, 141
1.4401	23/11 MoZl	111, 141	GE, A, 18/17 E	111, 135, 141
1.4404 1.4429 1.4435	23/11 MoZl 25/14 E 18/17 E	111, 141 111, 141 111, 141	GE, A, 18/17 E	111, 135, 141
1.4438 1.4439	18/17 E	111, 141	18/17 E	111, 135, 141
1.4462	22/09	111, 141	22/09	111, 141
1.4541 1.4550	25/14 E	111, 141	H, HE	111, 135, 141
1.4571 1.4573 1.4580	23/11 MoZl 25/14 E	111, 141 111, 141	A, GE, 18/17 E 1)	111, 135, 141
2.4610	Nimo C	111, 141	Nimo C	111, 131, 141
2.4816	Nicro 82 Nicro 182	111, 141 111	Nicro 82 Nicro 182	111, 131, 141 111
2.4856	625	111, 141	625	111, 131, 141
2.4858	30/40 E	111, 141	30/40 E	111, 141
1.4876	21/33 Nicro 82 Nicro 182 625 617	111, 141 111, 141 111 111, 141 111, 141	21/33 Nicro 82 Nicro 182 625 617	111, 141 111, 131, 141 111 111, 131, 141 111, 131, 141

Heat treatment: Mostly none. If necessary, see section E.

1) Service temperatures up to max. 300 °C (572 °F).

Welding process according to EN24063: 111 = SMAW
131 = GMAW-pulsed method
135 = GMAW-pulsed method
141 = GTAW

Material test certificates according to EN 10 204

Increasingly, certificates attesting the characteristics and property values of the welding filler metals are required by customers or inspection authorities within the framework of the acceptance testing of weldments.

A few explanatory notes are given below with the request that they be kept in mind when making inquiries or ordering.

The EN standard 10 204 is taken as a basis to determine the schedule of such certificates in the case of inquiries and orders. EN 10 204 defines who is responsible for testing and authorized to sign, and whether the certificates must contain details concerning general typical values or specific test results relating to the particular delivery in question.

We would like to emphasize strongly that the EN standard 10 204 does not contain the following details and that these must be specified by the customer when ordering:

Scope of testing: e.g. type and number of tests, individual elements in case of chemical analyses

Consumables: e.g. type of shielding gas, etc.

Test paramenters: e.g. postweld heat treatment of the test piece, test temperature

Requirements: e.g. minimum values for yield strength, tensile strength, elongation, impact values, chemical composition tolerances

Inspection society: e.g. TÜV, Germanischer Lloyd, DB

All certificates issued in conformity with EN 10 204 must be paid for and are charged separately.

On next page are examples of standard certificates issued for filler metals:

Type of certificate	Confirmation of certificate by	Content of the certificate
Test report “2.2”	Manufacturer	Non specific values, based on continuous production records
Inspection certificate “3.1”	The manufacturer’s authorized representative independent of the manufacturing department	Specific test results determined from the consignment or representative lot of this consignment
Inspection certificate “3.2”	The manufacturer’s authorized representative independent of the manufacturing department and the purchaser’s authorized representative or inspector designated by the official regulations.	Specific test results determined from the consignment or representative lot of this consignment

Comparsion chart of approvals for all welding consumables

The following comparsion charts of qualification tests and approvals should allow you to find out quickly by which authorithy or classification companies the welding consumable you are searching for is approved.

For each society the grade or number of approvals or the Kennblatt-Nr. is mentioned. With reference to TÜV registrations we would like to draw your attention to the fact that among VdTÜV approvals there are some with “preliminary approval”. They have the same validity, because normaly they are a substitute for the original when something has been changed. The period of validity is shown on the preliminary approval (at present 2 years max.). During this time they will be replaced by the final approval.

If required please ask for the approval certificate in question.

The VdTÜV approval certificates as well as the Deutsche Bahn approval certificates specify only some base materials/groups which are listed in the approval range as “Bescheinigte Werkstoffe”.

In “VdTÜV-Merkblatt 1000” (published by: Verband der Technischen Überwachungsvereine e.V., Essen) base materials are listed under “Miterfasste Werkstoffe” – included materials – which are also approved by testing.

The chart old and new material designations shows the comparsion of previous material designations according to DIN and the new one according to EN.

Followed by the table “Included base materials – Deutsche Bahn” this shows for each approval group those materials that are included in the approval range – “Miterfasste Werkstoffe”.

In addition to the approval authorities mentioned in the tables the following approvals also exist:

1.) Certificate of conformity according to “Bauregelliste A” / Ü-Zeichen / CE-sign

All welding consumables and auxiliary products which are registered by “Deutsche Bahn” or classified accordingly to “Bauregelliste A” are delivered with Ü-sign or CE-sign.

2.) UDT-approval

All consumables approved by TÜV are also approved by URZEDU DOZURU TECHNICZNEGO, Warsaw/Poland – official for technical inspection (registration No. M-2713-97).

3.) Registration according to NAKS / VNIIST / VNIIGAZ

Type	Quality
SE	Phoenix K 50 R Mod.
SE	Phoenix SH Schwarz 3 K Mod.
SE	Phoenix SH Ni 2 K 90
DE	Union K Nova

Definition of shortcuts for the table of approvals

DE = Wire electrodes
DEU = Sub-arc wire electrodes
DPK = Wire/flux combinations
FDE = Flux cored wires
GS = Gas welding rods
SD = Welding wires
SE = Covered electrodes
SS = Welding rods
PUL = Welding fluxes

Approvals and approval authorities

TÜV	**TÜV** **Verband des Technischen Überwachungsvereins e.V., Essen**
DB	**DB** **Deutsche Bahn AG**
Ü	**zugelassene** **Schweißzusätze nach Landesbauordnung**
ABS	**ABS** **American Bureau of Shipping**
CONTROLAS	**C** **Controlas, Niederlande**
BUREAU VERITAS	**BV** **Bureau Veritas**
FORCE TECHNOLOGY	**FT** **Force Technology, Dänemark**
Germanischer Lloyd	**GL** **Germanischer Lloyd**
Lloyd's Register	**LR** **Lloyd's Register of Shipping**
DNV	**DNV** **Det Norske Veritas**
Snamprogetti	**Snamprogetti, Italien**
ÖBB	**ÖBB** **Österreichische Bundesbahnen**
ASME	**The American Society of Mechanical Engineers**

FRAMATOME ANP	**Framatome ANP**
WIWEB	**WIWEB** **Wehrwissenschaftliches Institut für Werk-, Explosiv-, und Betriebsstoffe**
RS	**RS** **Russian Maritime Register of Shipping**
CWB	**CWB** **Canadian Welding Bureau**
RINA	**Rina** **Registro Italiano Navale**
UDT	**UDT** **URZEDU DOZURU TECHNICZNEGO, Warschau/Polen**
KTA 1408	**Sicherheitstechnische Regeln des Kerntechnischen Ausschusses**
Stamicarbon bv	**Stamicarbon, Niederlande**
VNIIST	**VNIIST, Russland**
DIN EN ISO 9001 : 2000	**Quality Management Systems**
DIN EN ISO 14001	**Environmental Management System**
Gaz de France	**Gaz de France**
STATOIL	**Statoil**

The approval range concerning the base metals, welding positions, heat treatment conditions, diameter of the welding consumables, shielding gases, welding fluxes etc. are shown on the applicable certificate.

Approvals and qualification tests for welding consumables

Covered electrodes

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Phoenix 120 K	SE	3H10/3Y	4Y40H5	0172		3YH10	E51 3B(H)	3YH10	3/3YH15	00348	10.132.17	AWS E 7018
Phoenix 300 Blau K	SE										20.132.06	
Phoenix 350 Rosa	SE										20.132.02	
Phoenix 6013	SE	2				2			2/2Y	09448		
Phoenix 7018	SE	3H10/3Y		0484		3YH10		3YH10	3/3YH15	09449		
Phoenix Blau	SE	2/2Y	2Y	0527		2	E 51 2R	2Y	2/2Y	00425	10.132.19	AWS E 6013
Phoenix Blau Mo	SE									06542		
Phoenix Cel 70	SE	E6010		0420		3		3	3/3Y	00247	10.132.44	
Phoenix Cel 75	SE			0334					3/3Y	03199		
Phoenix Cel 80	SE	E8010-P1		0316					3/3Y	00536		
Phoenix Cel 90	SE			1068						00105		
Phoenix Chromo 1	SE			1073						06535		
Phoenix Chromo 5	SE									09182		
Phoenix E 7018 LH	SE			1357					3/3YH15	07250		
Phoenix Grün	SE										10.132.10	
Phoenix Grün M	SE									03714	10.132.41	
Phoenix Grün T	SE	2	2Y	0113		2	E43 0RR	2	2	00350	80.132.01	AWS E 6013
Phoenix K 50	SE	3H10	4Y40H10			3YH10		3YH10	3/3YH15	01586	10.132.05	
Phoenix K 50 R	SE	3H10/3Y				3YH10		3YH10	3H15	01587	10.132.18	
Phoenix K 50 R Mod.	SE									06987		
Phoenix K 90 S	SE									01807	10.132.39	
Phoenix Nautica 20	SE							~AWS D 3.6				
Phoenix Rot AR 160	SE	2/2Y	3Y40	0938		3	E51 3AR	3Y	3/3Y	00535	10.132.29	
Phoenix Rot BR 160	SE	3/3Y	3Y40	0760		3	E51 3B	3Y	3/3Y	01700	10.132.36	
Phoenix Rot R 160	SE	2	3Y	0499		2	E51 2RR	2Y	2	00349	10.132.09	AWS E 7024
Phoenix Rot R 160 S	SE	2	2Y	0200		2		2Y	2/2Y	01495		
Phoenix SH Blau	SE							2Y	2	00342	80.132.03	
Phoenix SH Chromo 2 KS	SE			0492			EV 19H			01823		
Phoenix SH Gelb	SE									01589	10.132.01	
Phoenix SH Gelb B	SE	3H15				3		3H	3	01590	10.132.08	
Phoenix SH Gelb R	SE	3/3Y	3Y	0533		3		3Y	3/3Y	01591	10.132.20	
Phoenix SH Gelb S	SE			0279		3		2	2	01592	10.132.25	
Phoenix SH Gelb T	SE	3	3Y			3		3	3	01593	10.132.03	

Approvals and qualification tests for welding consumables

Covered electrodes

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Phoenix SH Grün K 45	SE									01594	10.132.33	
Phoenix SH Grün K 50 W	SE	3H10/3Y	4Y40H5	0040		3YH10		3YH10	3/3Y	01824	10.132.12	
Phoenix SH Grün K 52 W	SE	3H10/3Y		0614		3YH10	E51 3 B(H)	3YH10	3/3Y			
Phoenix SH Grün K 70	SE	3H10/3Y				3YH10		3Y38H10	3/3Y	01751	10.132.06	
Phoenix SH Grün K 70 W	SE										10.132.13	
Phoenix SH Grün TB	SE									01496	10.132.23	
Phoenix SH Kupfer 1 K	SE									01756	10.132.15	
Phoenix SH Kupfer 1 KC	SE									04746		
Phoenix SH Kupfer 1 TR	SE									01595		
Phoenix SH Kupfer 3 K	SE									00546		
Phoenix SH Kupfer 3 KC	SE									03187		
Phoenix SH Lila R	SE					2		2	2	01596	10.132.22	
Phoenix SH Multifer 130	SE	2	2Y	0266		2		2Y	2	00583	10.132.28	
Phoenix SH Multifer 180	SE	2	2Y	1009		2	E51 2RR	2Y	2/2Y	01598	10.132.07	
Phoenix SH Ni 2 K 100	SE		4Y69H5					6Y69H10		00548	10.132.35	WIWEB
Phoenix SH Ni 2 K 130	SE										10.132.46	
Phoenix SH Ni 2 K 70	SE	2Ni (-60)	5Y40			5YH10		7Y42H10	3/3YH15	01599		
Phoenix SH Ni 2 K 90	SE							6Y55H10		00547	10.132.34	WIWEB
Phoenix SH Patinax Kb	SE									01600	10.132.24	
Phoenix SH Schwarz 3	SE									01828	10.132.04	
Phoenix SH Schwarz 3 K	SE	3H15		0432		3YH10		3Y46H10		01829	10.132.14 20.132.15	
Phoenix SH Schwarz 3 K Ni	SE			1491						00512 08100		
Phoenix SH Schwarz 3 MK	SE	3H15				3YH15	EV 17H		3/3Y	00902	10.132.31	
Phoenix SH Schwarz 3 TR	SE									01603		
Phoenix SH V 1	SE			0439		5Y42H10		6Y46H10	5Y40H15	00531	10.132.37	
Phoenix SH V 370	SE									02199 08011		
Phoenix Spezial D	SE	3H10	4Y40H10	0088		3YH10	E42 3B12	3YH10	3/3Y	03282	10.132.42	RINA

Approvals and qualification tests for welding consumables

Covered electrodes

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Thermanit 13/04	SE									01581		
Thermanit 13/65 TTW	SE							5680		09379		
Thermanit 14 K	SE									01436		
Thermanit 14 Mn	SE										20.132.16	
Thermanit 18/17 E	SE									02070		
Thermanit 18/17 EW	SE									03842		
Thermanit 19/15 H	SE									01813	30.132.12	
Thermanit 19/15 W	SE									02849		
Thermanit 20/10 W	SE			0738				4431	gvV4P-12	01772	30.132.10	
Thermanit 20/16 SM	SE											WIWEB
Thermanit 20/25 Cu	SE									03990		
Thermanit 20/25 CuW	SE									04112		
Thermanit 21/33	SE									03931		
Thermanit 21/33 So	SE			0626						07255		
Thermanit 22/09	SE									04300		
Thermanit 22/09 W	SE	E2209-17		1050		Duplex/ CMn steel		4462	Duplex/ CMn steel	03297		
Thermanit 23/11 MoZLW	SE			0965						04146 08075		
Thermanit 25/09 CuW	SE									05200		
Thermanit 25/14 E	SE									00423		
Thermanit 25/14 EW	309 L-17 SE			0287	E309L-17					00424		
Thermanit 25/22 H	SE									04171		
Thermanit 25/35 R	SE			0520								
Thermanit 30/10 W	SE										30.132.11	
Thermanit 30/40 EW	SE									04587		
Thermanit 617	SE									06844		
Thermanit 600 Violett	SE										20.132.04	
Thermanit 600 Violett T	SE										20.132.10	
Thermanit 600 Violett W	SE										20.132.05	
Thermanit 625	SE	ENiCrMo-3		0920		W10651		NiCr20Mo9Nb		03463		

Approvals and qualification tests for welding consumables

Covered electrodes

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Thermanit A	SE									00603		
Thermanit A Spezial	SE									07663		
Thermanit ATS 4	SE			0194						01526		
Thermanit AW	SE			1074						00607	30.132.09	
Thermanit C	SE									01232		
Thermanit Chromo 9 V	SE			1353						06173		
Thermanit CM	SE									01314		
Thermanit CW 310-16	SE			0566								
Thermanit D	SE									01249		
Thermanit DW	SE									01315		
Thermanit GE	SE									00487		
Thermanit GE Spezial	SE					316				06521		
Thermanit GEW 316L-17	SE			0024	E316L-17			4429	316L	00484	30.132.14	
Thermanit GEW/F	SE									09092		
Thermanit HE Spezial	SE									07665		
Thermanit HEW	SE									02074 08076		
Thermanit HW	SE			0208						00608		
Thermanit JE Spezial	SE									06523	30.132.13	
Thermanit JEW 308 L-17	SE			0627	E308L-17					00558	30.132.07	
Thermanit MTS 3	SE									09168		
Thermanit MTS 4	SE									01898		
Thermanit MTS 616	SE									09289		
Thermanit MTS 911	SE									07991		
Thermanit Ni 55	SE											SLV approval DVS-1502
Thermanit Nicro 182	SE									02073 08109		
Thermanit Nicro 82	SE			0820				NiCr 19 Nb		01775		
Thermanit Nimo C 24	SE									09272		
Thermanit P23	SE									10272		
Thermanit P24	SE									10156		

Approvals and qualification tests for welding consumables

Covered electrodes

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Thermanit X	SE									05650	30.132.01	
Thermanit XW	SE							4370	fuV4R-12	01235	30.132.08	
Thermanit XW 140 K	SE									00120		

