Nickel-based welding consumables

Content

Stick electrodes

Product name	C	Si	Mn	Cr	Ni	Mo	Co	Nb	Ti	Fe	Al
Thermanit Nicro 182	0.03	0.40	6.00	16.00	Bal.			2.20		6.00	
Thermanit Nicro 82	< 0.05	< 0.4	4.00	19.50	Bal.	1.50		2.00		< 4.0	
Thermanit 617	< 0.08	0.80	0.20	21.00	Bal.	9.00	11.00		0.25	< 1.5	0.70
Thermanit 625	0.03	0.40	0.70	22.00	Bal.	9.00	≤ 0.05	3.30		< 1.0	≤ 0.4
Thermanit 690	0.03	0.50	3.80	28.00	Bal.			1.80		8.50	
Thermanit Nimo C 24	< 0.02	0.10	< 0.5	23.00	Bal.	16.00				< 1.5	

GTAW rods

Product name	C	Si	Mn	Cr	Ni	Mo	W	V	Co	Nb	Ti
Thermanit Nicro 82	0.02	0.10	3.00	20.00	> 67.0					2.50	
Thermanit 625	0.03	0.10	0.10	22.00	Bal.	9.00				3.60	
Thermanit 22	< 0.01	< 0.1	< 0.5	21.00	Bal.	13.00	3.00	< 0.2	< 2.5		
Thermanit Nimo C 24	0.01	< 0.10	< 0.5	23.00	Bal.	16.00					
Thermanit 686	0.01	0.10	< 0.5	22.80	Bal.	16.00	3.80				
Thermanit 690	0.02	0.20	0.30	29.00	Bal.	0.10			< 0.1		
Thermanit 617	0.05	0.10	0.10	21.50	Bal.	9.00			11.00		0.30

Solid wires

Product name	C	Si	Mn	Cr	Ni	Mo	W	Co	Nb	Ti	Fe
Thermanit Nicro 82	0.02	0.20	2.80	19.50	> 67				2.50		< 2.0
Thermanit 625	0.03	0.25	0.20	22.00	Bal.	9.00			3.60		< 0.5
Thermanit 22	< 0.01	< 0.1	< 0.5	22.00	Bal.	13.50	3.00				3.00
Thermanit Nimo C 24	0.01	0.10	< 0.5	23.00	Bal.	16.00					< 1.5
Thermanit 686	0.01	0.08	< 0.5	22.80	Bal.	16.00	3.80				< 1.0
Thermanit 690	0.03	0.30	0.30	29.00	Bal.	0.10		< 0.1			9.00
Thermanit 617	0.05	0.10	0.10	21.50	Bal.	9.00		11.00		0.30	0.50

SAW wire/flux combinations

Product name	C	Si	Mn	Cr	Ni	Mo	W	Nb	Fe
Thermanit 625 - Marathon 104	0.02	0.30	0.20	21.70	Bal.	9.00		3.20	< 1.5
Thermanit 625 - Marathon 504	0.02	0.35	0.10	21.70	Bal.	8.70		3.30	< 2.0
Thermanit 625 - Marathon 444	0.01	0.16	0.20	21.80	Bal.	9.00		3.20	< 1.0
Thermanit Nicro 82 - Marathon 104	0.02	0.25	3.00	20.20	Bal.			2.40	< 1.0
Thermanit Nicro 82 - Marathon 444	0.01	0.25	3.00	20.20	Bal.			2.40	< 1.0
Thermanit Nimo C 276 - Marathon 104	0.01	0.10	0.50	15.40	Bal.	16.00	3.70		6.00

Flux-cored wire

Product name	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
BÖHLER NIBAS 70/20-FD	0.03	0.40	3.20	19.50	Bal.		2.50	2.50
BÖHLER NIBAS 70/20 Mn-FD	0.03	0.30	5.50	19.70	Bal.		2.40	2.00
BÖHLER NIBAS 625 PW-FD	0.05	0.40	0.40	21.00	Bal.	8.50	3.30	< 1.0

Thermanit Nicro 182

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172
E Ni 6182 (NiCr15Fe6Mn)

AWS A5.11 / SFA-5.11
ENiCrFe-3

Characteristics and typical fields of application

Basic coated nickel-base electrode of E Ni 6182 / ENiCrFe-3 type for welding of nickel-base alloys, creep resistant steels, heat resisting and cryogenic materials, dissimilar joints and low-alloyed steels with limited weldability. Dissimilar joining for service temperatures above 300ºC or applications where post-weld heat treatment is required. Well-suited for dissimilar welding of stainless and nickel alloys to mild steels. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. Scaling resistant up to 950ºC and creep resistant up to 800ºC. Good toughness at subzero temperatures down to –196ºC. Heat resistant with a temperature limit of 500ºC in sulfurous atmospheres and max. 900ºC for fully stressed welds. Resistant to embrittlement, hot cracking and thermal shock. Easy slag removal and excellent welding characteristics in all welding positions, except vertical down.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32–21

Alloy 600, Alloy 600 L, Alloy 800 / 800H

UNS N06600, N07080, N0800, N0810

Typical analysis of all-weld metal

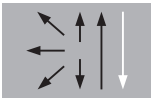
	C	Si	Mn	Cr	Ni	Nb	Fe
wt.-%	0.025	0.4	6.0	16.0	Bal.	2.2	6.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	400 (≥ 360)	670 (≥ 600)	40 (≥ 30)	120 (≥ 90)	80 (≥ 32)

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification Thermanit Nicro 182 NiCrFe-3

Dimension mm	Current A
2.5 × 300	45 – 70
3.2 × 350	65 – 100
4.0 × 350	95 – 130
5.0 × 450	130 – 160

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys.

Re-drying if necessary for 2 h at 250 – 300ºC.

Need for preheating and post-weld heat treatment determined by the base material.

Approvals

TÜV (02073), TÜV (KTA 1408.1) (08128.00), CE

SMAW

Thermanit Nicro 82

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172
E Ni 6082 (NiCr20Mn3Nb)

AWS A5.11 / SFA-5.11
ENiCrFe-3 (mod.)

Characteristics and typical fields of application

Coated nickel-base electrode of E Ni 6082 / ENiCrFe-3 (mod.) type for welding heat and creep resistant Cr and CrNi-steels and nickel-base alloys. Resistant to scaling up to 1000ºC. Heat resistant with a temperature limit of 550ºC in sulfurous atmospheres and max. 900ºC for fully stressed welds. Good toughness at subzero temperatures as low as –269ºC.

Well-suited for dissimilar welding of stainless and nickel alloys to mild steels. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels. Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32–21

NiCr15Fe, X8Ni9, 10CrMo9-10 Alloy 600, 600L, 800, 800H UNS N06600, N07080, N0800, N0810

Typical analysis of all-weld metal

	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wt.-%	< 0.05	< 0.4	4.0	19.5	Bal.	1.5	2.0	< 4.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$	Tensile strength R_m	Elongation A (L_0=5d_0)	Impact values ISO-V KV J		
	MPa	MPa	%	20°C	–196°C	–269°C
u	380	620	40 (≥ 22)	90	70	50

u untreated, as-welded

Operating data

Polarity DC+

Electrode identification Thermanit Nicro 82 Ni 6082 (NiCr20Mn3Nb)

Dimension mm	Current A
2.5 × 300	45 – 70
3.2 × 350	65 – 100
4.0 × 350	85 – 130
5.0 × 450	130 – 160

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys up to 900ºC.

Need for preheating and-weld heat treatment determined by the base material.

Approvals

TÜV (01775), TÜV (KTA 1408.1) (08129.00), DNV GL, CE

Thermanit 617

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172
E Ni 6117 (NiCr22Co12Mo)

AWS A5.11 / SFA-5.11
ERNiCrCoMo-1 (mod)

Characteristics and typical fields of application

Coated nickel-base electrode of E Ni 6117 / ENiCrCoMo-1 (mod.) type. Suitable for joining high-temperature and similar nickel-base alloys, heat resistant austenitic stainless steels and cast alloys. The weld metal is resistant to hot-cracking and is used for service temperatures up to 1100ºC. Scaling resistant up to 1100ºC in oxidizing and carburized atmospheres, e.g. gas turbines, ethylene production plants. Can be welded in all positions except vertical-down. It has a stable arc and the resulting weld finely rippled and notch-free. Easy slag removal.

Base materials

1.4558 X2NiCrAlTi32-20, 1.4859 GX10NiCrNb38-18 / GX10NiCrNb32-20, 1.4861 X10NiCr32-20, 1.4876 X10NiCrAlTi32-20 / X10NiCrAlTi 32-21, 1.4877 X6NiCrNbCe32-27, 1.4959 X8NiCrAlTi32-21, 2.4663 NiCr23Co12Mo, 2.4851 NiCr23Fe

UNS N08810, Alloy 800, 800H, 800HT

AC66

Typical analysis of all-weld metal

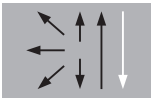
	C	Si	Mn	Cr	Ni	Mo	Co	Ti	Fe	Al
wt.-%	< 0.08	0.8	0.2	21.0	Bal.	9.0	11.0	0.25	< 1.5	0.7

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450 (≥ 400)	700 (≥ 620)	35 (≥ 22)	100

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification Thermanit 617ENi 6117 (NiCr22Co-12Mo)

Dimension mm	Current A
2.5 × 250	55 – 75
3.2 × 300	70 – 90
4.0 × 350	90 – 110

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Preheating temperature should be adjusted to the base material. Post-weld heat treatments can be applied independently of the weld metal.

Creep rupture properties according to matching high temperature steels / alloys.

Hold stick electrode as vertically as possible, keep a short arc. Use string bead technique. Fill end crater carefully.

Re-drying if necessary at 250 – 300ºC for 2 – 3h.

Approvals

TÜV (06844), CE

SMAW

Thermanit 625

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172
E Ni 6625 (NiCr22Mo9Nb)

AWS A5.11 / SFA-5.11
ENiCrMo-3

Characteristics and typical fields of application

Basic coated nickel-base electrode of E Ni 6625 / ENiCrMo-3 type for welding the nickel-base alloys 625 and 825 as well as CrNiMo-steels with high molybdenum content (e.g. 6% Mo-steels). Also recommended for high temperature and creep resisting steels, heat resisting and cryogenic materials, dissimilar joints, and low-alloyed problem steels. Suitable in pressure vessel fabrication for –196ºC to 550ºC, otherwise up to the scaling resistance temperature of 1200ºC (S-free atmosphere). Due to the weld metal embrittlement at 600 – 850ºC, this temperature range should be avoided. Highly resistant to hot cracking and thermal shock. Extremely resistant to stress corrosion cracking and pitting (PREN 52). Fully austenitic. Excellent welding characteristics in all positions except vertical-down, easy slag removal, high resistance to porosity.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 9% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels

1.4529 X1NiCrMoCuN25–20–7, 1.4547 X1CrNiMoCuN20–18–7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2 / 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32–21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe / 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH, P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of all-weld metal

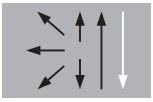
	C	Si	Mn	Cr	Ni	Mo	Co	Nb	Fe	Al
wt.-%	0.025	0.4	0.7	22.0	Bal.	9.0	≤ 0.05	3.3	< 1.0	≤ 0.4

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	530 (≥ 420)	800 (≥ 760)	40 (≥ 27)	80	45 (≥ 32)

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification Thermanit 625 E Ni 6625 (NiCr-22Mo9Nb)

Dimension mm	Current A
2.5 × 300	45 – 60
3.2 × 300	65 – 95
4.0 × 350	90 – 120

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys.

Re-drying if necessary at 250 – 300ºC for min. 2 – 3 h.

Approvals

TÜV (03463), DNV GL, CE

Thermanit 690

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172
E Ni 6152 (NiCr30Fe9)

AWS A5.11 / SFA-5.11
ENiCrFe-7

Characteristics and typical fields of application

Basic coated nickel-base electrode of E Ni 6152 / ENiCrFe-7 type. High resistance to stress corrosion cracking in pure water environments and resistance in oxidizing media e.g. nitric acid. Particularly suited for conditions in nuclear fabrication. Applicable for joining matching or similar steels, surfacing of low alloy and stainless steels.

Base materials

2.4642 NiCr29Fe

UNS N06690

Alloy 690

Typical analysis of all-weld metal

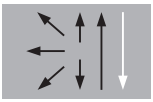
	C	Si	Mn	Cr	Ni	Nb	Fe
wt.-%	0.03	0.5	3.8	28.0	Bal.	1.8	8.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	380	600	35	100

u untreated, as-welded

Operating data



Polarity DC +

Electrode identification Thermanit 690 E NiCrFe-7

Dimension mm	Current A
3.2 × 350	80 – 110
4.0 × 350	100 – 130

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100°C. Preheating and post-weld heat treatment not needed.

Approvals

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Thermanit Nimo C 24

Stick electrode, high-alloyed, nickel-base

Classifications

EN ISO 14172
E Ni 6059 (NiCr23Mo16)

AWS A5.11 / SFA-5.11
ENiCrMo-13

Characteristics and typical fields of application

Coated nickel-base electrode of E Ni 6059 / ENiCrMo-13 type. High corrosion resistance in reducing and predominantly 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.

Base materials

1.4565 X2CrNiMnMoNb N25-18-5-4 2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4610 NiMo16Cr16Ti, 2.4819 NiMo16Cr15W

Alloy C-22, Alloy 59, Alloy C-4, Alloy C-276, Alloy 24 UNS S34565, N06022, N06059, N06455, N10276

Typical analysis of all-weld metal

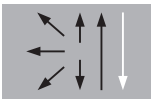
	C	Si	Mn	Cr	Ni	Mo	Fe
wt.-%	< 0.02	0.10	< 0.5	23.0	Bal.	16.0	< 1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	420 (≥ 350)	700 (≥ 690)	30 (≥ 22)	60

u untreated, as-welded

Operating data



Polarity DC+

Electrode identification Thermanit Nimo C 24 E Ni 6059 (NiCr23Mo16)

Dimension mm	Current A
2.5 × 250	45 – 70
3.2 × 300	65 – 105
4.0 × 350	85 – 135

Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys up to 800ºC.

Re-drying if necessary at 250 – 300ºC for min. 2 h. Postweld heat treatment mostly not needed when following the recommendation. In special cases, solution annealing can be performed at 1150 – 1175ºC followed by water quenching to restore full corrosion resistance.