Approvals and qualification tests for welding consumables

Flux cored wires

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Thermanit 22/09-PW Gas: C1	FDE	E2209				Duplex/ CMn steel		4462S/ CMn steel	Duplex/ CMn steel			
Thermanit 22/09-PW Gas: M21	FDE	E2209T1-4				Duplex/ CMn steel		4462S/ CMn steel	Duplex/ CMn steel	09106		
Thermanit 308 L-PW Gas: C1, M2, M32	FDE									09770		
Thermanit 309 L-PW Gas: C1, M2, M32	FDE									09772		
Thermanit 309 MoL-PW Gas: C1, M2, M32	FDE									09773		
Thermanit 316 L-PW Gas: C1, M2, M32	FDE									09771		
Thermanit TG 22/09 Gas: C1, M21	FDE	E2209T0-4				Duplex/ CMn steel		4462 (C1/M21)	Duplex/ CMn steel	07656		
Thermanit TG 308 L Gas: C1, M21	FDE							4550 (C1)		07538	43.132.15	
Thermanit TG 308 L Gas: M21	FDE							4550				
Thermanit TG 309 L Gas: C1, M21	FDE							4332 (C1)		07540	43.132.14	
Thermanit TG 309 L Gas: M21	FDE							4332				
Thermanit TG 309 Mo L Gas: M32, C1, M21	FDE	E 309 Mo L/ T0-4				309MoL		4459 (C1/M21)	Stainless Steel DH36	07688	43.132.17	
Thermanit TG 316 L Gas: C1, M21	FDE							4571 (C1)		07539	43.132.16	
Thermanit TG 316 L Gas: M21	FDE							4571				
Union BA 70 Gas: C1, M21	FDE	4SA/4YSA		0494 C1-M21		IV YMSH5			3/4Y	07184	42.132.31	
Union MV 70 Gas: C1, M21-M33	FDE	4SA/4YSA		1119 M21		Y4YMSH5		4YH5S	3/4Y	07187		
Union MV CrMo Gas: M21	FDE									07192		
Union MV Mo Gas: M21	FDE									07838	42.132.36	
Union RV 71 Gas: C1, M21-M33	FDE	3SA/3YSA		1197 C1-M21		III YMSH5		3YH5S	3/3Y	07185	42.132.32	

Approvals and qualification tests for welding consumables

Flux cored wires

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Union RV 72 Gas: C1	FDE							3YH5S		07186		
Union TG 50 B Gas: M2, C1	FDE									06623	42.132.27	
Union TG 50 B Gas: M21	FDE			1135				5YH10S	3S/3YSH15			
Union TG 50 M Gas: C1	FDE							3YH10S				
Union TG 50 M Gas: M21	FDE			1418				3YH10S	3S/4Y40SH15	06622	42.132.28	
Union TG 50 Ni Gas: M21	FDE			1272				3Y46S	3S/5Y40SH15	06624	42.132.30	
Union TG 55 Fe Gas: M21	FDE		SA4YMHHH	1497		IVYMS(H5)		4YH5S		06538	42.132.37	

Approvals and qualification tests for welding consumables

Wire electrodes, welding wires and welding rods

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Thermanit 13/04 Si Gas: I1	SS/ SD									01582		
Thermanit 14 K Gas: I1	SS									01437		
Thermanit 1610 Si Gas: M11	DE										43.132.04	
Thermanit 17/15 TT Gas: I1	SS									03090		
Thermanit 17/15 TT Gas: M13-M21	DE					NV5Ni (M13)		5680S	fuV13R-12	02890		
Thermanit 17/15 TT Gas: M13	DE		N50BT			NV5Ni						
Thermanit 17/15 TT Gas: M21	DE		N50BT					5680S				
Thermanit 1720 Gas: M11, I1	DE									08107		
Thermanit 1740 Gas: M11	DE										43.132.07	
Thermanit 18/17 E Gas: I1	SS			0539						02071		
Thermanit 18/17 E Gas: M11, M12	DE									02077	43.132.09	
Thermanit 19/15 H Gas: I1	SS									03497		
Thermanit 19/15 Gas: M11, M12	DE									06005	43.132.12	
Thermanit 19/15 Gas: M12	DE							5680S				
Thermanit 19/15 Gas: M13	DE					NV5Ni						
Thermanit 20/10 Gas: I1, I3	SS/ SD					308Mo/I1				01774		
Thermanit 20/10 Gas: M11, M12	DE									01773		
Thermanit 20/16 SM Gas: I1	SS							3954				WIWEB
Thermanit 20/16 SM Gas: M11 bzw. M22	DE							3954S				WIWEB

Approvals and qualification tests for welding consumables

Wire electrodes, welding wires and welding rods

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Thermanit 20/25 Cu Gas: I1	SS									04301		
Thermanit 20/25 Cu Gas: M12	DE									04302		
Thermanit 21/33 So Gas: I1	SS			0658						07256		
Thermanit 22/09 Gas: I1	SS	ER2209		0416		Duplex CMn steel		4462	Duplex/ CMn steel			
Thermanit 22/09 Gas: I1	SS/ SD									03343		
Thermanit 22/09 Gas: M11 + M12	DE									03342		
Thermanit 22/09 Gas: M12	DE			0083		Duplex		4462S				
Thermanit 25/09 CuT Gas: I1	SS			0923								
Thermanit 25/14 E-309L Gas: I1	SS			0651	ER309L-Si					02661		
Thermanit 25/14 E-309L Gas: M12, M13	DE			0404	309L	309L				09362		
Thermanit 25/14 E-309L Si Gas: M12	DE				ER309L-Si			4332S 4332		02661		
Thermanit 25/22 H Gas: I1	SS									04875		
Thermanit 25/35 R Gas: I1	SS			0637								
Thermanit 25/35 R Gas: M11	DE			0100								
Thermanit 30/40 E Gas: I1	SS/ SD									00118		
Thermanit 30/40 E Gas: I1, I3, M*	DE									05588		*see TÜV data sheet
Thermanit 617 Gas: I1	SS									06845		
Thermanit 625 Gas: I1	DE									03462		
Thermanit 625 Gas: I1	SS			1006		W10652						
Thermanit 625 Gas: I1	SS/SD									03464	43.132.25	

Approvals and qualification tests for welding consumables

Wire electrodes, welding wires and welding rods

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Thermanit A Gas: I1, I3, R1	SS/SD									09474		
Thermanit A Si Gas: I1	SS			0582								
Thermanit A Si Gas: I1 bis I3	SS/SD									04149	43.132.02	
Thermanit A Si Gas: M11	DE			0242							43.132.02	
Thermanit A Si Gas: M11, M12	DE									00601	43.132.02	
Thermanit ATS 4 Gas: I1	SS			0948								
Thermanit ATS 4 Gas: I1, R1	SS/SD									01616		
Thermanit ATS 4 Gas: M12	DE									06522		
Thermanit GE-316L Gas: I1	SS			0433	ER316L	316L		4429			43.132.20	
Thermanit GE-316L Gas: I1, I3, R1	SS/SD									09500		
Thermanit GE-316L Si Gas: I1	SS			0165		316LM					43.132.10	
Thermanit GE-316L Si Gas: I1	SS/ SD					316L				00488		
Thermanit GE-316L Si Gas: M11	DE			0972	ER316L-Si							
Thermanit GE-316L Si Gas: M11, M12	DE					316L (M13)		4429S		00489	43.132.10	
Thermanit GE-316L Si Gas: M12	DE							4429S	ftV3R-12			
Thermanit H Si Gas: I1	SS										43.132.06	
Thermanit H Si Gas: I1 bis I3	SS/ SD									04163		
Thermanit H Si Gas: M11, M12	DE									00604	43.132.06	
Thermanit H-347 Gas: I1, I3, R1	SS/ SD									09475		
Thermanit JE-308L Gas: I1	SS			0969	ER308L						43.132.19	
Thermanit JE-308L Gas: I1, I3, R1	SS/ SD									09451		

Approvals and qualification tests for welding consumables

Wire electrodes, welding wires and welding rods

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Thermanit JE-308L Si Gas: I1	SS			1362	ER308L-Si							
Thermanit JE-308L Si Gas: I1, I3	SS/ SD									04164	43.132.08	
Thermanit JE-308L Si Gas: M11	DE			0003	ER308L-Si	308L (M23)						
Thermanit JE-308L Si Gas: M11,M12,Corgon1	DE									00555	43.132.08	
Thermanit MTS 3 Gas: I1	SS			1451								
Thermanit MTS 3 Gas: I1	SS/SD									06166		
Thermanit MTS 4 Si Gas: I1	SS/SD									02624		
Thermanit MTS 616 Gas: I1	SS									09290		
Thermanit MTS 911 Gas: I1	SS									07992		
Thermanit Nicro 82 Gas: I	SS/SD									01703		
Thermanit Nicro 82 Gas: I1	DE					NV5Ni		NiCr 20 Nb		03089		
Thermanit Nicro 82 Gas: I1	SS										43.132.11	
Thermanit Nimo C Gas: I1	DE									04381		
Thermanit Nimo C Gas: I1	SS									01790		
Thermanit Nimo C 24 Gas: I1	DE									06461		
Thermanit Nimo C 24 Gas: I1	SS/SD									06462		
Thermanit X Gas: I	SS/SD					C steel/ 18/8				01234		
Thermanit X Gas: I1	SS			0229							43.132.01	
Thermanit X Gas: M11	DE			0595		C steel/ 18/8 (M23)						
Thermanit X Gas: M11 bis M21	DE					C steel/ 18/8 (M13)				05651	43.132.01	
Thermanit X Gas: M12	DE							4370S				
Union A 600 IG Gas: C1, M21	DE										20.132	
Union AlMg 4,5 Mn Gas: I1	DE	ER 5183	RC/WC			5183		S-AlMg 4,5Mn	5083 O&F	02195	61.132.03	WIWEB
Union AlMg 4,5 Mn Gas: I1	SS									02196	61.132.03	WIWEB

Approvals and qualification tests for welding consumables

Wire electrodes, welding wires and welding rods

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Union AlMg 4,5 MnZr Gas: I1	DE							S-AlMg 4,5MnZr			61.132.04	WIWEB
Union AlMg 4,5 MnZr Gas: I1	SS							S-AlMg 4,5MnZr			61.132.04	WIWEB
Union AlMg 5 Gas: I1	DE	ER 5356						S-AlMg5	5083 O&F	02197	61.132.01	
Union AlMg 5 Gas: I1	SS									02198	61.132.01	
Union AlSi 5	DE/SS								^1		61.132.02	
Union FeNi 60 IG	DE										62.132.02	
Union I 1,2 Ni Gas: I1	SS/SD						VY46			00513 08012		
Union I 2,5 Ni Gas: I1	SS			0342								
Union I 2,5 Ni Gas: I1	SS/SD									07500		
Union I 52 Gas: I1	SD									03890	42.132.11	
Union I 52 Gas: I1	SS			0714		IIIYS				01656	42.132.11	
Union I CrMo Gas: C, M1, M2, M3	DE									00905	42.132.19	
Union I CrMo Gas: I	SS/SD									00906		
Union I CrMo Gas: I1	SS			0834			EV 18H				42.132.19	
Union I CrMo 5 Gas: I1	SS/SD									09107		
Union I CrMo 910 Gas: I	SS/SD									00908		
Union I CrMo 910 Gas: I1	SS			0151			EV 19H				42.132.06	
Union I CrMo 910 Gas: M1, M21	DE									00907	42.132.06	
Union I Mo Gas: C, M21	DE									01831	42.132.14	
Union I Mo Gas: I	SS/SD									01250		
Union I Mo Gas: I1	SS			0322			EV 17H				42.132.14	
Union I Mo Gas: M21	DE			1041								
Union I P23 Gas: I1	SS/SD									10271		
Union I P24Gas: I1	SS/SD									10157		
Union K 5 Ni Gas: C, M21	DE									00514	42.132.13	
Union K 52 Gas: C, M1, M2, M3	DE									00106	42.132.02	

Approvals and qualification tests for welding consumables

Wire electrodes, welding wires and welding rods

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Union K 52 Gas: C1	DE	3SA/2YSA		1108		IIIYMS	E 51 3	3YH15S	3S/3YSH15			
Union K 52 Gas: M21	DE	3SA/3YSA		0896		IIIYMS	E 51 3	3YH15S	3S/3YSH15			
Union K 52 Gas: M24	DE	3SA/3YSA		0896		IIIYMS		3YH15S	3S/3YSH15			
Union K 52 S Gas: C1	DE	3SA/2YSA				IIIYMS			3/3Y	09333		
Union K 52 S Gas: M21	DE	3SA/3YSA				IIIYMS			3/3Y	09333		
Union K 52 S Gas: M24	DE	3SA/3YSA				IIIYMS			3/3Y	09333		
Union K 52 T Gas: TIME-Gas	DE										42.132.20	
Union K 56 Gas: C, M1, M2, M3	DE									00376	42.132.01	
Union K 56 Gas: C1	DE	3SA/2YSA	3Y40	1367	ER480S-6	IIIYMS	E 51 3	3Y46H15S	3S/3YSH15		20.132.12	
Union K 56 Gas: M21	DE	3SA/3YSA	4Y40	0186		IIIYMS	E 51 3	3YH15S	3S/3YSH15			LR: ceram. back.
Union K 58 Gas: C, M1, M2, M3	DE									02537	42.132.07	
Union K Nova Gas: C, M21	DE									05926		
Union K Nova Gas: M21	DE			1459		IVY46MS						
Union K Nova Ni Gas: M21	DE					IVY46MS						
Union MoNi Gas: M21	DE					IIIY55MS		3Y55S		00926		WIWEB
Union MoNi Gas: M21 + M32	DE										42.132.09	
Union Ni 2,5 Gas: M21	DE	x (-60)	5Y50			VY50MS		7YS	3S/3YSH15	01627		
Union NiMoCr Gas: C1, M21, M33	DE										42.132.09	
Union NiMoCr Gas: M21	DE	x (-60)	5Y69			VY69MS		6Y69S		02760		
Union Patinax Gas: C, M21	DE									00337	42.132.05	
Union Rob 2 Gas: C, M1, M2, M3	DE									04168	42.132.16	
Union Rob 3 Gas: C, M1, M2, M3	DE									04169	42.132.17	
Union Rob 3 Gas: C1	DE										20.132.08	
Union SG 2-H Gas: C1, M21/23/24, M32	DE							3YS		03640	42.132.15	

Approvals and qualification tests for welding consumables

Wire electrodes, welding wires and welding rods

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Union SG 3-H Gas: C1, M21/23, M32	DE							3YS		07461	42.132.29	
Union X 85 Gas: M21	DE										42.132.21	
Union X 90 Gas: M21	DE									07675	42.132.12	
Union X 96 Gas: M21	DE										42.132.26	

Approvals and qualification tests for welding consumables

Gas welding rods

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Union 37	GS										70.132.01	
Union Mo	GS									02188	70.132.06	
Union Rot N	GS									02191	70.132.05	
Union Schwarz	GS										70.132.04	

Approvals and qualification tests for welding consumables

Wire/flux combinations

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Marathon 104 / Thermanit 17/15 TT	DPK					NV5Ni				09361		
Marathon 104 / Thermanit 18/17 E	DPK								ftV4R-12	06480		
Marathon 104 / Thermanit 19/15	DPK					NV5Ni				03911		
Marathon 104 / Thermanit 22/09	DPK							4462M				
Marathon 104 / Thermanit A	DPK									06086		
Marathon 104 / Thermanit ATS 4	DPK									07371		
Marathon 104 / Thermanit GE-316L	DPK									06085		
Marathon 104 / Thermanit H-347	DPK									06084		
Marathon 104 / Thermanit JE-308L	DPK									06083		
Marathon 111 / Thermanit 19/15	DPK									05805		
Marathon 213 / Thermanit 19/15	DPK							4429M				
Marathon 213 / Thermanit 20/10	DPK							4431M	ftV4R-12			
Marathon 213 / Thermanit 25/14 E-309L	DPK									09617		
Marathon 213 / Thermanit A	DPK									09616		
Marathon 213 / Thermanit GE-316L	DPK							4429M	ftV7P-12	09615		
Marathon 213 / Thermanit H-347	DPK									09613		

Approvals and qualification tests for welding consumables

Wire/flux combinations

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
Marathon 213 / Thermanit JE-308L	DPK									09612		
Marathon 431 / Thermanit 20/10	DPK									07801		
Marathon 431 / Thermanit 22/09	DPK	ER2209		1302		Duplex		4462TM	S31803	06112		
Marathon 431 / Thermanit A	DPK									06985		
Marathon 431 / Thermanit GE-316L	DPK			1372						06113		
Marathon 431 / Thermanit H-347	DPK									06479		
Marathon 431 / Thermanit JE-308L	DPK			1428						06114		
Marathon 444 / Thermanit 625	DPK							NiCr21Mo9Nb		10173		
Marathon 444 / Thermanit Nicro 82	DPK									07767		
Marathon 543 / Thermanit MTS 3	DPK			1373						06527		
Marathon 543 / Thermanit MTS 616	DPK									09391		
Marathon 543 / Thermanit MTS 911	DPK									09228		
OP 33 / ATS 4	DPK									06879		
OP 33 / Thermanit 20/10	DPK									06889		

Approvals and qualification tests for welding consumables

Wire/flux combinations

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
UV 305 / Union S 1 CrMo2	DPK									10284		
UV 305 / Union S 2 CrMo	DPK									10290		
UV 306 / Union S 1	DPK										51.132.04	
UV 306 / Union S 2	DPK	2M/2YM		0268		IIIYTM		3YTM	2M/2YM	02590	51.132.04	
UV 306 / Union S 2 Mo	DPK									07739		
UV 400 / Union S 2	DPK	3YTM	4Y40TM	1266		IIIYTM		3YTM	3YTM	06170	51.132.03	
UV 400 / Union S 2 Mo	DPK	3YT/4YM	4Y40TM	1370		IIIYT/IVYM		3YT/4YM	3YTM	06233	51.132.03	
UV 418 TT / Union S 2										10410		
UV 418 TT / Union S 3 Si	DPK		5Y46	1379		VY42(H5)		6Y42M	5Y42H5/5Y42sr	07276	51.132.05	

Approvals and qualification tests for welding consumables

Wire/flux combinations

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
UV 420 TT / Union S 1 CrMo 2	DPK						EV 19H			05209	51.132.02	
UV 420 TT / Union S 2 CrMo	DPK						EV 18H			01794		
UV 420 TT / Union S 2 Mo	DPK			0179			S 46A			01793		
UV 420 TT / Union S 3 NiMo 1	DPK			0189						03020		
UV 420 TT R / Union S 1 CrMo 2	DPK			0167						02734		
UV 420 TT R / Union S 2	DPK									03437		
UV 420 TT R / Union S 2 CrMo	DPK			0162						03439		
UV 420 TT R / Union S 2 Mo	DPK									03438		
UV 420 TT R / Union S 3	DPK									03440		
UV 420 TT R / Union S 3 Mo	DPK									03441		
UV 420 TT R / Union S 3 NiMo	DPK									03442		
UV 420 TT R / Union S 3 NiMo 1	DPK									03021 08015		
UV 420 TT R / Union S 3 NiMoCr	DPK									03443		
UV 420 TT R-W / Union S 1 CrMo 2	DPK									06541		
UV 420 TT/UV 420 TT-LH / Thermanit MTS 4	DPK									04674		
UV 420 TT-LH / Union Patinax U	DPK									01799	51.132.02	

Approvals and qualification tests for welding consumables

Wire/flux combinations

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
UV 420 TT-LH / Union S 1 CrMo 2	DPK									05209		
UV 420 TT-LH / Union S 2	DPK									03358	51.132.02	
UV 420 TT-LH / Union S 2 CrMo	DPK									01794		
UV 420 TT-LH / Union S 2 Mo	DPK									01793		
UV 420 TT-LH / Union S 3	DPK									01795		
UV 420 TT-LH / Union S 3 Mo	DPK									01796		
UV 420 TT-LH / Union S 3 NiMo	DPK									01797		
UV 420 TT-LH / Union S 3 NiMo 1	DPK									03020		
UV 420 TT-LH / Union S 3 NiMoCr	DPK									02206		
UV 421 TT / Union S 2	DPK								4Y40	05497	51.132.06	
UV 421 TT / Union S 2 Mo	DPK									03344	51.132.06	
UV 421 TT / Union S 2 Ni 2,5	DPK	Ni2	5Y42UM	0064		VYM		7YM	3M/5Y40M	02213	51.132.06	
UV 421 TT / Union S 2 Ni 370	DPK									08010 05210	51.132.06	
UV 421 TT / Union S 3	DPK					IVYM			4Y40M	05498		
UV 421 TT / Union S 3 NiMo	DPK							5Y55M				WIWEB DPA England

Approvals and qualification tests for welding consumables

Wire/flux combinations

Designation	Pro-duct	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
UV 421 TT / Union S 3 NiMoCr	DPK		4Y69M					5Y69M		05063	51.132.06	WIWEB
UV 421 TT / Union S 3 NiMo1	DPK					VY50		5Y50		temporary 460		
UV 421 TT / Union S 3 Si	DPK					IVY46MS		6Y42M	5Y46M	10424		
UV 430 TTR-W / Union S 1 CrMo2V	DPK									10231		
UV 430 TTR-W / Union S P 23	DPK									10294		
UV 430 TTR-W / Union S P 24	DPK									10293		

Approvals and qualification tests for welding consumables

SAW wires and welding fluxes

Designation	Art	ABS	BV	C	CWB	DNV	FT	GL	LR	TÜV	DB	Note
UV 306	PUL										51.132.04	
UV 400	PUL										51.132.03	
UV 418 TT	PUL										51.132.05	
UV 420 TT/LH	PUL										51.132.02	
UV 421 TT	PUL										51.132.06	
Thermanit 18/17 E	UP										52.132.12	
Thermanit A	UP										52.132.11	
Thermanit H-347	UP										52.132.10	
Union Patinax U	UP										52.132.09	
Union S 1	UP										52.132.01	
Union S 1 CrMo 2	UP										52.132.13	
Union S 2	UP										52.132.02	
Union S 2 CrMo	UP										52.132.08	
Union S 2 Mo	UP										52.132.06	
Union S 2 Ni 2,5	UP										52.132.15	
Union S 3	UP										52.132.03	
Union S 3 Mo	UP										20.132.13	
Union S 3 NiMoCr	UP										52.132.16	
Union S 3 Si	UP										52.132.14	
Union S 4 Mo	UP										52.132.07	
Union S 6	UP										52.132.05	

*Product::

DE = wire electrode
DEU = sub-arc-wire electrode
DPK = Draht-/Pulverkombination
FDE = flux cored wire
GS = gas welding rods
SD = welding wire
SE = covered electrode
SS = welding rods
PUL = welding flux

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Comparable unalloyed materials

Convert to EN-standards in preparing

Material category	DIN Designation	Material specification
1 Leading material	H I / H II C 16.8 GS-38 GS-45 H I H II RSt 37-2 SPH 235 SPH 265 St 33 St 35 St 35.4 St 35.8 St 37 St 37-3 St 37.0 St 37.4 St 37.8 St 38.7 StE 210.7 TTSt 35 N TTSt 35 V U St 37.0 WSt 37-2 WSt 37-2 WSt 37-3	DIN 17155 VdTÜV-Wbl. 370 DIN 1681 DIN 1681 DIN 17155 DIN 17155 DIN EN 10207 DIN EN 10207 DIN 17100 DIN 1629 DIN 1629 DIN 17175 DIN 17100 DIN 1628/1630 DIN 17177 DIN 17172 DIN 17173, 17174 DIN 17173, 17174 DIN 17100 DIN 17100
2 Leading material	StE 255 C 21 C 22.3 C 22.8 C 22.8 S1 GS-C 25 H III SPH 275 St 42.8 St 44	DIN 17102, 17179 VdTÜV-Wbl. 399 VdTÜV-Wbl. 364 DIN 17243/ VdTÜV-Wbl. 350 VdTÜV-Wbl. 453 DIN 17245 DIN EN 10207 DIN 17177
	St 44-2 St 44-3 St 44.0 St 44.4 St 45.4 St 45.8 StE 240.7 StE 255 TTSt 41 N TTSt 41 V TTSt 45 N TTSt 45 V	DIN 17100 DIN 17100 DIN 1626/1629 DIN 1628/1630 DIN 1629 DIN 17175 DIN 17172 (SEW 680)
3 Leading material	17 Mn 4 H IV StE 285 StE 290.7 StE 290.7 TM X 42 (API 5 LX)	DIN 17155/ 17175/17243 DIN 17102, 17179 DIN 17172 DIN 17172 DIN 17172
4 Leading material	StE 355 19 Mn 5 19 Mn 6 20 Mn 5 21 Mn 6 GS-21 Mn 5 St 52 St 52-3 St 52.0 St 52.4 StE 315 StE 320.7 StE 320.7 TM StE 360.7 StE 360.7 TM TStE 315	DIN 17102, 17179 DIN 17175 DIN 17155 DIN 17243 VdTÜV-Wbl. 373 SEW 685 DIN 17100 DIN 1626/1629 DIN 1628/1630 DIN 17102 DIN 17172 DIN 17172 DIN 17172 DIN 17172 DIN 17102
	TStE 355 WSt 52.3 WSt 52-3 WStE 255 bis WStE 315 WStE 355 WTSt 52-3 X 46 (API 5 LX) X 52 (API 5 LX)	DIN 17102 DIN 17100 DIN 17102 DIN 17102 SEW 087 DIN 17172 DIN 17172
5 Leading material	15 Mo 3 GS-22 Mo 4	DIN 17155/17175/ 17177/17243/45 DIN 17245
6 Leading material	13 CrMo 4 4 GS-17 CrMo 5 5	DIN 17155/17175/ 17243 DIN 17245
7 Leading material	GS-18 CrMo 9 10 10 CrMo 9 10 12 CrMo 9 10	DIN 17245 DIN 17155/17175/ 17243 VdTÜV-Wbl. 404
8 Leading material	StE 380 StE 385.7 StE 385.7 (TM)	DIN 17102 DIN 17172 DIN 17172
	StE 385.7 TM TStE 380 WStE 380 X 56 (API 5LX)	DIN 17172 DIN 17102 DIN 17102 DIN 17172
9 Leading material	StE 420 StE 415.7 StE 415.7 TM TStE 420 WStE 420 X 60 (API 5LX)	DIN 17102, 17179 DIN 17172 DIN 17172 DIN 17102 DIN 17102 DIN 17172
10 Leading material	StE 460 StE 445.7 TM TStE 460 WStE 460 X 65 (API LX5)	DIN 1702, 17179 DIN 17172 DIN 17102 DIN 17102 DIN 17172
11 Leading material	StE 500 StE 480.7 TM TStE 500 WStE 500 X 70 (API 5 LX)	DIN 17102 DIN 17172 DIN 17102 DIN 17102 DIN 17172

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Comparable austenitic materials and ferritic/austenitic materials, covered by the approvals.

Material category	DIN Designation	Material Number	Material specification
21			
Leading material	X 5 CrNi 18 10	1.4301	DIN 17440
	G-X 6 CrNi 18 9	1.4308	DIN 17445 VdTÜV-Wbl. 286
	X 12 CrNi 18 9	1.6900	
	G-X 8 CrNi 18 10	1.6901	SEW 685 VdTÜV-Wbl. 411
	X 6 CrNi 18 10	1.6902	SEW 685
	X 6 CrNi 18 10	1.6902	
	X 10 CrNiTi 18 10	1.6903	
22	also covered: Gruppe 21		
Leading material	X 2 CrNi 19 11	1.4306	DIN 17440
23			
Leading material	X 2 CrNiN 18 10	1.4311	DIN 17440
24	also covered: Gruppen 21 und 22		
Leading material	X 5 CrNiMo 17 12 2	1.4401	DIN 17440
25	also covered: Werkst. 1.4308 und 1.4408		
Leading material	X 2 CrNiMo 17 13 2	1.4404	DIN 17440
	G-X 6 CrNiMo 18 10	1.4408	DIN 17445 VdTÜV-Wbl. 286
26	also covered: Gruppe 23		
Leading material	X 2 CrNiMoN 17 13 3	1.4429	DIN 17440
	X 2 CrNiMoN 17 12 2	1.4406	DIN 17440
27	also covered: Gruppen 21, 22, 24 und 25		
Leading material	X 2 CrNiMo 18 14 3	1.4435	DIN 17440
	X 2 CrNiMo 17 12 2	1.4404	DIN 17440
28	also covered: Gruppen 21 und 24		
Leading material	X 5 CrNiMo 17 13 3	1.4436	DIN 17440
29	also covered: Gruppen 21 und 22		
Leading material	X 6 CrNiNb 18 10	1.4550	DIN 17440
	X 6 CrNiTi 18 10	1.4541	DIN 17440
	G-X 5 CrNiNb 18 9	1.4552	DIN 17445
	X 6 CrNi 18 11	1.4948	VdTÜV-W.Bl. 313, SEW 640
30	also covered: Gruppen 21, 22, 24, 25, 27, 28 und 29		
Leading material	X 10 CrNiMoNb 18 12	1.4583	
	X 6 CrNiMoTi 17 12 2	1.4571	DIN 17440
	X 10 CrNiMoTi 18 12	1.4573	
	X 6 CrNiMoNb 17 12 2	1.4580	DIN 17440
	G-X 5 CrNiMoNb 18 10	1.4581	DIN 17445 VdTÜV-Wbl. 286
31			
Leading material	X 2 CrNiMoN 22 5 3	1.4462	VdTÜV-W.Bl. 418
	X 2 CrNiN 23 4	1.4362	
	X 2 CrNiMoSi 19 5	1.4417	VdTÜV-W.Bl. 385

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Old and new base material designation

The national standards DIN 17 100, DIN 17 102 (only plate materials) and DIN 17 155 are replaced by european standard EN 10025, EN 10028-2 and EN 10028-3.
The following table shows the comparsion of old and new material designation.

Old material designation		New material designation	
Short name	Material specification	Short name	Material specification
UST 37-2		S235JRG1	
USt 37-2		S235JRG1	
RSt 37-2		S235JRG2	
St 37-3 N	DIN 17 100	S235J2G3	DIN EN 10025
St 44-2		S275JR	
St 44-3 N		S275J2G3	
St 52-3 N		S355J2G3	
H I		P235GH	
H II		P265GH	
17 Mn 4		P295GH	
19 Mn 6	DIN 17 155	P355GH	DIN EN 10028-2
15 Mo 3		16Mo3	
13 CrMo 4 4		13CrMo4-5	
10 CrMo 9 10		10CrMo9-10	
StE 285		P275N	
WStE 285		P275NH	
TStE 285		P275NL1	
EStE 285		P275NL2	
StE 355		P355N	
WStE 355	DIN 17 102	P355NH	DIN EN 10028-3
TStE 355		P355NL1	
EStE 355		P355NL2	
StE 460		P460N	
WStE 460		P460NH	
TStE 460		P460NL1	
EStE 460		P460NL2	

Included base materials – Deutsche Bahn

Besides those materials specified in the scope of “Übereinstimmungszertifikat” certificate of compliance the following materials are also included.