Approvals

TÜV (09272), CE

Thermanit Nicro 82

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6082 (NiCr20Mn3Nb)

AWS A5.14 / SFA-5.14
ERNiCr-3

Characteristics and typical fields of application

Nickel-base solid wire TIG rod of S Ni 6082 (NiCr20Mn3Nb) / ERNiCr-3 for welding of many creep-resistant steels and nickel-base alloys. Well-suited for dissimilar welding of stainless and nickel alloys to mild steels. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. Heat and high temperature resistant. Good toughness at subzero temperatures as low as -269°C. Service temperature limit is max. 900°C for fully stressed welds.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo-stainless steels. Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32-21

NiCr15Fe, X8Ni9, 10CrMo9-10

Alloy 600, 600L, 800, 800H,

UNS N06600, N07080, N0800, N08810

Typical analysis of the wire rod

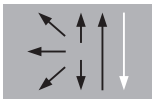
	C	Si	Mn	Cr	Ni	Nb	Fe
wt.-%	0.02	0.1	3.0	20	> 67.0	2.5	< 2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–269°C
u	400	620	35	150	32

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Preheating and post-weld heat treatment according to the parent metal. Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels. To minimize the risk of hot cracking when welding fully austenitic and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100°C.

Creep rupture properties according to matching high temperature steels / alloys up to 900°C.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (01703 / 08125), DB (43.132.11), DNV GL, CE

Thermanit 625

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6625 (NiCr22Mo9Nb)

AWS A5.14 / SFA-5.14
ERNiCrMo-3

Characteristics and typical fields of application

Nickel-base solid wire TIG rod of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining and surfacing work with matching / similar corrosion resistant materials as well as with matching and similar heat resistant alloys. For joining and surfacing work on cryogenic austenitic CrNi(N)-steels and cast steel grades and on cryogenic Ni-steels suitable for quenching and tempering. High resistance to corrosive environment. Resistant to stress corrosion cracking. Service temperature limit max. 500°C in sulfurous atmospheres, otherwise heat resistant up to 900°C. Good toughness at subzero temperatures as low as -196°C.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 9Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo-stainless steels

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe, 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH, P285NH, P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of the wire rod

	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wt.-%	0.03	0.1	0.1	22	Bal.	9.0	3.6	≤ 0.5

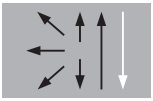
Structure: Austenite

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Yield strength $R_{p1.0}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	460	500	740	35	120	100

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max. 1.5 kJ/mm, interpass temperature max. 100°C.

Creep rupture properties according to matching high temperature steels / alloys.

Shielding gas: 100% Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (03464), DB (43.132.33), DNV GL, CE

Thermanit 22

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6022 (NiCr21Mo13Fe4W3)

AWS A5.14 / SFA-5.14
ERNiCrMo-10

Characteristics and typical fields of application

Nickel-base TIG rod of S Ni 6022 (NiCr21Mo13Fe4W3) / ERNiCrMo-10 for joining and surfacing of matching and similar alloys. For welding the clad side of plates of matching and similar alloys. High corrosion resistance in reducing and oxidizing environments. Also an alternative to Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 and Ni 6059 (NiCr23Mo16) / ERNiCrMo-13 when dissimilar welding of stainless steels containing high levels of nitrogen; e.g. superduplex alloys to superaustenitics.

Base materials

2.4602 NiCr21Mo14W, 2.4603 NiCr30FeMo, 2.4665 NiCr22Fe18Mo

UNS N06002, N06022

Alloy C-22

and combinations with ferritic or austenitic steels

Typical analysis of the wire rod

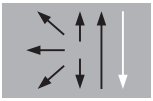
	C	Si	Mn	Cr	Ni	Mo	W	V	Co	Fe	Cu
wt.-%	< 0.01	< 0.1	< 0.5	21	Bal.	13.0	3	< 0.2	< 2.5	3.0	< 0.2

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	> 400	> 700	> 30	55

u untreated, as-welded - shielding gas Ar

Operating data



Rod marking Ni 6022 / ERNiCrMo-10

Dimension mm	Current A	Voltage V
2.4 × 1000	130 – 160	16 – 18

Heat input max. 1.0 kJ/mm, interpass temperature max. 100°C.

Preheating and post weld heat treatment not required. In special cases, solution annealing can be performed at 1100 – 1150°C followed by water quenching.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

-

Thermanit Nimo C 24

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6059 (NiCr23Mo16)

AWS A5.14 / SFA-5.14
ERNiCrMo-13

Characteristics and typical fields of application

TIG rod of S Ni 6059 (NiCr23Mo16) / ERNiCrMo-13 type for joining and surfacing with matching and similar alloys and cast alloys. For welding the cladded side of plates of matching and similar alloys. Suitable for welding 7Mo-steels such as 1.4565 / UNS S34565, 625 and 825; and for dissimilar welds between stainless and nickel-base alloys to mild steel. The wire is free from molybdenum, which increases the ductility of dissimilar joints with nitrogen-alloyed stainless steels. To minimize the risk of hot cracking when welding fully austenitic steels and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. High corrosion resistance in reducing and, above all, in oxidizing environments. Superior resistance to pitting and crevice corrosion. Meets the corrosion test requirements per ASTM G48 Methods A and E (80ºC).

Base materials

1.4565 X2CrNiMnMoNbN25-18-5-4, 2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4610 NiMo16Cr16Ti, 2.4819 NiMo16Cr15W

Alloy C-22, Alloy 59, Alloy C-4, Alloy C-276, Alloy 24

UNS S34565, N06022, N06059, N06455, N10276

Typical analysis of the wire rod

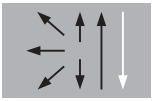
	C	Si	Mn	Cr	Ni	Mo	Fe
wt.-%	0.01	< 0.10	< 0.5	23	Bal.	16.0	< 1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450	700	35	120

u untreated, as-welded - shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.0 × 1000	50 – 70	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18
3.2 × 1000	160 – 200	17 – 20

Heat input max. 1.0 kJ/mm, interpass temperature max. 100ºC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1120ºC followed by water quenching.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (06462), DNV GL, CE

Thermanit 686

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6686 (NiCr21Mo16W4)

AWS A5.14 / SFA-5.14
ERNiCrMo-14

Characteristics and typical fields of application

Nickel-base solid wire TIG rod of S Ni 6686 (NiCr21Mo16W4) / ERNiCrMo-14 type for joining and surfacing on matching and similar wrought and cast alloys. For welding the cladded side of plates of matching and similar alloys e.g. flue gas desulfurization scrubber. High corrosion resistance in reducing and oxidizing environments.

Base materials

2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4606 NiCr21Mo16W, 2.4819 NiMo16Cr15W

UNS N06022, N06059, N06686, N10276

Alloy 22, Alloy 59, Alloy 686, Alloy C-276

16Mo3

Typical analysis of the wire rod

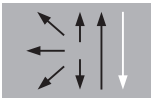
	C	Si	Mn	Cr	Ni	Mo	W	Fe	Al
wt.-%	0.01	0.1	< 0.5	22.8	Bal.	16.0	3.8	< 1.0	0.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450	760	30	50

u untreated, as-welded – shielding gas Ar

Operating data



Dimension mm	Current A	Voltage V
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input max. 1.0 kJ/mm, interpass temperature max. 100ºC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at min. 1180ºC followed by water quenching.

Shielding gas: Ar or Ar + 2% H_2. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

-

Thermanit 690

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6052 (NiCr30Fe9)

AWS A5.14 / SFA-5.14
ERNiCrFe-7

Characteristics and typical fields of application

Nickel-base TIG rod of S Ni 6052 (NiCr30Fe9) / ERNiCrFe-7 type for joining matching and similar steels, surfacing with low-alloy and stainless steels. Particularly suited for the conditions in nuclear fabrication. High resistance to stress corrosion cracking in oxidizing acids and water at high temperatures.