1. Unalloyed and low-alloy steels, cast steel, fine-grained structural steels and stainless steels

Material category	Certified materials	Materials also covered
1	S355J2G3 DIN EN 10 025	S235JR bis S355J2G3 DIN EN 10 025 S275N, M bis S355N, M DIN EN 10 113 GS 38, GS 45, GS 38.3, GS 45.3, GS 52, GS 52.3 DIN 1681 BSt 420S, BSt 500S, BSt 500M DIN 488
2	E335 DIN EN 10 025	E295, E335 DIN EN 10 025
3	E360 DIN EN 10 025	E295, E335, E360 DIN EN 10 025 GS 60, GS 52, GS 52.3, GS 60.3, GS 62.3 DIN 1681
4	S420N DIN EN 10 113	like category 1, additionally: S275N, M bis S420N, M DIN EN 10 113
5	S460N DIN EN 10 113	like category 4, additionally: S275N, M bis S460N, M DIN EN 10 113
6	S550Q DIN EN 10 137-2	NAXTRA 56, DSE 550 VB, VT, VE
7	S620Q DIN EN 10 137-2	like category 6, additionally: NAXTRA 63, XABO 63, DSE 620 VB, VT, VE
8	S690Q DIN EN 10 137-2	like category 6 and 7, additionally: DSE 690 VB, VT, VE, NAXTRA 70, T1, OX 812 M2
9	X 5 CrNi 18 10 (1.4301)	X 5 CrNi 18 10 (1.4301)
10	X 6 CrNiTi 18 10 (1.4541)	X 5 CrNi 18 10 (1.4301)
11	X6CrNiMoTi17-12-2 (1.4571) [1] DIN EN 10 088	X 5 CrNi 18 10 (1.4301) X 5 CrNiMo 17 12 2 (1.4401) X 6 CrNiTi 18 10 (1.4541) X 5 CrNiMo 17 12 2 (1.4571) DIN 17 440, DIN 17 441 X5CrNi18-10 (1.4301) X5CrNiMo17-12-2(1.4401) X6CrNiTi18-10 (1.4541) X6CrNiMo17-12-2(1.4571) DIN EN 10 088

1) also still valid 1.4583 – alternatively

Included base materials – Deutsche Bahn

2. Aluminium and aluminium-wrought alloys

Material category	Weld. consumable acc. to DIN 1732	Certified materials	Materials also covered
12	SG-AlMg5 bzw. SG-AlMg5Zr oder SG-AlMg4,5Mn bzw. SG-AlMg4,5MnZr	AlZn4,5Mg1 AlMg4,5Mn	AlMgSi 0,5 - AlMgSi 1, AlMg1,8, AlMg 3, AlMg2Mn0,8, AlMg2,7, AlMg 5, AlMg4,5Mn, AlZn4,5Mg1, AlMn1Mg1, AlCuMg1, AlZnMgCu0,5 DIN 1712 EN AW-AlMg, EN AW-AlSiMg, EN AW-AlSiMgMn, DIN EN 573 EN AW-AlMg3, EN AW-AlMg2,5, EN AW-AlMg2Mn0,8, EN AW-AlMg5, EN AW-AlMg4,5Mn0,7, EN AW-AlZn4,5Mg1 DIN EN 573
13	SG-AlMg 3	AlMg3	AlMg2Mn0,8 DIN 1712 EN AW-AlMg3 DIN EN 573
14a	SG-AlSi 5	AlMgSi1 AlSi-Guß-legierungen	AlMgSi 0,5 - AlMgSi 1 DIN 1712 EN AW-AlMg, EN AW-AlSiMg, EN AW-AlSi1MgMn DIN EN 573
14b			AlSi- and AlSiMg cast alloy acc. DIN 1725-2
14c			Category 14b in combination with Category 12
15	SG-Al 99,5 or SG-Al 99,5 Ti	Al99,5	Al99,5 - Al99,8 DIN 1712 EN AW-Al99,5, EN AW-Al99,8 DIN EN 573

Recommendations of Thermanit welding consumables for high alloyed steels/cast steel grades

* = Data upon request

Parent material			Thermanit filler metal		
Mat. No.	Short name	AISI/SAE/ UNS/Alloy	Weld-ability	Equivalent or similar	Higher alloyed
Materials with special physical properties (non magnetic)					
1.3805	X35Mn18		+	19/15	20/16 SM
1.3914	X2CrNiMnMoNNb21-15-7-3		+	20/16 SM	
1.3941	(G-)X4CrNi18-13		+	18/17 E, 19/15	20/16 SM
1.3945	X2CrNiN18-11		+	19/15	
1.3948	X4CrNiMnMoN19-13-8		+	19/15	20/16 SM
1.3951	X2CrNiMoN22-15 / GX4CrNiMoN22-15		+	20/16 SM	
1.3952	(G)X2CrNiMoN18-14-3		+	18/17 E, 19/15	
1.3953	(G-)X2CrNiMo18-15		+	18/17 E, 19/15	20/16 SM
1.3955	GX12CrNi18-11		+	18/17 E, 19/15	20/16 SM
1.3957	X2CrNiMoNbN21-15		+	20/16 SM	
1.3958	X5CrNi18-11		+	18/17 E	
1.3964	(G-)X2CrNiMnMoNNb21-16-5-3	50	+	20/16 SM	
1.3965	X8CrMnNi18-8		+	19/15	20/16 SM
Stainless steels					
1.4000	X6Cr13	403	+	14 K	CM, Nicro 82
1.4001	X7Cr14 / G-X7Cr13	429	+	14 K	CM, Nicro 82
1.4002	X6CrAl13	405	+	14 K	CM, Nicro 82
1.4003	X2CrNi12 / X2Cr11		+	14 K	JE, X, Nicro 82
1.4006	(G)X12Cr13	410	+	14 K	JE, X, Nicro 82
1.4008	GX8CrNi13 (GX7CrNiMo12-1)		+	14 K	13/04, Nicro 82
1.4016	X6Cr17	430	o	1610, 17	JE
1.4021	X20Cr13	420	o	14 K	Nicro 82
1.4024	X15Cr13		o	14 K	Nicro 82
1.4027	GX20Cr14		o	14 K	Nicro 82
1.4057	X17CrNi16-2	431	o	17	
1.4059	GX22CrNi17		o	17	
1.4107	GX8CrNi12		o	MTS 4	
1.4113	X6CrMo17-1	434	o		JE, HE, X
1.4120	(G)X20CrMo13		o		Nicro 82
1.4122	X39CrMo17-1 / (G)X35CrMo17	440C	o	1740	

Recommendations of Thermanit welding consumables for high alloyed steels/cast steel grades

* = Data upon request

Parent material			Thermanit filler metal		
Mat. No.	Short name	AISI/SAE/ UNS/Alloy	Weld-ability	Equivalent or similar	Higher alloyed
1.4301	X5CrNi18-10	304	+	JE	H, HE
1.4303	X4CrNi18-12	308	+	JE	H, HE
1.4306	X2CrNi19-11	304L	+	JE	H, HE
1.4308	GX5CrNi19-10 / GX6CrNi18-9	CF-8	+	JE	H, HE
1.4311	X2CrNiN18-10	304LN	+	JE	H, HE
1.4312	GX10CrNi18-8		+	JE	H, HE
1.4313	X3CrNiMo13-4 / X4CrNi13-4 / GX5CrNi13-4	CA6-NM	+	13/04	17/06
1.4315	X5CrNiN19-9		+	JE	19/15
1.4318	X2CrNiN18-7		+	JE, HE	GE, 19/15
1.4335	X1CrNi25-21		+		25/22 H, 30/40 E
1.4339	GX32CrNi28-10		+	30/10	
1.4340	GX40CrNi27-4		o	L	30/10
1.4347	GX8CrNiN26-7 (GX6CrNiN26-7)		+	L	30/10
1.4362	X2CrNiN23-4	32.304	+		22/09
1.4401	X5CrNiMo17-12-2	316	+	GE, A	18/17 E
1.4404	X2CrNiMo17-12-2 / GX2CrNiMoN18-10	316L	+	GE, A	18/17 E, 19/15
1.4405	X5CrNiMo16-5 / GX4CrNiMo16-5-1		+	17/06	
1.4406	X2CrNiMoN17-11-2	316LN	+	GE, A	18/17 E, 19/15
1.4407	GX5CrNiMo13-4		+	13/04	17/06
1.4408	GX5CrNiMo19-11-2 / GX6CrNiMo18-10	CF-8M	+	GE, A	19/15
1.4410	X2CrNiMoN25-7-4	32750	+	25/09 CuT	
1.4414	GX4CrNiMo13-4		+	13/04	17/06
1.4418	X4CrNiMo16-5-1		+	17/06	
1.4420	X5CrNiMo18-11		+	GE, A	19/15
1.4429	X2CrNiMoN17-13-3	316LN	+	GE, A	18/17 E, 19/15
1.4435	X2CrNiMo18-14-3	316L	+	GE, A	18/17 E, 19/15
1.4436	X3CrNiMo17-13-3	316	+	GE, A	18/17 E, 19/15
1.4437	GX6CrNiMo18-12		+	GE, A	18/17 E, 19/15

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Recommendations of Thermanit welding consumables for high alloyed steels/cast steel grades

* = Data upon request

Parent material			Thermanit filler metal		
Mat. No.	Short name	AISI/SAE/ UNS/Alloy	Weld-ability	Equivalent or similar	Higher alloyed
1.4438	X2CrNiMo18-15-4	317L	+	18/17 E	20/25 Cu, 30/40 E
1.4439	X2CrNiMoN17-13-5	31726	+	18/17 E	30/40 E, 625
1.4446	GX2CrNiMoN17-13-4		+	18/17 E	
1.4448	GX6CrNiMo17-13		+	18/17 E	
1.4460	X3CrNiMoN27-5-2	329	+	22/09	
1.4462	X2CrNiMoN22-5-3	2205	+	22/09	
1.4463	GX6CrNiMo24-8-2		+	22/09	
1.4464	GX40CrNiMo27-5		o	22/09	
1.4465	X1CrNiMoN25-25-2 / GX2CrNiMoN25-25-2		+	25/22 H	30/40 E
1.4466	X1CrNiMoN25-22-2		+	25/22 H	30/40 E
1.4467	X2CrMnNiMoN26-5-4		+		25/09 CuT
1.4468	GX3CrNiMoN26-6-3 (GX2CrNiMoN25-6-3)		+		25/09 CuT
1.4469	GX2CrNiMoN26-7-4 / G-X2CrNiMoN25-7-4	SX	+		25/09 CuT
1.4500	GX7NiCrMoCuNb25-20		+	20/25 Cu	30/40 E
1.4501	X2CrNiMoCuWN25-7-4	32760	+	25/09 CuT	
1.4503	X3NiCrCuMoTi27-23		+		30/40 E
1.4505	X4NiCrMoCuNb20-18-2		+	20/25 Cu	30/40 E
1.4506	X5NiCrMoCuTi20-18		+	20/25 Cu	30/40 E
1.4507	X2CrNiMoCuN25-6-3	32550	+	25/09 CuT	
1.4509	X2CrTiNb18		o		HE, X
1.4510	X3CrTi17	439	o	1610	H, JE
1.4511	X3CrNb17		o	1610	H
1.4512	X2CrTi12 / X6CrTi12	409	+	409 Cb	X
1.4515	GX3CrNiMoCuN26-6-3		+	25/09 CuT	
1.4517	GX2CrNiMoCuN25-6-3-3 / GX3CrNiMoCuN26-6-3-3		+	25/09 CuT	
1.4529	X1NiCrMoCuN25-20-7 (X1NiCrMoCuN25-20-6)	31254	+	26/22/5*	625, Nimo C, Nimo C 24
1.4531	GX2NiCrMoCuN20-18		+	20/25 Cu	30/40 E, 625
1.4536	GX2NiCrMoCuN25-20		+	20/25 Cu	30/40 E

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Recommendations of Thermanit welding consumables for high alloyed steels/cast steel grades

* = Data upon request

Parent material			Thermanit filler metal		
Mat. No.	Short name	AISI/SAE/ UNS/Alloy	Weld-ability	Equivalent or similar	Higher alloyed
1.4538	X2NiCrMoCuN20-18		+	20/25 Cu	30/40 E
1.4539	X1NiCrMoCu25-20-5	904L	+	20/25 Cu	30/40 E, 625
1.4541	X6CrNiTi18-10	321	+	H, HE, JE	A
1.4550	X6CrNiNb18-10	347	+	H, HE, JE	A
1.4552	GX5CrNiNb19-11 / GX5CrNiNb18-9		+	H, HE, JE	A
1.4558	X2NiCrAlTi32-20		+		Nicro 82, 625, 617
1.4561	X1CrNiMoTi18-13-2		+		19/15
1.4562	X1NiCrMoCu32-28-7	31	+		Nimo C
1.4563	X1NiCrMoCu31-27-4 / X1NiCrMoCuN31-27-4	Sanicro 28	+	30/40 E	Nimo C, 625
1.4565	X2CrNiMnMoNbN25-18-5-4	34565	+	26/22/5*	Nimo C, Nimo C 24
1.4569	GX2CrNiMnMoNNb21-15-4-3		+	20/16 SM	
1.4571	X6CrNiMoTi17-12-2	316Ti	+	A, GE	19/15
1.4573	X10CrNiMoTi18-12	316Ti	+	A, GE	19/15
1.4577	X3CrNiMoTi25-25		+	25/22 H	30/40 E
1.4580	X6CrNiMoNb17-12-2	316Cb	+	A, GE	19/15
1.4581	GX5CrNiMoNb19-11-2 / GX5CrNiMoNb18-10		+	A, GE	
1.4582	X4CrNiMoNb25-7		+	22/09	25/09 CuT
1.4583	(G)X10CrNiMoNb18-12	318	+	A, GE	
1.4585	GX7CrNiMoCuNb18-18		+	20/25 Cu	30/40 E
1.4586	X5NiCrMoCuNb22-18		+	20/25 Cu	30/40 E
1.4589	X5CrNiMoTi15-2		+		JE, X
Creep resistant and/or corrosion resistant steels / alloys					
2.4602	NiCr21Mo14W	C-22	+		Nimo C 24
2.4605	NiCr23Mo16Al	59	+	Nimo C 24	
2.4606	NiCr21Mo16W	686	+		Nimo C 24
2.4610	NiMo16Cr16Ti	C-4	+	Nimo C	Nimo C 24
2.4630	NiCr20Ti	75	+	Nicro 82	625
2.4631	NiCr20TiAl	80A	+	Nicro 82	625
2.4633	NiCr25FeAlY	602CA	+	617	

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Recommendations of Thermanit welding consumables for high alloyed steels/cast steel grades

* = Data upon request

Parent material			Thermanit filler metal		
Mat. No.	Short name	AISI/SAE/ UNS/Alloy	Weld-ability	Equivalent or similar	Higher alloyed
2.4642	NiCr29Fe	690	+	690	
1.4652	X1CrNiMoN24-22-7	32654	+	Nimo C 24	
2.4660	NiCr20CuMo	20Cb3	+	30/40 E	625, Nimo C
2.4663	NiCr23Co12Mo	617	+/o	617	
Hitzebeständige Stähle					
1.4710	GX30CrSi6		o	17	X, D
1.4712	X10CrSi6		o	17	X, D
1.4713	X10CrAl7 (X10CrAlSi7)		o	17	X, D
1.4724	X10CrAl13 (X10CrAlSi13)	Sicromal 9	o	17	L, D
1.4729	GX40CrSi13		o	17	D
1.4740	GX40CrSi17		o	17	D
1.4742	X10CrAl18 (X10CrAlSi18)	Sicromal 10	o	17	L, D
1.4745	GX40CrSi23		o		L, C
1.4746	X8CrTi25		o		L, C
1.4762	X10CrAl24 (X10CrAlSi25)	446	o		L, C
1.4776	GX40CrSi29		o		L, CR
1.4815	GX8CrNi19-10		+	ATS 4	X, D
2.4816	NiCr15Fe (NiCr15Fe8)	600	+	Nicro 82	625, 617
2.4817	LC-NiCr15Fe	602	+	Nicro 82	
2.4819	NiMo16Cr15W	C-276	+		Nimo C 24
1.4821	X20CrNiSi25-4 (X15CrNiSi25-4)		o/+	L	C
1.4822	GX40CrNi24-5		o	L	C, CR
1.4823	GX40CrNiSi27-4		o	L	C, CR
1.4825	GX25CrNiSi18-9		+		X, D
1.4826	GX40CrNiSi22-9		+	D	CM, CR
1.4827	GX8CrNiNb19-10		+	ATS 4	
1.4828	X15CrNiSi20-12	309	+	D	C, CM
1.4832	GX25CrNiSi20-14		+	D	CM
1.4833	X7CrNi23-14 / X12CrNi24-12 (X12CrNi23-13)	309S	+	CM	
1.4837	GX40CrNiSi25-12		+	C, CR	

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Recommendations of Thermanit welding consumables for high alloyed steels/cast steel grades

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Parent material			Thermanit filler metal		
Mat. No.	Short name	AISI/SAE/ UNS/Alloy	Weld-ability	Equivalent or similar	Higher alloyed
1.4840	GX15CrNi25-20		+	C, CR	25/24 R
1.4841	X15CrNiSi25-20 (X15CrNiSi25-21)	310	+	C, CR	
1.4845	X12CrNi25-21 (X8CrNi25-21)	310S	+	C, CR	
1.4847	X8CrNiAlTi20-20	334	o	21/33 (So)	
1.4848	GX40CrNiSi25-20	HK	+	CR	
1.4849	GX40NiCrSiNb38-18		+	21/33	25/35 R
2.4851	NiCr23Fe	601	+	Nicro 82	617, 625
1.4852	GX40NiCrSiNb35-25		+	25/35 R	
2.4856	NiCr22Mo9Nb	625	+	625	617
1.4857	GX40NiCrSi35-25		+	25/35 R	
2.4858	NiCr21Mo	825	+	30/40 E	625
1.4859	GX10NiCrNb32-20		+	21/33 (So)	Nicro 82
1.4861	X10NiCr32-20		+	21/33 (So)	Nicro 82, 625
1.4864	X12NiCrSi36-16 (X12NiCrSi35-16)	330	+	21/33	
1.4865	GX40NiCrSi38-18		+	21/33	25/35 R
1.4876	X10NiCrAlTi32-20 (X10NiCrAlTi32-21)	800(H)	+	21/33 (So)	Nicro 82, 617
1.4877	X6NiCrNbCe32-27	AC66	o		617, 625
1.4878	X12CrNiTi18-9 (X10CrNiTi18-10)	321	+	ATS 4	X, D
1.4885	X12CrNiMoNb20-15		+		CM
1.4893	X8CrNiSiN21-11	30815	+	D	C
High temperature resistant steels					
1.4903	X10CrMoVNb9-1	P91	+	MTS 3	
1.4905	X11CrMoWVNb9-1-1		+	MTS 911	
1.4919	X6CrNiMo17-13	316H	+		Nicro 82
1.4921	X19CrMo12-1		o	MTS 4	
1.4922	X20CrMoV12-1		o	MTS 4	