Base materials

2.4642 NiCr29Fe

UNS N06690

Alloy 690

Typical analysis of the wire rod

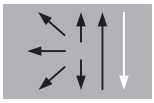
	C	Si	Mn	Cr	Ni	Mo	Co	Fe
wt.-%	0.02	0.2	0.3	29	Bal.	0.1	< 0.1	9.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	380	600	35	100

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking Ni 6052 / ERNiCrFe-7

Dimension mm	Current A	Voltage V
1.2 × 1000	60 – 80	9 – 11
1.6 × 1000	80 – 120	10 – 13
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

Heat input max. 1.0 kJ/mm, interpass temperature max. 100°C.

Creep rupture properties according to matching high temperature steels / alloys.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

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Thermanit 617

TIG rod, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6617 (NiCr22Co12Mo9)

AWS A5.14 / SFA-5.14
ERNiCrCoMo-1

Characteristics and typical fields of application

Nickel-base solid wire TIG rod of S Ni 6617 (NiCr22Co12Mo9) / ERNiCrCoMo-1 type for joining and surfacing applications with matching and similar heat resistant steels and alloys. Temperature resistant up to 1000ºC. High resistance to hot gases in oxidizing and carburizing atmospheres.

Base materials

1.4558 X2NiCrAlTi32-20, 1.4859 GX10NiCrNb38-18 / GX10NiCrNb32-20, 1.4861 X10NiCr32-20, 1.4876 X10NiCrAlTi32-20 / X10NiCrAlTi 32-21, 1.4877 X6NiCrNbCe32-27, 1.4959 X8NiCrAlTi32-21, 2.4663 NiCr23Co12Mo, 2.4851 NiCr23Fe

UNS N08810, N08151, N08800, N08811, N06617, N06601 Alloy 800, 800H, 800HT, 617, 617B, 601

Typical analysis of the wire rod

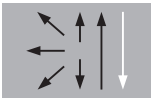
	C	Si	Mn	Cr	Ni	Mo	Co	Ti	Fe	Al
wt.-%	0.05	0.1	0.1	21.5	Bal.	9.0	11.0	0.3	0.5	1.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	> 450	> 700	> 30	> 60

u untreated, as-welded – shielding gas Ar

Operating data



Rod marking Ni 6617 / ER NiCrCoMo-1

Dimension mm	Current A	Voltage V
2.0 × 1000	100 – 130	14 – 16
2.4 × 1000	130 – 160	16 – 18

To minimize the risk of hot cracking when welding fully austenitic and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.0 kJ/mm and interpass temperature max. 100ºC.

Preheating and post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC.

Shielding gas: Ar. Gas flow: 8 – 12 l/min.

Polarity: DC-

Approvals

TÜV (06845)

Thermanit Nicro 82

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6082 (NiCr20Mn3Nb)

AWS A5.14 / SFA-5.14
ERNiCr-3

Characteristics and typical fields of application

Solid wire of S Ni 6082 (NiCr20Mn3Nb) / ERNiCr-3 type for welding of many creep-resistant steels and nickel-base alloys. Provides high resistance to cracking and is well-suited for dissimilar welding of stainless and nickel-base alloys to mild steels. Heat and high temperature resistant – can be used for welding nickel-base alloys for use in high temperature applications. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. Good toughness at subzero temperatures as low as -269ºC. Service temperature limit is max. 900ºC for fully stressed welds. High resistance to stress corrosion cracking, but also excellent resistance to intergranular corrosion due to the low carbon content and absence of secondary phases.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels. Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32-21

NiCr15Fe, X8Ni9, 10CrMo9-10

Alloy 600, 600L, 800, 800H,

UNS N06600, N07080, N0800, N08810

Typical analysis of the solid wire

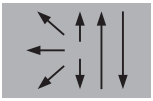
	C	Si	Mn	Cr	Ni	Nb	Fe	FN
wt.-%	0.02	0.2	2.8	19.5	> 67	2.5	< 2.0	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	380	620	35	90

u untreated, as-welded – shielding gas Ar + 30% He + 2% H_2 + 0.1% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 spray arc	170 – 210	20 – 22
1.2 spray arc	200 – 240	24 – 28
1.6 spray arc	250 – 660	25 – 29

Preheating and post-weld heat treatment according to the parent metal. Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels. To minimize the risk of hot cracking when welding fully austenitic and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys up to 900ºC.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: Ar. Gas flow: 5 – 12 l/min.

Approvals

TÜV (03089), DNV GL, CE

Thermanit 625

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6625 (NiCr22Mo9Nb)

AWS A5.14 / SFA-5.14
ERNiCrMo-3

Characteristics and typical fields of application

Solid wire of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining and surfacing work with matching / similar corrosion resistant materials as well as with matching and similar heat resistant alloys. For joining and surfacing work on cryogenic austenitic CrNi(N)-steels and cast steel grades and on cryogenic Ni-steels suitable for quenching and tempering. High resistance to corrosive environment. Resistant to stress corrosion cracking. Resistant to scaling up to 1000ºC. Service temperature limit max. 500ºC in sulfurous atmospheres, otherwise heat resistant up to 900ºC. Good toughness at subzero temperatures as low as -196ºC. Excellent resistance to general, pitting and intercrystalline corrosion in chloride containing environments.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 9% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels.

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9 2.4816 NiCr15Fe, 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH, P285NH, P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of the solid wire

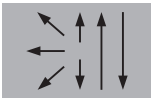
	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wt.-%	0.03	0.25	0.20	22	Bal.	9.0	3.6	< 0.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	520 (≥ 460)	790 (≥ 740)	39 (≥ 30)	130	90

u untreated, as-welded – shielding gas Ar + 30% He + 0.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
0.8 short arc	60 – 100	20 – 22
1.0 spray arc	170 – 210	24 – 28
1.2 spray arc	180 – 220	25 – 29
1.6 spray arc	250 – 330	29 – 32

To minimize the risk of hot cracking when welding fully austenitic and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC.

Creep rupture properties according to matching high temperature steels / alloys. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC followed by water quenching.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1 – 0.5% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: Ar. Gas flow 5 – 12 l/min.

Approvals

TÜV (03462), DB (43.132.25), BV, CE

Thermanit 22

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6022 (NiCr21Mo13Fe4W3)

AWS A5.14 / SFA-5.14
ERNiCrMo-10

Characteristics and typical fields of application

Nickel-base solid wire ERNiCrMo-10 type for joining and surfacing of matching and similar alloys and cast alloys. For welding the cladded side of plates of matching and similar alloys. High corrosion resistance in reducing and oxidizing environments.

Base materials

2.4602 NiCr21Mo14W, 2.4603 NiCr30FeMo, 2.4665 NiCr22Fe18Mo

UNS N06002, N06022

Alloy C-22

and combinations with ferritic or austenitic steels

Typical analysis of the solid wire

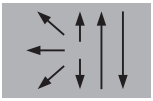
	C	Si	Mn	Cr	Ni	Mo	W	Fe
wt.-%	< 0.01	< 0.1	< 0.5	22.0	Bal.	13.5	3.0	3.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–40°C
u	520 (> 450)	710 (> 700)	30 (> 25)	150 (≥ 47)	110 (≥ 47)

u untreated, as welded – shielding gas Ar + 30 % He + 2 % CO_2

Operating data



Dimension mm	Current A	Voltage V
1.14 spray arc	200 – 240	25 – 29
1.2 spray arc	200 – 240	25 – 29

Suggested heat input is max. 1.0 kJ/mm and interpass temperature max. 100ºC. Preheating and post-weld heat treatment not required. In special cases, solution annealing can be performed at 1100-1150ºC followed by water quenching.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2, Gas flow 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: Ar or Ar + 30% He + 2% H_2, Gas flow 5 – 12 l/min.

Approvals

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Thermanit Nimo C 24

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6059 (NiCr23Mo16)

AWS A5.14 / SFA-5.14
ERNiCrMo-13

Characteristics and typical fields of application

Solid wire of S Ni 6059 (NiCr23Mo16) / ERNiCrMo-13 type for joining and surfacing with matching and similar alloys and cast alloys. Suitable for welding 7Mo-steels such as 1.4565 / UNS S34565, 625 and 825; and for dissimilar welds between stainless and nickel-base alloys to mild steel. The wire is free from niobium, which increases the ductility of dissimilar joints with nitrogen-alloyed stainless steels. High corrosion resistance in reducing and, above all, in oxidizing environments. Superior resistance to pitting and crevice corrosion. Meets the corrosion test requirements per ASTM G48 Methods A and E (> 80ºC).

Base materials

1.4565.X2CrNiMnMoNbN25-18-5-4, 2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4610 NiMo16Cr16Ti, 2.4819 NiMo16Cr15W

Alloy C-22, Alloy 59, Alloy C-4, Alloy C-276, Alloy 24 UNS S34565, N06022, N06059, N06455, N10276

Typical analysis of the solid wire

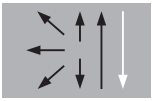
	C	Si	Mn	Cr	Ni	Mo	Fe	FN
wt.-%	0.01	0.1	< 0.5	23	Bal.	16.0	< 1.5	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	420	700	40	60

u untreated, as-welded – shielding gas Ar + 30% He + 2% H_2 + 0.1% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 spray arc	170 – 210	24 – 28
1.2 spray arc	200 – 240	25 – 29
1.6 spray arc	250 – 660	29 – 32

To minimize the risk of hot cracking when welding fully austenitic and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. No preheating for matching alloys. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150 – 1200ºC followed by water quenching.

For MAG welding: Polarity: DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity: DC-. Shielding gas: Ar. Gas flow 5 – 12 l/min.

Approvals

TÜV (06461), CE

Thermanit 686

Solid wire high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6686 (NiCr21Mo16W4)

AWS A5.14 / SFA-5.14
ERNiCrMo-14

Characteristics and typical fields of application

Solid wire of S Ni 6686 (NiCr21Mo16W4) / ERNiCrMo-14 type for joining and surfacing work with matching / similar corrosion resistant materials as well as with matching and similar heat resistant alloys. For joining and surfacing work on cryogenic austenitic CrNi(N)-steels and cast steel grades and on cryogenic Ni-steels suitable for quenching and tempering. High resistance to corrosive environment. Resistant to stress corrosion cracking. Service temperature limit max. 500°C in sulfurous atmospheres, otherwise heat resistant up to 900°C. Good toughness at subzero temperatures as low as -196°C. High corrosion resistance in reducing and oxidizing environments.

Base materials

2.4602 NiCr21Mo14W, 2.4605 NiCr23Mo16Al, 2.4606 NiCr21Mo16W, 2.4819 NiMo16Cr15W

UNS N06022, N06059, N06686, N10276

Alloy 22, Alloy 59, Alloy 686, Alloy C-276

16Mo3

Typical analysis of the solid wire

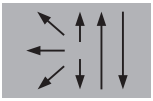
	C	Si	Mn	Cr	Ni	Mo	W	Fe	Al
wt.-%	0.01	0.08	< 0.5	22.8	Bal.	16.0	3.8	< 1.0	0.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	450	760	30	50

u untreated, as-welded – shielding gas Ar + 30% He + 2% H_2 + 0.1% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 spray arc	170 – 210	24 – 28
1.2 spray arc	200 – 240	25 – 29

To minimize the risk of hot cracking when welding fully austenitic and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.0 kJ/mm and interpass temperature max. 100°C.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1180°C followed by water quenching.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: Ar. Gas flow: 5 – 12 l/min.

Approvals

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Thermanit 690

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6052 (NiCr30Fe9)

AWS A5.14 / SFA-5.14
ERNiCrFe-7

Characteristics and typical fields of application

Solid wire of S Ni 6052 (NiCr30Fe9) / ERNiCrFe-7 type for joining matching and similar steels, surfacing with low-alloyed and stainless steels. Particularly suited for the conditions in nuclear fabrication. High resistance to stress corrosion cracking in oxidizing acids and water at high temperatures.

Base materials

2.4642 NiCr29Fe

UNS N06690

Alloy 690

Typical analysis of the solid wire

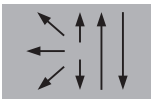
	C	Si	Mn	Cr	Ni	Mo	Co	Fe
wt.-%	0.03	0.3	0.3	29	Bal.	0.1	< 0.1	9.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	350	600	35	80

u untreated, as-welded – shielding gas Ar + 30% He + 0.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.2 spray arc	200 – 240	25 – 29

To minimize the risk of hot cracking when welding fully austenitic and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. No preheating or post-weld heat treatment needed for matching alloys.

For MAG welding: Polarity: DC+. Shielding gas: Ar + 30% He + 0.5% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity: DC-. Shielding gas: Ar. Gas flow: 5 – 12 l/min.

Approvals

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Thermanit 617

Solid wire, high-alloyed, nickel-base

Classifications

EN ISO 18274
S Ni 6617 (NiCr22Co12Mo9)

AWS A5.14 / SFA-5.14
ERNiCrCoMo-1

Characteristics and typical fields of application

Solid wire of S Ni 6617 (NiCr22Co12Mo9) / ERNiCrCoMo-1 type for joining and surfacing applications with matching and similar heat resistant steels and alloys. Temperature resistant up to 1000ºC. High resistance to hot gases in oxidizing and carburizing atmospheres.

Base materials

1.4558 X2NiCrAlTi32-20, 1.4859 GX10NiCrNb38-18 / GX10NiCrNb32-20, 1.4861 X10NiCr32-20, 1.4876 X10NiCrAlTi32-20 X10NiCrAlTi 32-21, 1.4877 X6NiCrNbCe32-27, 1.4959 X8NiCrAlTi32-21, 2.4663 NiCr23Co12Mo, 2.4851 NiCr23Fe

UNS N08810, N08151, N08800, N08811, N06617, N06601

Alloy 800, 800H, 800HT, 617, 617B, 601

Typical analysis of the solid wire

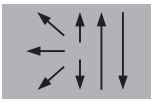
	C	Si	Mn	Cr	Ni	Mo	Co	Ti	Fe	Al
wt.-%	0.05	0.1	0.1	21.5	Bal.	9.0	11.0	0.3	0.5	1.3

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	400	700	40	100

u untreated, as-welded – shielding gas Ar + 30% He + 0.5% CO_2

Operating data



Dimension mm	Current A	Voltage V
1.0 spray arc	170 – 210	24 – 28
1.2 spray arc	200 – 240	25 – 29

To minimize the risk of hot cracking when welding fully austenitic and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.0 kJ/mm and interpass temperature max. 100ºC.