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Recommendations of Thermanit welding consumables for high alloyed steels/cast steel grades

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Parent material			Thermanit filler metal		
Mat. No.	Short name	AISI/SAE/ UNS/Alloy	Weld-ability	Equivalent or similar	Higher alloyed
1.4923	X22CrMoV12-1		o	MTS 4	
1.4926	X21CrMoV12-1		o	MTS 4	
1.4931	GX23CrMoV12-1		o	MTS 4	
1.4935	X20CrMoWV12-1	422	o	MTS 4	
1.4948	X6CrNi18-11 (X6CrNi18-10)	304H	+	ATS 4	Nicro 82
1.4949	X3CrNiN18-11		+	ATS 4	Nicro 82
2.4951	NiCr20Ti	75	+	Nicro 82	617, 625
2.4952	NiCr20TiAl	80A	+	Nicro 82	617, 625
1.4959	X8NiCrAlTi32-21	800HT	+	21/33	617
1.4961	X8CrNiNb16-13		+		Nicro 82
1.4968	GX7CrNiNb16-13		+		Nicro 82
1.4981	X8CrNiMoNb16-16		+		Nicro 82
1.4988	(G)X8CrNiMoVNb16-13		+		Nicro 82
Alloyed stainless steels					
1.5637	12Ni14 / 10Ni14	A350-LF3	+		17/15 TT, 19/15, Nicro 82/182
1.5638	G9Ni14 / GS-10Ni14		+		17/15 TT, 19/15, Nicro 82/182
1.5662	(G)X8Ni9	A353	+		13/65 TTW 150, 17/15 TT, Nicro 82, 625
1.5680	12Ni19 / X12Ni5	2515	+		17/15 TT, 19/15, Nicro 82, 625
1.5681	GX10Ni5 / GS-10Ni19		+		17/15 TT, 19/15, Nicro 82, 625
1.6902	G-X6CrNi18-10 (GX6CrNi18-10)		+	JE, 17/15 TT, 19/15	Nicro 82, 625
1.6905	GX5CrNiNb18-10		+	JE, 17/15 TT, 19/15	Nicro 82, 625
1.6907	X3CrNiN18-10		+	JE, 17/15 TT, 19/15	Nicro 82, 625
1.6909	X5CrMnNiN18-9		+	JE, 17/15 TT, 19/15	Nicro 82, 625
1.6967	X3CrNiMoN18-14		+	JE, 17/15 TT, 19/15	Nicro 82, 625

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Physical properties of high alloyed weld metals

THERMANIT	Density	Specific heat capacity at +20 °C	Specific electrical resistance at +20 °C	Heat conductivity at +20 °C	Thermal expansion coefficient (10^{-6}/°C) between +20 °C and			
	g/cm³	J/g · °C	Ohm · mm²/m	W/m · °C	100 °C	500 °C	800 °C	1000 °C
Alphabetical order:								
A	7,9	0,50	0,75	15	14,6	16,5	17,9	–
ATS 4	7,9	0,50	0,74	15	14,5	17,2	18,3	–
C	7,9	0,50	0,73	15	14,2	17,2	18,0	18,8
CM	7,9	0,50	0,73	15	14,2	17,2	18,0	18,8
CR	7,9	0,50	0,73	15	14,0	17,0	18,0	19,0
D	7,9	0,50	0,85	15	14,4	17,1	18,2	19,1
GE	7,9	0,50	0,75	15	15,0	17,1	18,3	–
HE	7,9	0,50	0,73	15	14,8	16,7	18,1	–
JE	7,9	0,50	0,73	15	14,5	17,2	18,3	–
L	7,7	0,50	0,80	17	8,7	12,6	13,6	–
MTS 4	7,8	0,46	0,75	25	9,1	11,6	12,0 (600 °C)	–
NICRO 82	8,2	0,46	1,10	13	10,4	14,8	16,3	–
NICRO 182	8,1	0,46	1,15	13	10,0	15,2	16,4	–
NIMO C	8,9	0,38	1,33	13	11,1	13,2	14,3	–
X	7,9	0,50	0,75	15	14,6	18,3	19,3	–
Numerical order:								
13/04	7,7	0,46	0,70	25	7,8	11,8	–	–
13/65 TTW 150	8,2	0,46	1,09	13	11,5	13,8	–	–
14 H	7,7	0,46	0,75	25	8,7	11,3	12,3	–
14 K	7,7	0,46	0,75	25	8,2	11,7	12,5	–

THERMANIT	Density	Specific heat capacity at +20 °C	Specific electrical resistance at +20 °C	Heat conductivity at +20 °C	Thermal expansion coefficient (10^{-6}/°C) between +20 °C and			
	g/cm³	J/g · °C	Ohm · mm²/m	W/m · °C	100 °C	500 °C	800 °C	1000 °C
1610	7,7	0,46	0,70	25	8,4	11,5	12,0	–
17	7,7	0,46	0,70	25	8,1	11,4	12,2	–
17/06	7,7	0,46	0,70	25	7,7	11,6	–	–
17/15 TT	7,9	0,50	0,73	14	16,8	–	–	–
1720	7,7	0,46	0,70	25	7,8	11,5	11,8	–
1740	7,7	0,46	0,70	25	7,9	11,0	11,3	–
18/17 E	8,0	0,50	0,85	17	15,1	17,3	18,5	–
19/15 (H)	7,9	0,50	0,85	15	14,5	17,3	18,7	–
20/10	7,9	0,50	0,75	15	15,0	17,1	18,3	–
20/16	7,9	0,50	0,85	15	14,5	17,3	18,7	–
20/16/510	7,9	0,50	0,85	15	14,6	17,5	18,9	–
20/25 Cu	7,9	0,50	0,78	15	15,5	18,3	–	–
21/33 (So)	8,0	0,50	0,90	15	13,7	16,0	17,1	17,8
22/09	7,9	0,50	0,73	15	14,5	17,1	18,6	–
23/11 MoZL	7,9	0,50	0,85	15	15,1	17,3	18,5	–
25/14 E	7,9	0,50	0,85	15	14,3	16,8	17,8	–
25/22 H	7,9	0,50	0,85	15	14,4	16,9	17,9	–
25/35 R	8,0	0,50	0,90	15	13,5	15,1	17,0	19,5
30/10	7,8	0,50	0,80	16	10,0	15,0	16,2	–
30/40 E	8,2	0,42	0,90	15	14,7	17,5	18,4	–
625	8,4	0,44	1,19	11,5	12,0	13,5	15,1	16,1

Hardness conversion table

R_m = Tensile strength (N/mm²)
HV = Vickers hardness
HB = Brinell hardness
HRC = Rockwell hardness

R_m	HV	HB	HRC
200	63	60	–
210	65	62	–
220	69	66	–
225	70	67	–
230	72	68	–
240	75	71	–
250	79	75	–
255	80	76	–
260	82	78	–
270	85	81	–
280	88	84	–
285	90	86	–
290	91	87	–
300	94	89	–
305	95	90	–
310	97	92	–
320	100	95	–
330	103	98	–
335	105	100	–
340	107	102	–
350	110	105	–
360	113	107	–
370	115	109	–
380	119	113	–
385	120	114	–
390	122	116	–
400	125	119	–
410	128	122	–
415	130	124	–
420	132	125	–
430	135	128	–
440	138	131	–
450	140	133	–
460	143	136	–
465	145	138	–
470	147	140	–
480	150	143	–
490	153	145	–
495	155	147	–
500	157	149	–
510	160	152	–
520	163	155	–
530	165	157	–
540	168	160	–
545	170	162	–
550	172	163	–
560	175	166	–
570	178	169	–
575	180	171	–
580	181	172	–
590	184	175	–
595	185	176	–
600	187	178	–
610	190	181	–
620	193	184	–
625	195	185	–
630	197	187	–
640	200	190	–
650	203	193	–
660	205	195	–
670	208	198	–
675	210	199	–
680	212	201	–
690	215	204	–
700	219	208	–
705	220	209	–
710	222	211	–
720	225	214	–
730	228	216	–
740	230	219	–
750	233	221	–
755	235	223	–
760	237	225	–
770	240	228	–
780	243	231	21
785	245	233	
790	247	235	
800	250	238	22
810	253	240	
820	255	242	23
830	258	245	
835	260	247	24
840	262	249	
850	265	252	
860	268	255	25
865	270	257	
870	272	258	26
880	275	261	
890	278	264	
900	280	266	27
910	283	269	
915	285	271	
920	287	273	28
930	290	276	
940	293	278	29
950	295	280	
960	299	284	
965	300	285	
970	302	287	30
980	305	290	
990	308	293	
995	310	295	31
1000	311	296	
1010	314	299	
1020	317	301	32
1030	320	304	
1040	323	307	
1050	327	311	33
1060	330	314	
1070	333	316	
1080	336	319	34
1090	339	322	
1095	340	323	
1100	342	325	
1110	345	328	35
1120	349	332	
1125	350	333	
1130	352	334	
1140	355	337	36
1150	358	340	
1155	360	342	
1160	361	343	
1170	364	346	37
1180	367	349	
1190	370	352	
1200	373	354	38
1210	376	357	
1220	380	361	
1230	382	363	39
1240	385	366	
1250	388	369	
1255	390	371	

Hardness conversion table

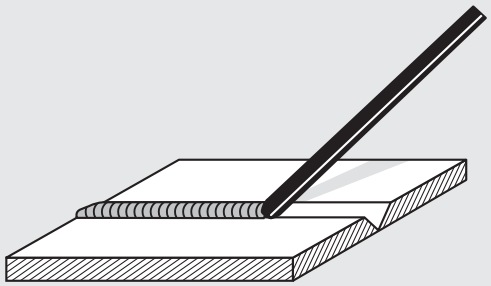
R_m = Tensile strength (N/mm²)
HV = Vickers hardness
HB = Brinell hardness
HRC = Rockwell hardness

R_m	HV	HB	HRC
1260	392	372	40
1270	394	374	
1280	397	377	
1290	400	380	
1300	403	383	41
1310	407	387	
1320	410	390	
1330	413	393	42
1340	417	396	
1350	420	399	
1360	423	402	43
1370	426	405	
1380	430	409	
1390	431	410	
1400	434	413	44
1410	437	415	
1420	440	418	
1430	443	421	45
1440	446	424	
1450	449	427	
1455	450	428	
1460	452	429	
1470	455	432	
1480	458	435	46
1485	460	437	
1490	461	438	
1500	464	441	
1510	467	444	
1520	470	447	
1530	473	449	47
1540	476	452	
1550	479	455	
1555	480	456	
1560	481		
1570	484		48
1580	486		
1590	489		
1595	490		
1600	491		
1610	494		
1620	497		49
1630	500		
1640	503		
1650	506		
1660	509		
1665	510		
1670	511		
1680	514		50
1690	517		
1700	520		
1710	522		
1720	525		
1730	527		51
1740	530		
1750	533		
1760	536		
1770	539		
1775	540		
1780	541		
1790	544		52
1800	547		
1810	550		
1820	553		
1830	556		
1840	559		
1845	560		53
1850	561		
1860	564		
1870	567		
1880	570		
1890	572		
1900	575		
1910	578		54
1920	580		
1930	583		
1940	586		
1950	589		
1955	590		
1960	591		
1970	594		
1980	596		55
1990	599		
1995	600		
2000	602		
2010	605		
2020	607		
2030	610		
2040	613		
2050	615		56
2060	618		
2070	620		
2080	623		
2090	626		
2100	629		
2105	630		
2110	631		
2120	634		
2130	636		
2140	639		57
2145	640		
2150	641		
2160	644		
2170	647		
2180	650		
2190	653		
2200	655		58
	675		59
	698		60
	720		61
	745		62
	773		63
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	829		65
	864		66
	900		67
	940		68

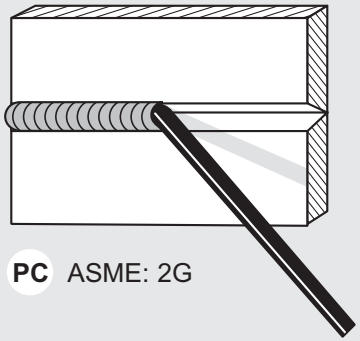
Caution: Because of their approximate nature, conversion tables must be regarded as only an estimate of comparative values. It is recommended that hardness conversions be applied primarily to values such as specification limits, which are established by agreement or mandate, and that the conversion of test data be avoided whenever possible.

Welding positions according to EN 287 / EN ISO 6947 and ASME code, section IX

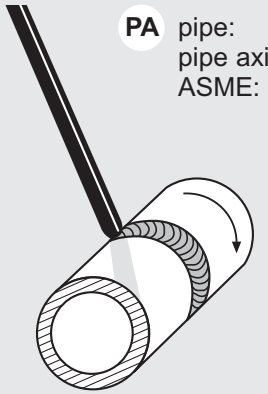
Butt welds



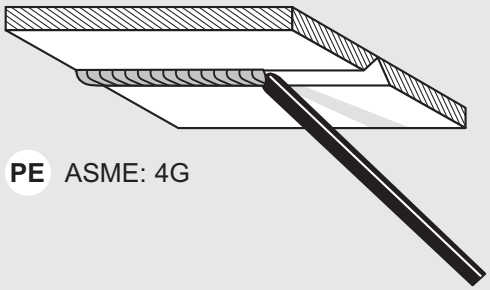
PA ASME: 1G



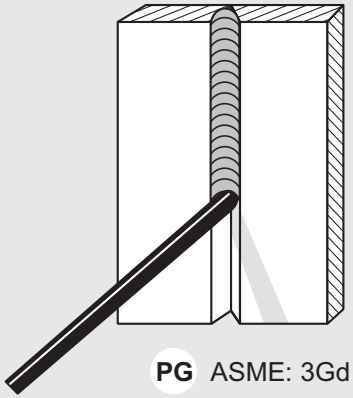
PC ASME: 2G



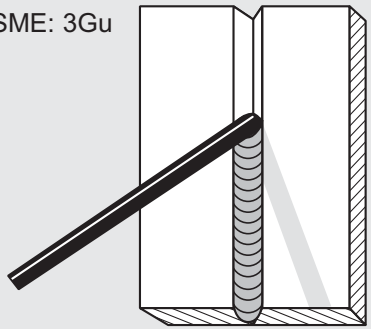
PA pipe: rotated
pipe axis: horizontal
ASME: 1G



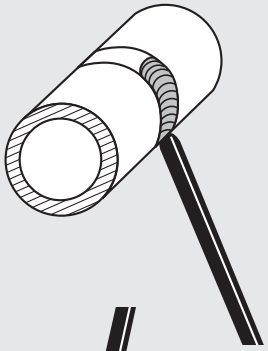
PE ASME: 4G



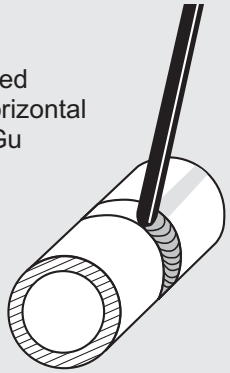
PG ASME: 3Gd



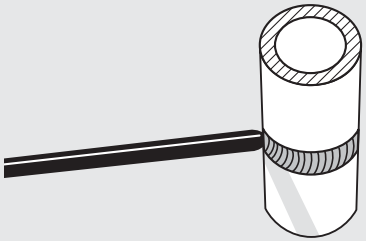
PF ASME: 3Gu



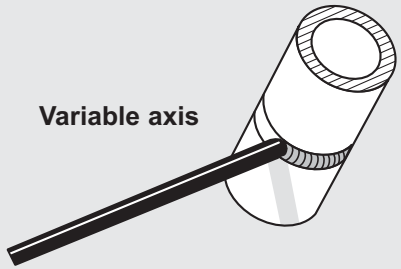
PG pipe: fixed
pipe axis: horizontal
ASME: 5Gd