Preheating and post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC.

For MAG welding: Polarity DC+. Shielding gas: Ar + 30% He + 2% H_2 + 0.1% CO_2 and pulsed arc. Gas flow: 15 – 20 l/min.

For automatic TIG welding: Polarity DC-. Shielding gas: 100% Ar. Gas flow 5 – 12 l/min.

Approvals

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Thermanit 625 - Marathon 104

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	S A FB 2 AC

Characteristics and typical fields of application

Thermanit 625 - Marathon 104 is a wire/flux combination for submerged arc welding. Solid wire of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining similar nickel-alloys and dissimilar joints between Ni-alloys with low-alloyed and stainless steels and surfacing on low-alloyed steels. Also used for joining of 6Mo superaustenitic grades, e.g. 254 SMO® (1.4547 / UNS S31254). Resistant to scaling up to 1000ºC. Service temperature limit max. 500ºC in sulfurous atmospheres, otherwise heat resistant up to 900ºC. Resistant to stress corrosion cracking. Excellent resistance to general, pitting, crevice and intercrystalline corrosion in chloride containing environments. Good toughness at subzero temperatures as low as –196ºC. Creep rupture properties according to matching high temperature steels / alloys.

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless and heat resistant steel grades. The weld metal is characterized by high resistance to hot cracking and is recommended for the highest demanding applications. For more information regarding this flux, see the separate datasheet.

Base materials

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Cladding and dissimilar welding unalloyed and low-alloyed steels, e.g. P265GH-P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of the weld metal

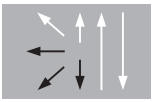
wt.-%	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wire	0.01	0.10	0.10	22.0	Bal.	9.0	3.6	< 1.0
all-weld metal	0.02	0.30	0.20	21.7	Bal.	9.0	3.2	< 1.5

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	(≥ 420)	(≥ 720)	(≥ 35)	(≥ 80)	(≥ 60)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Preheat and interpass temperature: max. 100ºC. Suggested heat input is max. 1.5 kJ/mm. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC followed by water quenching.

Approvals

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Thermanit 625 - Marathon 504

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	S A BA 2 AC

Characteristics and typical fields of application

Thermanit 625 - Marathon 504 is a wire/flux combination for submerged arc welding. Especially suitable for surfacing of low-alloyed steels. Solid wire of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining similar nickel-alloys and dissimilar joints between Ni-alloys with low-alloyed and stainless steels and surfacing on low-alloyed steels. Also used for joining of 6Mo superaustenitic grades, e.g. 254 SMO® (1.4547 / UNS S31254). Resistant to scaling up to 1000ºC. Service temperature limit max. 500ºC in sulfurous atmospheres, otherwise heat resistant up to 900ºC. Good toughness at subzero temperatures as low as –196ºC. Resistant to stress corrosion cracking. Excellent resistance to general, pitting and intercrystalline corrosion in chloride containing environments. Creep rupture properties according to matching high temperature steels / alloys.

Marathon 504 is an agglomerated welding flux designed for joining and surfacing applications. It has neutral metallurgical behavior and provides excellent slag detachability. For more information regarding this flux, see the separate datasheet.

Base materials

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe, 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1 Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Cladding and dissimilar welding un- and low-alloyed steels, e.g. P265GH, P295GH, 16Mo3, S355N

254 SMO®

SAW

Typical analysis of the weld metal

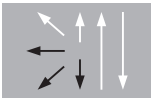
wt.-%	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wire	0.01	0.10	0.10	22.0	Bal.	9.0	3.6	< 1.0
all-weld metal	0.015	0.35	0.10	21.7	Bal.	8.7	3.3	< 2.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	490 (≥ 460)	760 (≥ 720)	45 (≥ 35)	80 (≥ 47)	65 (≥ 47)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. No preheating. Suggested heat input is max. 1.2 kJ/mm and interpass temperature max. 120ºC. PWHT generally not needed. In special cases, solution annealing can be performed at 1150ºC followed by water quenching.

Approvals

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Thermanit 625 - Marathon 444

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6625 (NiCr22Mo9Nb)	ERNiCrMo-3	S A FB 2 AC

Characteristics and typical fields of application

Thermanit 625 - Marathon 444 is a wire/flux combination for submerged arc welding. Solid wire of S Ni 6625 (NiCr22Mo9Nb) / ERNiCrMo-3 type for joining similar nickel-alloys and dissimilar joints between Ni-alloys with low-alloyed and stainless steels and surfacing on low-alloyed steels. Also used for joining of 6Mo superaustenitic grades, e.g. 254 SMO® (1.4547 / UNS S31254). Resistant to scaling up to 1000ºC. Service temperature limit max. 500ºC in sulfurous atmospheres, otherwise heat resistant up to 900ºC. Resistant to stress corrosion cracking. Excellent resistance to general, pitting, crevice and intercrystalline corrosion in chloride containing environments. Good toughness at subzero temperatures as low as –196ºC. Creep rupture properties according to matching high temperature steels / alloys.

Marathon 444 is an agglomerated fluoride basic welding flux with high basic slag characteristics without Cr-support. The weld metals show excellent mechanical properties with high hot cracking resistance. For more information regarding this flux, see the separate datasheet.

Base materials

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4558 X2NiCrAlTi32-20, 1.4580 X6CrNiMoNb17-12-2 1.4583 X10CrNiMoNb18-12, 1.4876 X8NiCrAlTi32-21, 1.4877 X6NiCrNbCe32-27, 1.4958 X5NiCrAlTi31-20, 1.5662 X8Ni9, 2.4816 NiCr15Fe 2.4641 NiCr21Mo6Cu, 2.4817 LC-NiCr15Fe, 2.4856 NiCr22Mo9Nb, 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Cladding and dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH-P295GH, 16Mo3, S355N

254 SMO®

Typical analysis of the weld metal

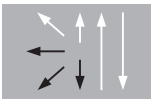
wt.-%	C	Si	Mn	Cr	Ni	Mo	Nb	Fe
wire	0.01	0.10	0.10	22.0	Bal.	9.0	3.6	< 1.0
all-weld metal	0.012	0.16	0.20	21.8	Bal.	9.0	3.2	< 1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	(≥ 420)	(≥ 700)	(≥ 40)	≥ 80	≥ 70

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 – 350	28 – 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. No preheating. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+ or AC.

Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1150ºC followed by water quenching.

Approvals

TÜV (10173), DNV GL, CE

Thermanit Nicro 82 - Marathon 104

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	S A FB 2 AC

Characteristics and typical fields of application

Thermanit Nicro 82 - Marathon 104 is a wire/flux combination for submerged arc welding. Solid wire of S Ni 6082 (NiCr20Mn3Nb) / ERNiCr-3 type for welding of many creep-resistant steels and nickel-base alloys such as Alloy 600. Provides high resistance to cracking and is well-suited for dissimilar welding of stainless and nickel-base alloys to mild steels. Heat and high temperature resistant – can be used for welding nickel-base alloys for use in high temperature applications. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. It is mainly applied for components in chemical and in petrochemical plants. Good toughness at subzero temperatures down to –196ºC. High resistance to stress corrosion cracking, but also excellent resistance to intergranular corrosion due to the low carbon content. Resistant to scaling up to 1000ºC.

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless and heat resistant steel grades. The weld metal is characterized by high resistance to hot cracking and is recommended for the highest demanding applications. For more information regarding this flux, see the separate datasheet.