PF pipe: fixed
pipe axis: horizontal
ASME: 5Gu



PC pipe: fixed
pipe axis: vertical
ASME: 2G

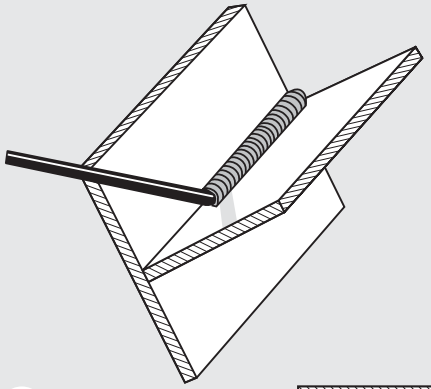


Variable axis

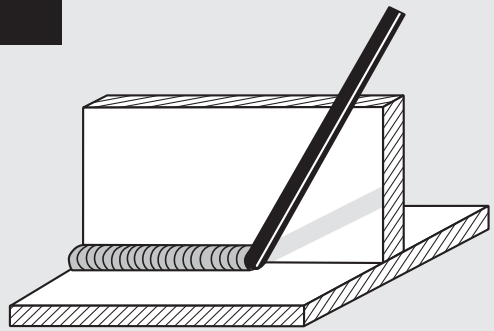
H-LO45 pipe: fixed
pipe axis: inclined (e.g. 45°)
ASME: 6G

Welding positions according to EN 287 / EN ISO 6947 and ASME code, section IX

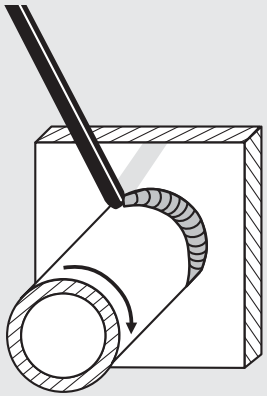
Fillets welds



PA ASME: 1F

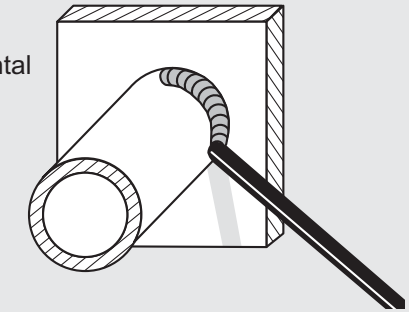


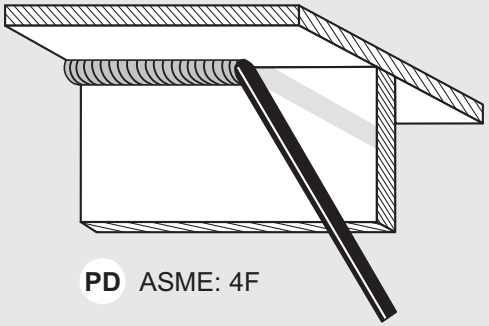
PB ASME: 2F



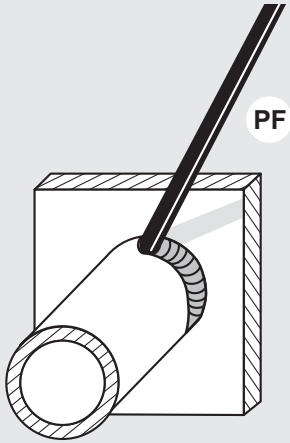
PB pipe: rotated
pipe axis: horizontal
ASME: 2F

PG pipe: fixed
pipe axis: horizontal
ASME: 5Fd

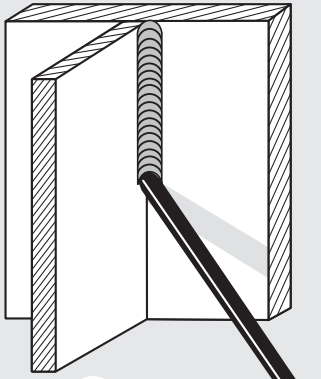




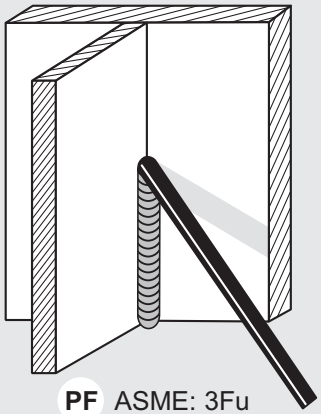
PD ASME: 4F



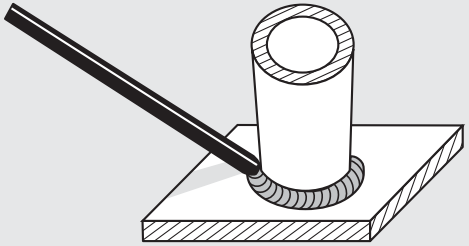
PF pipe: fixed
pipe axis: horizontal
ASME: 5Fu



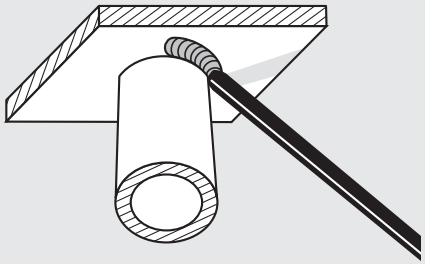
PG ASME: 3Fd



PF ASME: 3Fu



PB pipe: fixed
pipe axis: vertical
ASME: 2F



PD pipe: fixed
pipe axis: vertical
ASME: 4F

Consumables
(alphanumerical)

Page	Type	M.-No.	EN / •EN ISO	AWS	Product*	Page
370-373	Marathon 104	–	760 SA FB 2 55 AC	– –	PUL	370-373
374-375	Marathon 213	–	760 SF CS 2 63 DC	– –	PUL	374-375
376-377	Marathon 431	–	760 SA FB 2 64 DC	– –	PUL	376-377
378-379	Marathon 444	–	760 SA FB 2 AC	– –	PUL	378-379
324-325	Marathon 543	–	760 SA FB 2 55 DC	– –	PUL	324-325
12	Phoenix Blau	–	499 E 42 0 RC 11	A 5.1 E6013	SE	12
13	Phoenix Blau Mo	–	1599 E Mo R 1 1	A 5.5 E7011-A1	SE	13
14	Phoenix Cel 70	–	499 E 42 2 C 25	A 5.1 E6010	SE	14
15	Phoenix Cel 75	–	499 E 42 2 C 25	A 5.5 E7010-P1	SE	15
16	Phoenix Cel 80	–	499 E 46 3 C 25	A 5.5 E8010-P1	SE	16
17	Phoenix Cel 90	–	499 E 50 3 1 Ni C 25	A 5.5 E9010-G	SE	17
18	Phoenix Chromo 1	–	1599 E CrMo1 B 4 2 H5	A 5.5 E8018-B2	SE	18
19	Phoenix Grün (Sheet metal)	–	499 E 42 0 R 12	A 5.1 E6012	SE	19
20	Phoenix Grün M	–	499 E 42 0 RR 12	A 5.1 E6013	SE	20
21	Phoenix Grün T	–	499 E 42 0 RR 12	A 5.1 E6013	SE	21
22	Phoenix K 50	–	499 E 42 4 B 42	A 5.1 E7015	SE	22
23	Phoenix K 50 R	–	499 E 42 3 B 32	A 5.1 E7016	SE	23
24	Phoenix K 90 S	–	499 E 46 4 B 32 H5	A 5.1 E7016	SE	24
25	Phoenix NiMo 100	–	757 E 62 4 Mn 1 NiMo B 42 H5	A 5.5 E10018-G (E10018-D2 mod.)	SE	25
26	Phoenix Nut K	–	– –	– –	SE	26
27	Phoenix Nut S	–	– –	– –	SE	27
28	Phoenix Rot AR 160	–	499 E 42 2 RA 53	A 5.1 E7024-1	SE	28
29	Phoenix Rot BR 160	–	499 E 42 2 RB 53	A 5.1 E7028	SE	29
30	Phoenix Rot R 160	–	499 E 42 0 RR 53	A 5.1 E7024-1	SE	30
31	Phoenix Rot R 160 S	–	499 E 42 0 RR 53	A 5.1 E7024	SE	31
32	Phoenix SH Blau	–	499 E 42 0 RR 11	A 5.1 E6013	SE	32
33	Phoenix SH Chromo 2 KS	–	1599 E CrMo2 B 4 2 H5	A 5.5 E9015-B3	SE	33
34	Phoenix SH Gelb	–	499 E 35 0 A 12	A 5.1 E6020	SE	34
35	Phoenix SH Gelb B	–	499 E 38 2 RB 12	A 5.1 E6013	SE	35
36	Phoenix SH Gelb R	–	499 E 38 2 RB 12	A 5.1 E6013	SE	36
37	Phoenix SH Gelb S	–	499 E 38 0 RA 12	A 5.1 E6013	SE	37

*Product::
DE = wire electrode
DEU = sub-arc-wire electrode
FDE = flux cored wire
GS = gas welding rods
SD = welding wire
SE = covered electrode
SS = welding rods
PUL = welding flux

Consumables
(alphanumerical)

Page	Type	M.-No.	EN / •EN ISO	AWS	Product*	Page
38	Phoenix SH Gelb T	–	499 E 38 0 RA 12	A 5.1 E6013	SE	38
39	Phoenix SH Grün K 50 W	–	499 E 42 5 B 32 H5	A 5.1 E7018-1	SE	39
40	Phoenix SH Grün K 52 W	–	499 E 42 5 B 12 H5	A 5.1 E7016-1	SE	40
41	Phoenix SH Grün K 70	–	499 E 46 4 B 42 H5	A 5.5 E8018-G	SE	41
42	Phoenix SH Grün K 70 W	–	499 E 46 4 B 32 H5	A 5.5 E8018-G	SE	42
43	Phoenix SH Grün TB	–	499 E 42 0 RR 12	A 5.1 E6013	SE	43
44	Phoenix SH Kupfer 3 KC	–	1599 E ZCrMoV1 B 4 2 H5	A 5.5 E9015-G	SE	44
45	Phoenix SH Lila R	–	499 E 42 2 RB 12	A 5.1 E6013	SE	45
46	Phoenix SH Multifer 130	–	499 E 42 0 RR 53	A 5.1 E7014	SE	46
47	Phoenix SH Multifer 180	–	499 E 42 0 RR 73	A 5.1 E7024	SE	47
48	Phoenix SH Ni 2 K 70	–	499 E 46 6 2 Ni B 42 H5	A 5.5 E8018-C1	SE	48
49	Phoenix SH Ni 2 K 90	–	757 E 55 5 2 NiMo B 42 H5	A 5.5 E10018-M	SE	49
50	Phoenix SH Ni 2 K 100	–	757 E 69 5 Mn 2 NiCrMo B 42 H5	A 5.5 E11018-G (E11018-M mod.)	SE	50
51	Phoenix SH Ni 2 K 130	–	757 E 89 4 Mn 2 Ni 1 CrMo B 42 H5	A 5.5 E12018-G (E12018-M mod.)	SE	51
52	Phoenix SH Patinax Kb	–	499 E 38 3 Z 1 NiCu B 42	A 5.5 E7015-G	SE	52
53	Phoenix SH Schwarz 3 K	–	499/1599 E 50 4 Mo B 42 / E Mo B 4 2 H5	A 5.5 E7015-G (E7015-A1 mod.)	SE	53
54	Phoenix SH Schwarz 3 K Ni	–	499 E 50 4 1 NiMo B 42 H5	A 5.5 E9018-G	SE	54
55	Phoenix SH Schwarz 3 MK	–	499/1599 E 50 4 Mo B 42 / E Mo B 4 2 H5	A 5.5 E7018-G (E7018-A1 mod.)	SE	55
56	Phoenix SH Schwarz 3 TR	–	1599 E Mo R 1 2	A 5.5 E8013-G	SE	56
57	Phoenix SH V 1	–	499 E 50 6 Mn 1 Ni B 42 H5	A 5.5 E8018-G (E8018-C3 mod.)	SE	57
58	Phoenix SH V 370	–	499 E 46 6 1 Ni B 42 H5	A 5.5 E8018-C3	SE	58
59	Phoenix Spezial D	–	499 E 42 3 B 12 H10	A 5.1 E7016	SE	59
60-61	Phoenix 120 K	–	499 E 42 5 B 32 H5	A 5.1 E7018-1	SE	60-61
62	Phoenix 6013	–	499 E 42 0 RC 11	A 5.1 E6013	SE	62
63	Phoenix 7018	–	499 E 42 5 B 32 H5	A 5.1 E7018-1	SE	63
178	Thermanit A	1.4576	12072 W 19 12 3 Nb	A 5.9 ER318	SD/SS	178
360-361	Thermanit A	1.4576	12072 S 19 12 3 Nb	A 5.9 ER318	DEU	360-361
258	Thermanit A Si	1.4576	12072 G 19 12 3 Nb Si	A 5.9 ER318 (mod.)	DE	258
80	Thermanit A Spezial	1.4576	1600 E 19 12 3 Nb B 2 2	A 5.4 E318-15	SE	80
81	Thermanit ATS 4	≈ 1.4948	1600 E 19 9 B H 2 2	A 5.4 E308H-15	SE	81
179	Thermanit ATS 4	1.4948	12072 W 19 9 H	A 5.9 ER19 -10H	SD/SS	179
259	Thermanit ATS 4	1.4948	12072 G 19 9 H	A 5.9 ER19-10 H	DE	259

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Consumables
(alphanumerical)

Page	Type	M.-No.	EN / •EN ISO		AWS		Product*	Page
360-361	Thermanit ATS 4	1.4948	12072	S 19 9 H	A 5.9	ER19-10H	DEU	360-361
82	Thermanit AW	1.4576	1600	E 19 12 3 Nb R 3 2	A 5.4	E318-17	SE	82
83	Thermanit C	1.4842	1600	E 25 20 B 2 2	A 5.4	E310-15 (mod.)	SE	83
180-181	Thermanit C Si	1.4842	12072	W 25 20 Mn	A 5.9	ER310 (mod.)	SD/SS	180-181
260	Thermanit C Si	1.4842	12072	G 25 20 Mn	A 5.9	ER310 (mod.)	DE	260
64	Thermanit Chromo 9 V	–	1599	E CrMo91 B 4 2 H5	A 5.5	E9015-B9	SE	64
65	Thermanit Chromo T 91	–	1599	E CrMo91 B 4 2 H5	A 5.5	E9018-B9	SE	65
84-85	Thermanit CM	≈ 1.4842	1600	E 25 20 B 2 2	A 5.4	E310-15 (mod.)	SE	84-85
86	Thermanit CR	≈ 1.4846	1600	E 25 20 H B 2 2	A 5.4	E310H-15 (mod.)	SE	86
182	Thermanit CR	1.4846	12072	W 25 20 H	A 5.9	ER310 (mod.)	SD/SS	182
261	Thermanit CR	1.4846	12072	G 25 20 H	A 5.9	ER310 (mod.)	DE	261
87	Thermanit CW 310-16	1.4842	1600	E 25 20 R 1 2	A 5.4	E310-16	SE	87
88-89	Thermanit D	1.4829	1600	E 22 12 B 2 2	A 5.4	E309-15 (mod.)	SE	88-89
183	Thermanit D	1.4829	12072	W 22 12 H	A 5.9	ER309 (mod.)	SD/SS	183
262	Thermanit D	1.4829	12072	G 22 12 H	A 5.9	ER309 (mod.)	DE	262
90	Thermanit DW	1.4829	1600	E 22 12 R 3 2	A 5.4	E309-17	SE	90
91	Thermanit Fe Ni	–	•1071	E C Z NiFe-1	A 5.15	ENiFe-CI	SE	91
92	Thermanit GE Spezial	1.4430	1600	E 19 12 3 L B 2 2	A 5.4	E316L-15	SE	92
184	Thermanit GE-316L	1.4430	12072	W 19 12 3 L	A 5.9	ER316L	SD/SS	184
360-361	Thermanit GE-316L	1.4430	12072	S 19 12 3 L	A 5.9	ER316L	DEU	360-361
263	Thermanit GE-316L Si	1.4430	12072	G 19 12 3 L Si	A 5.9	ER316LSi	DE	263
93	Thermanit GEW 316L-17	1.4430	1600	E 19 12 3 L R 3 2	A 5.4	E316L-17	SE	93
94	Thermanit GEW/F	1.4430	1600	E 19 12 3 L R 1 5	A 5.4	E316L-16	SE	94
264-265	Thermanit H Si	1.4551	12072	G 19 9 Nb Si	A 5.9	ER347Si	DE	264-265
185	Thermanit H-347	1.4551	12072	W 19 9 Nb	A 5.9	ER347	SD/SS	185
360-361	Thermanit H-347	1.4551	12072	S 19 9 Nb	A 5.9	ER347	DEU	360-361
95	Thermanit HE Spezial	1.4551	1600	E 19 9 Nb B 2 2	A 5.4	E347-15	SE	95
96	Thermanit HW	1.4551	1600	E 19 9 Nb R 3 2	A 5.4	E347-17	SE	96
97	Thermanit JE Spezial	1.4316	1600	E 19 9 L B 2 2	A 5.4	E308L-15	SE	97
186-187	Thermanit JE-308L	1.4316	12072	W 19 9 L	A 5.9	ER308L	SD/SS	186-187
360-361	Thermanit JE-308L	1.4316	12072	S 19 9 L	A 5.9	ER308L	DEU	360-361
266	Thermanit JE-308L Si	1.4316	12072	G 19 9 L Si	A 5.9	ER308LSi	DE	266
98-99	Thermanit JEW 308L-17	1.4316	1600	E 19 9 L R 3 2	A 5.4	E308L-17	SE	98-99
100	Thermanit L	1.4820	1600	E 25 4 B 2 2	–	–	SE	100

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Consumables
(alphanumerical)

Page	Type	M.-No.	EN / •EN ISO		AWS		Product*	Page
267	Thermanit L	1.4820	12072	G 25 4	–	–	DE	267
362-363	Thermanit L	1.4820	12072	S 25 4	–	–	DEU	362-363
101	Thermanit LW	1.4820	1600	E 25 4 R 1 2	–	–	SE	101
154	Thermanit MTS 3	1.4903	12070	W CrMo91	A 5.28	ER90S-B9	SD/SS	154
228	Thermanit MTS 3	1.4903	12070	G CrMo91	A 5.28	ER90S -B9	DE	228
316-317	Thermanit MTS 3	1.4903	12070	S CrMo91	A 5.23	EB 9	DEU	316-317
66	Thermanit MTS 4	–	1599	E CrMoWV12 B 4 2 H5	–	–	SE	66
316-317	Thermanit MTS 4	1.4936	12070	S CrMoWV12	A 5.23	EG	DEU	316-317
155	Thermanit MTS 4 Si	1.4937	12070	W CrMoWV12Si	A 5.9	ER505 (mod.)	SD/SS	155
229	Thermanit MTS 4 Si	1.4937	12070	G CrMoWV12Si	A 5.9	ER505 (mod.)	DE	229
67	Thermanit MTS 616	–	1599	E ZCrMoWVNb9 0,5 2 B 4 2 H5	A 5.5	E9015-G (E9015-B9 mod.)	SE	67
156	Thermanit MTS 616	–	12070	W ZCrMoWVNb9 0.5 1.5	–	–	SD/SS	156
230	Thermanit MTS 616	–	12070	G ZCrMoWVNb9 0,5 1,5	–	–	DE	230
316-317	Thermanit MTS 616	–	12070	S ZCrMoWVNb9 0,5 1,5	A 5.23	EG [B9 (mod.)]	DEU	316-317
68	Thermanit MTS 911	–	1599	E ZCrMoWVNb9 1 1 B 4 2 H5	A 5.5	E9015-G (E9015-B9 mod.)	SE	68
157	Thermanit MTS 911	1.4905	12070	W ZCrMoWVNb 9 1 1	–	–	SD/SS	157
231	Thermanit MTS 911	–	12070	G ZCrMoWVNb 9 1 1	–	–	DE	231
316-317	Thermanit MTS 911	1.4905	12070	S ZCrMoWVNb 9 1 1	A 5.23	EG [B9 (mod.)]	DEU	316-317
106	Thermanit Ni 55	–	•1071	E C Z NiFe-1	A 5.15	ENiFe-CI	SE	106
107	Thermanit Nickel A	–	•1071	E C Z NiCl	A 5.15	ENi-CI	SE	107
104-105	Thermanit Nicro 182	2.4620	•14172	E Ni 6182 (NiCr15Fe6Mn)	A 5.11	ENiCrFe -3	SE	104-105
102-103	Thermanit Nicro 82	2.4648	•14172	E Ni 6082 (NiCr20Mn3Nb)	A 5.11	ENiCrFe -3 (mod.)	SE	102-103
188-189	Thermanit Nicro 82	2.4806	•18274	S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr -3	SD/SS	188-189
268-269	Thermanit Nicro 82	2.4806	•18274	S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr -3	DE	268-269
362-363	Thermanit Nicro 82	2.4806	•18274	S Ni 6082 (NiCr20Mn3Nb)	A 5.14	ERNiCr-3	DEU	362-363
190-191	Thermanit Nimo C	2.4839	•18274	S Ni 6452 (NiCr20Mo15)	A 5.14	ERNiCrMo -7 (mod.)	SD/SS	190-191
270-271	Thermanit Nimo C	2.4839	•18274	S Ni 6452 (NiCr20Mo15)	A 5.14	ERNiCrMo -7 (mod.)	DE	270-271
360-361	Thermanit Nimo C	2.4839	18274	S Ni 6452 (NiCr20Mo15)	A 5.14	ERNiCrMo-7 (mod.)	DEU	360-361
108-109	Thermanit Nimo C 24	2.4609	•14172	E Ni 6059 (NiCr23Mo16)	A 5.11	ENiCrMo-13	SE	108-109
192-193	Thermanit Nimo C 24	2.4607	•18274	S Ni 6059 (NiCr23Mo16)	A 5.14	ERNiCrMo -13	SD/SS	192-193
272-273	Thermanit Nimo C 24	2.4607	•18274	S Ni 6059 (NiCr23Mo16)	A 5.14	ERNiCrMo -13	DE	272-273
69	Thermanit P23	–	1599	E ZCr2WV B 42 H5	A 5.5	E9015-G	SE	69
70	Thermanit P24	–	1599	E ZCrMo2WVNb B 42 H5	A 5.5	E9015-G	SE	70
384-385	Thermanit TG 22/09	1.4462	12073	T 22 9 3 N LRM 3/T 22 9 3 N LRC3	A 5.22	E2209LT0-4/E2209LT0-1	FDE	384-385

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Consumables
(alphanumerical)

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386	Thermanit TG 307	–	12073	T 18 8 Mn RM3/T 18 8 Mn RC3	A 5.22	E307-T0-G	FDE	386
387	Thermanit TG 308 L	1.4316	12073	T 19 9 LRM3/T 19 9 LRC3	A 5.22	E308LT0-4/E308LT0-1	FDE	387
388-389	Thermanit TG 309 L	1.4332	12073	T 23 12 LRM3/T 23 12 LRC3	A 5.22	E309LT0-4/E309LT0-1	FDE	388-389
390-391	Thermanit TG 309 Mo L	1.4459	12073	T 23 12 2 LRM3/T 23 12 2 LRC3	A 5.22	E309LMoT0-4/E309LMoT0-1	FDE	390-391
392-393	Thermanit TG 316 L	1.4430	12073	T 19 12 3 LRM3/T 19 12 3 LRC3	A 5.22	E316LT0-4/E316LT0-1	FDE	392-393
394	Thermanit TG 317 L	≈ 1.4440	12073	T 19 13 4 LRM3	A 5.22	E317LT0-4	FDE	394
395	Thermanit TG 347	1.4551	12073	T 19 9 Nb RM3/T 19 9 Nb RC3	A 5.22	E347T0-4/E347T0-1	FDE	395
110-111	Thermanit X	1.4370	1600	E 18 8 Mn B 2 2	A 5.4	E307-15 (mod.)	SE	110-111
194-195	Thermanit X	1.4370	12072	W 18 8 Mn	A 5.9	ER307 (mod.)	SD/SS	194-195
274-275	Thermanit X	1.4370	12072	G 18 8 Mn	A 5.9	ER307 (mod.)	DE	274-275
360-361	Thermanit X	1.4370	12072	S 18 8 Mn	A 5.9	ER307 (mod.)	DEU	360-361
112-113	Thermanit XW	1.4370	1600	E 18 8 Mn R 1 2	A 5.4	E307-16 (mod.)	SE	112-113
114	Thermanit 13/04	1.4351	1600	E 13 4 B 2 2	A 5.4	E410NiMo-15	SE	114
362-363	Thermanit 13/04	1.4351	12072	S 13 4	A 5.9	ER410NiMo (mod.)	DEU	362-363
196-197	Thermanit 13/04 Si	1.4351	12072	W 13 4	A 5.9	ER410NiMo (mod.)	SD/SS	196-197
276-277	Thermanit 13/04 Si	1.4351	12072	G 13 4	A 5.9	ER410NiMo (mod.)	DE	276-277
115	Thermanit 14 K	1.4018	1600	E 13 1 B 2 2	A 5.4	E410-15 (mod.)	SE	115
198-199	Thermanit 14 K	1.4018	12072	W Z13 1	A 5.9	ER410 (mod.)	SD/SS	198-199
278	Thermanit 14 K Si	1.4009	12072	G 13	A 5.9	ER410 (mod.)	DE	278
279	Thermanit 1610 Si	1.4502	12072	G Z17 Ti	A 5.9	ER430 (mod.)	DE	279
116-117	Thermanit 17	1.4015	1600	E 17 B 2 2	A 5.4	E430-15	SE	116-117
280-281	Thermanit 17	1.4015	12072	G 17	A 5.9	ER430 (mod.)	DE	280-281
364-365	Thermanit 17	1.4015	12072	S 17	A 5.9	ER430 (mod.)	DEU	364-365
118-119	Thermanit 17/06	≈ 1.4405	1600	E Z17 6 B 2 2	–	–	SE	118-119
364-365	Thermanit 17/06	1.4405	12072	S Z17 6	A 5.9	ER630 (mod.)	DEU	364-365
282	Thermanit 17/15 TT	–	12072	G Z17 15 Mn W	–	–	DE	282
364-365	Thermanit 17/15 TT	–	12072	S Z17 15 Mn W	–	–	DEU	364-365
364-365	Thermanit 1720	1.4115	12072	S Z17 Mo	–	–	DEU	364-365
283	Thermanit 1740	1.4122	12072	G Z17 Mo H	–	–	DE	283
364-365	Thermanit 1740	1.4122	12072	S Z17 Mo H	–	–	DEU	364-365
200-201	Thermanit 18/17 E	≈ 1.4440	12072	W 18 16 5 N L	A 5.9	ER317L (mod.)	SD/SS	200-201
284-285	Thermanit 18/17 E	≈ 1.4440	12072	G 18 16 5 N L	A 5.9	ER317L (mod.)	DE	284-285

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Consumables
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120-121	Thermanit 18/17 EW	≈ 1.4440	1600	E 18 16 5 N L R 1 2	A 5.4	E317L-17 (mod.)	SE	120-121
202-203	Thermanit 19/15	1.4455	12072	W 20 16 3 Mn N L	A 5.9	ER316L (mod.)	SD/SS	202-203
286-287	Thermanit 19/15	1.4455	12072	G 20 16 3 Mn N L	A 5.9	ER316L (mod.)	DE	286-287
364-365	Thermanit 19/15	1.4455	12072	S 20 16 3 Mn N L	A 5.9	ER316L (mod.)	DEU	364-365
122-123	Thermanit 19/15 H	1.4455	1600	E 20 16 3 Mn N L B 2 2	A 5.4	E316L-15 (mod.)	DE	122-123
202-203	Thermanit 19/15*	1.4455	12072	W 20 16 3 Mn N L	A 5.9	ER316L (mod.)	SD/SS	202-203
288-289	Thermanit 20/10	1.4431	12072	G 20 10 3	A 5.9	ER308 Mo (mod.)	DE	288-289
366-367	Thermanit 20/10	1.4431	12072	S 20 10 3	A 5.9	ER308Mo (mod.)	DEU	366-367
124-125	Thermanit 20/10 W	1.4431	1600	E 20 10 3 R 3 2	A 5.4	E308Mo-17 (mod.)	SE	124-125
126-127	Thermanit 20/10 W 140 K	1.4431	1600	E 20 10 3 R 5 3	A 5.4	E308Mo-17 (mod.)	SE	126-127
128	Thermanit 20/16	≈ 1.3954	1600	E Z20 16 3 Mn N L R 1 2	–	–	SE	128
129	Thermanit 20/16 SM	≈ 1.3954	1600	E Z22 17 4 Mn N L R 1 2	–	–	SE	129
204	Thermanit 20/16 SM	1.3954	12072	W Z22 17 8 4 N L	–	–	SD/SS	204
290	Thermanit 20/16 SM	1.3954	12072	G Z22 17 8 4 N L	–	–	DE	290
205	Thermanit 20/25 Cu	1.4519	12072	W 20 25 5 Cu L	A 5.9	ER385	SD/SS	205
291	Thermanit 20/25 Cu	1.4519	12072	G 20 25 5 Cu L	A 5.9	ER385	DE	291
366-367	Thermanit 20/25 Cu	1.4519	12072	S 20 25 5 Cu L	A 5.9	ER385	DEU	366-367
130	Thermanit 20/25 CuW	1.4519	1600	E 20 25 5 Cu N L R 3 2	A 5.4	E385-16	SE	130
131	Thermanit 21/33	≈ 1.4850	1600	E Z21 33 Nb B 2 2	–	–	SE	131
206	Thermanit 21/33	≈ 1.4850	12072	W Z21 33 Nb	–	–	SD/SS	206
292	Thermanit 21/33	≈ 1.4850	12072	G Z21 33 Nb	–	–	DE	292
132-133	Thermanit 21/33 So	≈ 1.4850	1600	E Z21 33 Mn Nb B 2 2	–	–	SE	132-133
207	Thermanit 21/33 So	≈ 1.4850	12072	W Z21 33 Mn Nb	–	–	SD/SS	207
134	Thermanit 22/09	≈ 1.4462	1600	E 22 9 3 N L B 2 2	A 5.4	E2209-15	SE	134
208-209	Thermanit 22/09	≈ 1.4462	12072	W 22 9 3 N L	A 5.9	ER2209	SD/SS	208-209
293	Thermanit 22/09	≈ 1.4462	12072	G 22 9 3 N L	A 5.9	ER2209	DE	293
366-367	Thermanit 22/09	≈ 1.4462	12072	S 22 9 3 N L	A 5.9	ER2209	DEU	366-367
135	Thermanit 22/09 W	≈ 1.4462	1600	E 22 9 3 N L R 3 2	A 5.4	E2209-17	SE	135
396-397	Thermanit 22/09-PW	1.4462	12073	T 22 9 3 N LPM 1/T 22 9 3 N LPC1	A 5.22	E2209LT1-4/E2209LT1-1	FDE	396-397
136-137	Thermanit 23/11 MoZLW	1.4459	1600	E 23 12 2 L R 3 2	A 5.4	E309MoL-17	SE	136-137
138	Thermanit 25/09 CuT	≈ 1.4501	1600	E 25 9 4 N L B 2 2	A 5.4	E2553-15 (mod.)	SE	138
210-211	Thermanit 25/09 CuT	≈ 1.4501	12072	W 25 9 4 N L	A 5.9	ER2553 (mod.)	SD/SS	210-211