Base materials

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32-21

NiCr15Fe, 1.5680 X12Ni5, X8Ni9, 10CrMo9-10

Alloy 600, 600L, 800, 800H. UNS N06600, N07080, N0800, N0810

Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

Typical analysis of the weld metal

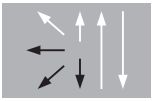
wt.-%	C	Si	Mn	Cr	Ni	Nb	Fe
wire	0.01	0.10	3.2	20.5	Bal.	2.6	< 1.0
all-weld metal	0.02	0.25	3.0	20.2	Bal.	2.4	< 1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C
u	≥ 380	≥ 600	≥ 35	≥ 100

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 - 350	28 - 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. No preheating. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels.

Polarity: DC+ or AC

Approvals

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Thermanit Nicro 82 - Marathon 444

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6082 (NiCr20Mn3Nb)	ERNiCr-3	S A FB 2 AC

Characteristics and typical fields of application

Thermanit Nicro 82 - Marathon 444 is a wire – flux combination for submerged arc welding of dissimilar austenite-ferrite joints, joints of stainless, heat resistant, creep resistant and cryogenic steels. Solid wire of S Ni 6082 (NiCr20Mn3Nb) / ERNiCr-3 type for welding of many creep-resistant steels and nickel-base alloys such as Alloy 600. 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 down to –196ºC. High resistance to stress corrosion cracking, but also excellent resistance to intergranular corrosion due to the low carbon content. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material.

Marathon 444 is an agglomerated fluoride-basic welding flux with high basic slag characteristics. The weld metals show excellent mechanical properties with high hot cracking resistance. For more information regarding this welding flux, see the separate datasheet.

Base materials

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32–21; NiCr15Fe, 1.5680 X12Ni5 ,X8Ni9, 10CrMo9-10

Alloy 600, 600L, 800, 800H,

UNS N06600, N07080, N0800, N0810.

Dissimilar welding of 1.4583 X10CrNiMoNb18-12 and 1.4539 X2NiCrMoCu25-20 with ferritic pressure vessel boiler steels.

Typical analysis of the weld metal

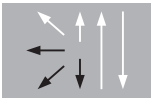
wt.-%	C	Si	Mn	Cr	Ni	Nb	Fe
wire	0.01	0.10	3.2	20.5	Bal.	2.6	< 1.0
all-weld metal	0.012	0.25	3.0	20.2	Bal.	2.4	< 1.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J 20°C
u	≥ 380	≥ 580	≥ 35	≥ 110

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.0	250 - 350	28 - 32
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking when welding fully austenitic and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. No preheating. Suggested heat input is max. 1.5 kJ/mm and interpass temperature max. 100ºC. Polarity: DC+ or AC.

Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels.

Approvals

TÜV (07767), CE

SAW

Thermanit Nimo C 276 - Marathon 104

SAW wire/flux combination, nickel-base

Classifications

EN ISO 18274	AWS A5.14 / SFA-5.14	EN ISO 14174
S Ni 6276 (NiCr15Mo16Fe6W4)	ERNiCrMo-4	S A FB 2 AC

Characteristics and typical fields of application

Thermanit Nimo C 276 - Marathon 104 is a wire/flux combination for submerged arc welding. It can be applied for joining similar Ni-alloys and dissimilar joints between Ni-alloys and low-alloyed or stainless steels; and surfacing on low-alloyed steels. Solid wire of S Ni 6276 (NiCr15Mo16Fe6W4) / ERNiCrMo-4. Provides high resistance to cracking and is well-suited for dissimilar welding of stainless and nickel-base alloys to mild steels. This wire/flux combination is especially recommended for joining cryogenic Ni-steels such as X8Ni9 and X12Ni5. The weld metal has an excellent corrosion resistance especially to pitting and crevice corrosion. High resistance to stress corrosion cracking, but also excellent resistance to intergranular corrosion due to the low carbon content. In dissimilar welding and cladding, the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. Good toughness at subzero temperatures down to –196ºC. Resistant to scaling up to 1000ºC.

Marathon 104 is an agglomerated fluoride-basic flux for submerged arc welding of stainless and heat resistant steel grades. The weld metal is characterized by high resistance to hot cracking and is recommended for the highest demanding applications. For more information regarding this welding flux, see the separate datasheet.

Base materials

1.5662 X8Ni9, 1.5680 X12Ni5 and 2.4819 NiMo16Cr15W

Joint welds of listed materials with low-alloyed and stainless steels.

SAW

Typical analysis of the weld metal

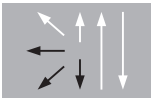
wt.-%	C	Si	Mn	Cr	Ni	Mo	W	Fe
wire	0.01	0.05	0.50	15.5	Bal.	16.0	3.8	6.0
all-weld metal	0.01	0.10	0.50	15.4	Bal.	16.0	3.7	6.0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A ($L_0=5d_0$) %	Impact values ISO-V KV J –196°C
u	450 (≥ 420)	720 (≥ 680)	45 (≥ 35)	110 (≥ 70)

u untreated, as-welded

Operating data



Dimension mm	Current A	Voltage V
1.6	200 – 300	23 – 30
2.4	300 – 400	29 – 33

To minimize the risk of hot cracking, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. Suggested heat input is max. 1.5 kJ/mm (depending on plate thickness). Preheating and post-weld heat treatment of dissimilar welds, heat-resistant Cr-steels and cryogenic Ni-steels according to the parent metal, but max. 120ºC. Attention must be paid to resistance to intercrystalline corrosion and embrittlement in case of austenitic stainless steels. Polarity:

- Wire diameter 1.6 mm: AC or DC+
- Wire diameter 2.4 mm, full penetration welds in 1G / PA and 2G / PC position: AC
- Wire diameter 2.4 mm, fillet welds: AC or DC+

Approvals

DNV GL, LR, CE, ABS

BÖHLER NIBAS 70/20-FD

Flux-cored wire, high-alloyed, nickel-base

Classifications

EN ISO 12153
T Ni 6082 R M21 3

AWS A5.34 / SFA-5.34
ENiCr3T0-4

Characteristics and typical fields of application

Nickel-base rutile flux-cored wire of T Ni 6082 R / ENiCr3T0 type for welding of many creep-resistant steels and nickel-base alloys. Well-suited for dissimilar welding of stainless and nickel alloys to mild steels and some copper alloys. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. The austenitic structure is very stable and the risk of solidification cracking is low. The weld metal has low coefficient of thermal expansion and is resistant to thermal shock. It provides high resistance to stress corrosion cracking and good resistance to intergranular corrosion. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for pressure vessel fabrication in the service temperature range –196ºC to 550ºC, otherwise resistant to scaling up to 1100ºC (in S-free atmosphere). Especially designed for flat and horizontal welding positions.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32–21

Alloy 600, Alloy 600 L, Alloy 800 / 800H. UNS N06600, N07080, N0800, N0810

Typical analysis of the wire

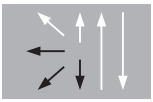
	C	Si	Mn	Cr	Ni	Nb	Fe	FN
wt.-%	0.03	0.4	3.2	19.5	Bal.	2.5	2.5	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	385 (≥ 360)	650 (≥ 550)	39 (≥ 25)	130	120 (≥ 32)

u untreated, as welded - shielding gas Ar + 18 % CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0
1.6	~ 3	200 – 350	25 – 30	4.5 – 9.5

Welding with standard GMAW power source on DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min. To minimize the risk of hot cracking when welding fully austenitic steels and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. The heat input should not exceed 1.5 kJ/mm, the interpass temperature be limited to max. 100ºC and the wire stick-out 15 – 20 mm. Slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050 – 1200ºC followed by water quenching.

Approvals

TÜV (10298), CE

BÖHLER NIBAS 70/20 Mn-FD

Flux-cored wire, high-alloyed, nickel-base

Classifications

EN ISO 12153
T Ni 6083 R M21 3

AWS A5.34 / SFA-5.34
ENiCr3T0-4 (mod.)

Characteristics and typical fields of application

Nickel-base rutile flux-cored wire of T Ni 6083 R / ENiCr3T0 type for welding of many creep-resistant steels and nickel-base alloys. Well-suited for dissimilar welding of stainless and nickel alloys to mild steels and some copper alloys. Can also be used as a buffer layer in many difficult-to-weld applications, where the high nickel content will minimize the carbon diffusion from the mild steel into the stainless material. The austenitic structure is very stable and the increased Mn content gives further improved resistance to hot cracking. The weld metal has low coefficient of thermal expansion and is resistant to thermal shock. It provides high resistance to stress corrosion cracking and good resistance to intergranular corrosion. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wire shows good wetting behavior and results in a finely rippled surface pattern. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion. Suitable for pressure vessel fabrication in the service temperature range –196°C to 650°C, otherwise resistant to scaling up to 1100°C (in S-free atmosphere). Especially designed for flat and horizontal welding positions.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 5% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels

2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 1.4876 X10NiCrAlTi32-21

Alloy 600, Alloy 600 L, Alloy 800 / 800H UNS N06600, N07080, N0800, N0810

Typical analysis of the wire

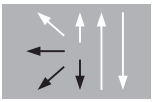
	C	Si	Mn	Cr	Ni	Nb	Fe	FN
wt.-%	0.03	0.3	5.5	19.7	Bal.	2.4	2.0	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C
u	380 (≥ 360)	640 (≥ 600)	41 (≥ 27)	130	115 (≥ 32)

u untreated, as welded - shielding gas Ar + 18 % CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	130 – 280	22 – 30	5.0 – 15.0

Welding with standard GMAW power source with DC+ polarity. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80°. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min. To minimize the risk of hot cracking when welding fully austenitic steels and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. The heat input should not exceed 1.5 kJ/mm, the interpass temperature be limited to max. 100°C and the wire stick-out 15 – 20 mm. Slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050 – 1200°C followed by water quenching.

Approvals

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BÖHLER NIBAS 625 PW-FD

Flux-cored wire, high-alloyed, nickel-base

Classifications

EN ISO 12153
T Ni 6625 P M21 2

AWS A5.34 / SFA-5.34
ENiCrMo3T1-4

Characteristics and typical fields of application

Nickel-base rutile flux-cored wire of T Ni 6625 P / ENiCrMo3T1 type for welding of nickel-base alloys with high Mo content, e.g. Alloy 625 and Alloy 825, as well as "6Mo" austenitic stainless steels such as 1.4547 / UNS S31254 – 254 SMO®. For welding of creep resistant, heat resistant and 9Ni-steels for cryogenic applications (e.g. LNG). The weld metal is exceptionally resistant to general corrosion in various types of acids and to pitting, crevice corrosion and stress corrosion cracking in chloride containing environments. Meets the corrosion test requirements per ASTM G48 Methods A, B and E (50ºC). Suitable for pressure vessel fabrication in the service temperature range –196ºC to 550ºC, otherwise resistant to scaling up to 1100ºC (in S-free atmosphere). The austenitic structure is very stable and the risk of solidification cracking is low. Because of embrittlement of the base material at 550 – 850ºC, service in this temperature range should be avoided. BÖHLER NIBAS 625 PW-FD can also be used for welding of dissimilar joints including low-alloyed "hard-to-weld" steels. High nickel content prevents C-diffusion at high service temperatures or during post-weld heat treatment of dissimilar steels. The weld metal has low coefficient of thermal expansion and is resistant to thermal shock. The fast freezing slag offers excellent weldability and slag control in all positions. Easy handling and high deposition rate result in high productivity with excellent welding performance and very low spatter formation. Increased travel speeds as well as self-releasing slag with little demand for cleaning and pickling provide considerable savings in time and money. The wide arc ensures even penetration and side-wall fusion to prevent lack of fusion.

Base materials

Suitable for high-quality weld joints of nickel-base alloys, joint welding of dissimilar steels and difficult-to-weld combinations including low-temperature steels up to 9% Ni, high-temperature and creep resistant materials, scaling resistant, unalloyed and high-alloyed Cr and CrNiMo stainless steels.

1.4529 X1NiCrMoCuN25-20-7, 1.4547 X1CrNiMoCuN20-18-7, 1.4580 X6CrNiMoNb17-12-2, 1.4583 X10CrNiMoNb18-12 1.4876 X8NiCrAlTi32–21, 1.5662 X8Ni9, 2.4816 NiCr15Fe, 2.4817 LC-NiCr15Fe, 2.4641 NiCr21Mo6Cu, 2.4856 NiCr22Mo9Nb 2.4858 NiCr21Mo

ASTM A 553 Gr.1, Alloy 600, Alloy 600 L, Alloy 625, Alloy 800 / 800H, Alloy 825

UNS N06600, N07080, N0800, N0810, N08367, N08926, S31254

Dissimilar welding with unalloyed and low-alloyed steels, e.g. P265GH, P285NH, P295GH, 16Mo3, S355N

Typical analysis of the wire

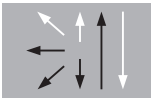
	C	Si	Mn	Cr	Ni	Mo	Nb	Fe	FN
wt.-%	0.05	0.4	0.4	21.0	Bal.	8.5	3.3	< 1.0	0

Mechanical properties of all-weld metal - typical values (min. values)

Condition	Yield strength $R_{p0.2}$ MPa	Tensile strength R_m MPa	Elongation A (L_0=5d_0) %	Impact values ISO-V KV J 20°C	–196°C	Lateral expansion mm –196°C
u	460 (≥ 420)	740 (≥ 690)	40 (≥ 25)	90	80 (≥ 32)	1.45
u1	435 (≥ 420)	730 (≥ 690)	43 (≥ 25)	100	84 (≥ 32)	

u untreated, as welded – shielding gas Ar + 18% CO_2
u1 untreated, as welded – shielding gas 100% CO_2

Operating data



Dimension mm	Arc length mm	Current A	Voltage V	Wire feed m/min
1.2	~ 3	120 – 230	23 – 27	6.0 – 12.0

Welding with standard GMAW power source. No pulsing needed. Backhand (drag) technique preferred with a work angle of appr. 80º. Ar + 15 – 25% CO_2 as shielding gas offers the best weldability. The gas flow should be 15 – 20 l/min. To minimize the risk of hot cracking when welding fully austenitic steels and nickel-base alloys, heat input and interpass temperature must be low and there must be as little dilution as possible from the parent metal. The heat input should not exceed 1.5 kJ/mm, the interpass temperature be limited to max. 100ºC and the wire stick-out 15 – 20 mm. Slight weaving is recommended for all welding positions. Post-weld heat treatment generally not needed. In special cases, solution annealing can be performed at 1050 – 1200ºC followed by water quenching.

Approvals

TÜV (11223), CE