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294-295	Thermanit 25/09 CuT	≈ 1.4501	12072	G 25 9 4 N L	A 5.9	ER2553 (mod.)	DE	294-295
139	Thermanit 25/09 CuW	–	1600	E Z25 9 3 Cu N L R 1 2	A 5.4	E2553-15 (mod.)	SE	139
212-213	Thermanit 25/14 E-309L	1.4332	12072	W 23 12 L	A 5.9	ER309L	SD/SS	212-213
366-367	Thermanit 25/14 E-309L	1.4332	12072	S 23 12 L	A 5.9	ER309L	DEU	366-367
296-297	Thermanit 25/14 E-309L Si	1.4332	12072	G 23 12 L Si	A 5.9	ER309L-Si	DE	296-297
140-141	Thermanit 25/14 EW 309L-17	1.4332	1600	E 23 12 L R 1 2	A 5.4	E309L-17	SE	140-141
142	Thermanit 25/22 H	≈ 1.4465	1600	E Z25 22 2 L B 2 2	–	–	SE	142
214	Thermanit 25/22 H	1.4465	12072	W 25 22 2 L	A 5.9	ER310 (mod.)	SD/SS	214
368-369	Thermanit 25/22 H	1.4465	12072	S 25 22 2 N L	A 5.9	ER310 (mod.)	DEU	368-369
143	Thermanit 25/35 R	1.4853	1600	E Z25 35 Nb B 2 2	–	–	SE	143
215	Thermanit 25/35 R	1.4853	12072	W Z25 35	–	–	SD/SS	215
298	Thermanit 25/35 R	1.4853	12072	G Z25 35	–	–	DE	298
216	Thermanit 25/35 Zr	≈ 1.4853	12072	W Z25 35 Zr	–	–	SD/SS	216
299	Thermanit 25/35 Zr	≈ 1.4853	12072	G Z25 35 Zr	–	–	DE	299
300	Thermanit 30/10	1.4337	12072	G 29 9	A 5.9	ER312	DE	300
144	Thermanit 30/10 W	1.4337	1600	E 29 9 R 1 2	A 5.4	E312-16 (mod.)	SE	144
217	Thermanit 30/40 E	2.4656	•18274	S Ni 8025 (NiFe30Cr29Mo)	A 5.9	ER383 (mod.)	SD/SS	217
301	Thermanit 30/40 E	2.4656	•18274	S Ni 8025 (NiFe30Cr29Mo)	A 5.9	ER383 (mod.)	DE	301
145	Thermanit 30/40 EW	2.4653	•14172	E Ni 8025 (NiCr29Fe30Mo)	–	–	SE	145
398-399	Thermanit 308 L-PW	1.4316	12073	T 19 9 LPM1/T 19 9 LPC1	A 5.22	E308LT1-4/E308LT1-1	FDE	398-399
400-401	Thermanit 309 L-PW	1.4332	12073	T 23 12 LPM1/T 23 12 LPC1	A 5.22	E309LT1-4/E309LT1-1	FDE	400-401
402-403	Thermanit 309 Mo L-PW	1.4459	12073	T 23 12 2 LPM1/T 23 12 2 LPC1	A 5.22	E309LMoT1-4/E309LMoT1-1	FDE	402-403
404-405	Thermanit 316 L-PW	1.4430	12073	T 19 12 3 LPM1/T 19 12 3 LPC1	A 5.22	E316LT1-4/E316LT1-1	FDE	404-405
146	Thermanit 35/45 Nb	–	•14172	E Ni Z 6152 (NiCr35Fe20Nb)	–	–	SE	146
218	Thermanit 35/45 Nb	–	12072	W Z35 45 Nb H	–	–	SD/SS	218
302	Thermanit 35/45 Nb	–	12072	G Z35 45 Nb H	–	–	DE	302
303	Thermanit 409 Cb	≈ 1.4009	12072	G Z13 Nb L	A 5.9	ER409 Cb	DE	303
304	Thermanit 430L Cb	≈ 1.4511	12072	G Z18 Nb L	A 5.9	ER430 (mod.)	DE	304
305	Thermanit 439 Ti	≈ 1.4009	12072	G Z18 Ti L	–	–	DE	305
147	Thermanit 617	2.4628	•14172	E Ni 6617 (NiCr22Co12Mo)	A 5.11	ENiCrCoMo-1 (mod.)	SE	147
219	Thermanit 617	2.4627	•18274	S Ni 6617 (NiCr22Co12Mo9)	A 5.14	ERNiCrCoMo -1	SD/SS	219

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306	Thermanit 617	2.4627	•18274	S Ni 6617 (NiCr22Co12Mo9)	A 5.14	ERNiCrCoMo -1	DE	306
368-369	Thermanit 617	2.4627	18274	S Ni 6617 (NiCr22Co12Mo9)	A 5.14	ERNiCrCoMo-1	DEU	368-369
148-149	Thermanit 625	2.4621	•14172	E Ni 6625 (NiCr22Mo9Nb)	A 5.11	ENiCrMo-3	SE	148-149
220-221	Thermanit 625	2.4831	•18274	S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo -3	SD/SS	220-221
305	Thermanit 625	2.4831	•18274	S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo -3	DE	305
366-367	Thermanit 625	2.4831	18274	S Ni 6625 (NiCr22Mo9Nb)	A 5.14	ERNiCrMo-3	DEU	366-367
222	Thermanit 690	2.4642	•18274	S Ni 6025 (NiCr30Fe9)	A 5.14	ERNiCrFe -7	SD/SS	222
308-309	Thermanit 690	2.4642	•18274	S Ni 6052 (NiCr30Fe9)	A 5.14	ERNiCrFe -7	DE	308-309
326	UA 600	–	760	SA AB 1 65 DC H5	–	–	PUL	326
166	Union 37	–	12536	O I	A 5.2	R45	GS	166
430	Union Al 99,5	3.0259	•18273	S Al Z (Al 99,5)	A 5.10	ER1100 (mod.)	SD/SS	430
431	Union AlMg 2,7 Mn 0,8	3.3538	•18273	S Al 5554 (AlMg2,7Mn)	A 5.10	ER5554	SD/SS	431
432	Union AlMg 3	3.3536	•18273	S Al 5754 (AlMg3)	A 5.10	–	SD/SS	432
433	Union AlMg 4,5 Mn	3.3548	•18273	S Al 5183 (AlMg4,5Mn0,7(A))	A 5.10	ER5183	SD/SS	433
434	Union AlMg 4,5 MnZr	3.3546	•18273	S Al 5087 (AlMg4,5MnZr)	A 5.10	ER5183 (mod.)	SD/SS	434
435	Union AlMg 5	3.3556	•18273	S Al 5356 (AlMg5Cr(A))	A 5.10	ER5356	SD/SS	435
436	Union AlSi 5	3.2245	•18273	S Al 4043A (AlSi5(A))	A 5.10	ER4043	SD/SS	436
406	Union BA 70	–	758	T 42 4 B M 3 H5/T 42 4 B C 3 H5	A 5.20	E70T-5MH4/E70T-5 H4	FDE	406
310	Union FeNi 60 H IG	–	•1071	SC NiFe -2	–	–	DE	310
311	Union FeNi 60 IG	2.4560	•1071	SC NiFe -1 (mod.)	–	–	DE	311
158	Union I 1,2 Ni	–	1668	W 42 6 W3Ni1	A 5.28	ER80S-G	SD/SS	158
159	Union I 2,5 Ni	–	1668	W 46 6 W2Ni2	A 5.28	ER80S-Ni2	SD/SS	159
160	Union I 52	–	1668	W 42 5 W3Si1	A 5.18	ER70S-6	SD/SS	160
161	Union I CrMo	1.7339	12070	W CrMo1Si	A 5.28	ER80S-G	SD/SS	161
247	Union I CrMo	–	12070	G CrMo1Si	A 5.28	ER80S-G	DE	247
162	Union I CrMo 910	1.7384	12070	W CrMo2Si	A 5.28	ER90S-G	SD/SS	162
248	Union I CrMo 910	–	12070	G CrMo2Si	A 5.28	ER90S-G	DE	248
163	Union I Mo	–	1668/12070	W2Mo/W MoSi	A 5.28	ER80S-G	SD/SS	163
249	Union I Mo	–	440/12070	G 46 4 M G2Mo/GMoSi	A 5.28	ER80S-G	DE	249
164	Union I P23	–	12070	W ZCr2WV	A 5.28	ER90S-G	SD/SS	164
165	Union I P24	–	12070	W ZCr2VTi/Nb	A 5.28	ER 90S-G	SD/SS	165
233	Union K 40	–	440	G2Si1 (mod.)	A 5.18	ER70S-G [ER70S-3 (mod.)]	DE	233

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232	Union K 5 Ni	–	440 G 46 3 C G3Ni1/G 50 5 M G3Ni1	A 5.28 ER80S-G	DE	232
234	Union K 52	–	440 G 42 2 C G3Si1/G 42 4 M G3Si1	A 5.18 ER70S-6	DE	234
235	Union K 56	–	440 G 46 2 C G4Si1/G 46 4 M G4Si1	A 5.18 ER70S-6	DE	235
167	Union Mo	–	12536 O IV	A 5.2 R60-G	GS	167
236	Union MoNi	–	12534 G 62 5 M Mn3Ni1Mo	A 5.28 ER90S-G	DE	236
407	Union MV 70	–	758 T 46 4 M M 2 H5/T 42 3 M C 2 H5	A 5.18 E70C-6MH4	FDE	407
408	Union MV CrMo	–	12071 T CrMo1 M M 2 H5	A 5.28 E80C-B2H4	FDE	408
409	Union MV CrMo 910	–	12071 T CrMo2 M M 2 H5	A 5.28 E90C-B3H4	FDE	409
410	Union MV Mo	–	758/12071 T 46 2 Mo M M 2 H5/T Mo M M 2 H5	A 5.28 E80C-GH4	FDE	410
237	Union Ni 2,5	–	440 G 50 6 M G2Ni2	A 5.28 ER80S-Ni2	DE	237
238	Union NiMoCr	–	12534 G 69 5 M Mn4Ni1,5CrMo	A 5.28 ER100S-G [ER100S-1 (mod.)]	DE	238
239	Union Patinax	–	440 G 42 3 C G0/G 46 4 M G0	A 5.18 ER70S-G	DE	239
240	Union Rob 2	–	440 G 42 2 C G3Si1/G 42 4 M G3Si1	A 5.18 ER70S-6	DE	240
241	Union Rob 3	–	440 G 46 2 C G4Si1/G 46 4 M G4Si1	A 5.18 ER70S-6	DE	241
168	Union Rot N	–	12536 O III	A 5.2 R60	GS	168
411	Union RV 71	–	758 T 42 2 P M 1 H5/T 42 2 P C 1 H5	A 5.20 E71T-1MJH4/E71T-1H4	FDE	411
316-317	Union S 1	–	756 S1	A 5.17 EL12	DEU	316-317
316-317	Union S 1 CrMo 2	–	12070 S CrMo2	A 5.23 EB3R	DEU	316-317
316-317	Union S 1 CrMo 2 V	–	12070 S ZCrMoV2	A 5.23 EG	DEU	316-317
316-317	Union S 1 CrMo 5	–	12070 S CrMo5	A 5.23 EB6	DEU	316-317
316-317	Union S 1 Mo 1,2	–	756 SZ	A 5.23 EG	DEU	316-317
318-319	Union S 2	–	756 S2	A 5.17 EM12	DEU	318-319
318-319	Union S 2 CrMo	–	12070 S CrMo1	A 5.23 EB2R	DEU	318-319
318-319	Union S 2 Mo	–	756/12070 S2Mo / S Mo	A 5.23 EA2	DEU	318-319
318-319	Union S 2 Ni 2,5	–	756 S2Ni2	A 5.23 ENi2	DEU	318-319
318-319	Union S 2 Ni 3,5	–	756 S2Ni3	A 5.23 ENi3	DEU	318-319
318-319	Union S 2 Ni 370	–	756 S2Ni1,5	A 5.23 EG [ENi1 (mod.)]	DEU	318-319
318-319	Union S 2 NiMo 1	–	756 SZ2Ni1	A 5.23 ENi1	DEU	318-319
320-321	Union S 2 Si	–	756 S2Si	A 5.17 EM12K	DEU	320-321
320-321	Union S 3	–	756 S3	A 5.17 EH10K	DEU	320-321
320-321	Union S 3 Mo	–	756/12070 S3Mo / S MnMo	A 5.23 EA4	DEU	320-321
320-321	Union S 3 Mo Ti B	–	756 SZ	A 5.23 EG	DEU	320-321
320-321	Union S 3 NiMo	–	756/14295 S3Ni1,5Mo	A 5.23 EG [EF1 (mod.)]	DEU	320-321
320-321	Union S 3 NiMo 1	–	756/14295 S3Ni1Mo	A 5.23 EG [EF3 (mod.)]	DEU	320-321

*Product::
DE = wire electrode
DEU = sub-arc-wire electrode
FDE = flux cored wire
GS = gas welding rods
SD = welding wire
SE = covered electrode
SS = welding rods
PUL = welding flux

Consumables
(alphanumerical)

Page	Type	M.-No.	EN / •EN ISO		AWS		Product*	Page
320-321	Union S 3 NiMoCr	–	14295	SZ3Ni2,5CrMo	A 5.23	EG [EF6 (mod.)]	DEU	320-321
322-323	Union S 3 Si	–	756	S3Si	A 5.17	EH12K	DEU	322-323
322-323	Union S 4 Mo	–	756	S4Mo	A 5.23	EA3	DEU	322-323
322-323	Union S P 23	–	12070	S ZCr2WV	A 5.23	EG	DEU	322-323
322-323	Union S P 24	–	12070	S ZCrMo2VNb	A 5.23	EG	DEU	322-323
169	Union Schwarz	–	12536	O II	A 5.2	R60	GS	169
242	Union SG 2-H	–	440	G 42 2 C G3Si1/G 42 3 M G3Si1	A 5.18	ER70S-6	DE	242
243	Union SG 3-H	–	440	G 46 2 C G4Si1/G 46 4 M G3Si1	A 5.18	ER70S-6	DE	243
412-413	Union TG 50 B	–	758	T 42 5 B M 1 H5/T 42 4 B C 1 H5	A 5.20	E71T-5MJH4/E71T-5 H4	FDE	412-413
414-415	Union TG 50 M	–	758	T 46 3 P M 1 H10/T 42 2 P C 1 H5	A 5.20	E71T-12MH8/E71T-1 H8	FDE	414-415
416-417	Union TG 50 Ni	–	758	T 46 5 1 Ni P M 1 H5	A 5.29	E81T1-Ni1MH4	FDE	416-417
418-419	Union TG 55 Fe	–	758	T 46 4 M M 1 H5	A 5.18	E70C-6MH4	FDE	418-419
420-421	Union TG 55 M	–	758	T 46 4 P M 1 H10 / T 42 2 P C 1 H5	A 5.20	E71T-1MJH8/E71T-JH8	FDE	420-421
422-423	Union TG 55 Ni	–	758	T 50 5 1 Ni P M 1 H5	A 5.29	E81T1-Ni1MH8	FDE	422-423
244	Union X 85	–	12534	G 79 5 M Mn4Ni1,5CrMo	A 5.28	ER110S-G	DE	244
245	Union X 90	–	12534	G 89 6 M Mn4Ni2CrMo	A 5.28	ER120S-G	DE	245
246	Union X 96	–	12534	G 89 5 M Mn4Ni2,5CrMo	A 5.28	ER120S-G	DE	246
327-328	UV 300	–	760	SA MS 1 87 AC H5	–	–	PUL	327-328
329	UV 305	–	760	SA AR 1 76 AC H5	–	–	PUL	329
330-331	UV 306	–	760	SA AR 1 77 AC H5	–	–	PUL	330-331
332	UV 309 P	–	760	SA AB 1 65 AC H5	–	–	PUL	332
333	UV 310 D	–	760	SA FB 1 55 DC H5	–	–	PUL	333
334-335	UV 400	–	760	SA AB 1 67 A C H5	–	–	PUL	334-335
336-338	UV 418 TT	–	760	SA FB 1 55 AC H5	–	–	PUL	336-338
339-343	UV 420 TT / UV 420 TT-LH	–	760	SA FB 1 65 DC/SA FB 1 65 DC H5	–	–	PUL	339-343
344-347	UV 420 TTR / UV 420 TTR-W	–	760	SA FB 1 65 DC/SA FB 1 65 AC	–	–	PUL	344-347
348	UV 420 TTRC	–	760	SA FB 1 65 DC	–	–	PUL	348
349-352	UV 421 TT	–	760	SA FB 1 65 DC H5	–	–	PUL	349-352
353-354	UV 430 TTR-W	–	760	SA FB 1 55 AC	–	–	PUL	353-354

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With the publication of this edition of the “Welding filler metals” welding guide all earlier editions cease to be valid.

Due to the continual improvement of the consumables, we reserve the right to change data given in this handbook without notice.
Details regarding the nature and application purpose of our products are intended for the information of the user. The data concerning the mechanical properties always refer to the all-weld metal deposit in accordance with the applicable standards.
In the area of the weld joint, the weld metal properties are influenced by the base metal, the welding position and the welding parameters.

A guarantee of the suitability for a specific type of application requires in each individual case an implicit agreement in writing.

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