



voestalpine Böhler Welding

# Filler Metals for Thermal Power Generation



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# Joining 1/4

	Alloy Group	Base Material Examples ASTM / EN	Welding Process	Product Name	Classification AWS	Classification EN ISO	
Bainitic Steels	0,5 Mo	T/P1 / 16Mo3	SMAW	Phoenix SH Schwarz 3 K	A5.5: E7015-G	3580-A: E Mo B 4 2 H5	
				BÖHLER FOX DMO Ti	A5.5: E7015-G	3580-A: E Mo R 1 2	
				BÖHLER FOX DMO Kb	A5.5: E7018-A1H4R	3580-A: E Mo B 4 2 H5	
			GTAW	Union I Mo	A5.28: ER70S-A1	21952-A: W MoSi	
				BÖHLER DMO-IG	A5.28: ER70S-A1 (ER80S-G (A1))	21952-A: W MoSi	
			GMAW	Union I Mo	A5.28: ER70S-A1	21952-A: G MoSi	
				BÖHLER DMO-IG	A5.28: ER70S-A1 (ER80S-G (A1))	21952-A: G MoSi	
			FCAW	Union MV Mo	A5.28: E 80 C-G H4	17632-A: T Mo M M 2 H5	
				BÖHLER DMO Ti-FD	A5.29: E 81 T1-A1M	17634-A: T Mo L P M 1	
			SAW wire	Union S 2 Mo	A5.23: EA2	14171: S2Mo	
				BÖHLER EMS 2 Mo	A5.23: EA2	14171: S2Mo	
			SAW flux	UV 420 TT		14174: SA FB 1 65 DC	
	UV 305			14174: SA AR 1 76 AC H5			
	BÖHLER BB 24			14174: SA FB 1 65 DC H5			
	1 1/4 Cr; 0,5 Mo	T/P12 / 13CrMo4-5	SMAW	Phoenix Chromo 1	A5.5: E8018-B2	3580-A: E CrMo 1 B 4 2 H5	
				BÖHLER FOX DCMS Ti	A5.5: E8013-B2 (mod.)	3580-A: E CrMo 1 R 1 2	
				BÖHLER FOX DCMS Kb	A5.5: E8018-B2 H4R	3580-A: E CrMo 1 B 4 2 H5	
			GTAW	Union I CrMo	A5.28: ER80S-G	21952-A: W CrMo 1 Si	
				Union ER 80S-B2	A5.28: ER80S-B2		
				BÖHLER DCMS-IG B2	A5.28: ER80S-B2		
			GMAW	BÖHLER DCMS-IG	A5.28: ER80S-G	21952-A: W CrMo 1 Si	
				Union I CrMo	A5.28: ER80S-G	21952-A: G CrMo 1 Si	
			FCAW	BÖHLER DCMS-IG	A5.28: ER80S-G	21952-A: G CrMo 1 Si	
				Union MV CrMo	A5.28: E 80 C-B2 H4	17634-A: T CrMo 1 M M 2 H5	
			SAW wire	BÖHLER DCMS Ti-FD	A5.29: E 81 T1-B2M	17634-A: (T CrMo 1 P M 1)	
				Union S 2 CrMo	A5.23: EB2R	24598-A: S CrMo1	
	SAW flux	BÖHLER EMS 2 CrMo	A5.23: EB2	24598-A: S CrMo1			
		UV 420 TT		14174: SA FB 1 65 H5			
		UV 305		14174: SA AR 1 76 AC H5			
	BÖHLER BB 24			14174: SA FB 1 65 DC H5			
	1 Cr; 1 Mo; V	-- / 15CrMoV5-10	SMAW	Phoenix SH Kupfer 3 K	A5.5: E9018-G	3580-A: E Z CrMoV1 B 4 2 H5	
				BÖHLER FOX DCMV	A5.5: E9018-G	3580-A: E Z CrMoV1 B 4 2 H5	
	0,5 Cr; 1 Mo; V	-- / 14MoV6-3	SMAW	BÖHLER FOX DMV 83 Kb	A5.5: E9018-G	3580-A: E Mo V B 4 2 H5	
				GTAW	BÖHLER DMV 83-IG	A5.28: ER80S-G	21952-A: W MoVSi
					BÖHLER DMV 83-IG	A5.28: ER80S-G	21952-A: G MoVSi
	1 Ni; 0,5 Cu; 0,5 Mo; Nb	-- / 15NiCuMoNb5 (WB36)	SMAW	Phoenix SH Schwarz 3 K Ni	A5.5: E9018-G	2560-A: E 50 4 1 NiMo B 4 2 H5	
				BÖHLER FOX DMO Kb	A5.5: E7018-A1H4R	3580-A: E Mo B 4 2 H5	
			GTAW	Union I Mo	A5.28: ER70S-A1	21952-A: W MoSi	
				BÖHLER DMO-IG	A5.28: ER70S-A1 (ER80S-G (A1))	21952-A: W MoSi	
			GMAW	Union MoNi	A5.28: ER90S-G	16834-A: G 62 5 M Mn3Ni1Mo	
BÖHLER DMO-IG				A5.28: ER70S-A1 (ER80S-G (A1))	21952-A: G MoSi		
SAW wire			Union S 3 NiMo 1	A5.23: EF3	14171-A: S3Ni1Mo / 26304-A: S3Ni1Mo		
			BÖHLER 3 NiMo 1-UP	A5.23: EF3	26304: S 3Ni1Mo		
SAW flux			UV 420 TT(R)		14174: SA FB 1 65 DC		
			BÖHLER BB 24		14174: SA FB 1 65 DC H5		
2 1/4 Cr; 1 Mo			T/P22 / 10CrMo9-10	SMAW	Phoenix SH Chromo 2 KS	A5.5: E9015-B3	3580-A: E CrMo 2 B 4 2 H5
					BÖHLER FOX CM 2 Kb	A5.5: E9018-B3 H4R	3580-A: E CrMo 2 B 4 2 H5
	GTAW	Union I CrMo 910		A5.28: ER90S-G	21952-A: W CrMo 2 Si		
		Union ER 90S-B3		A5.28: ER90S-B3			
		BÖHLER CM2-IG B3		A5.28: ER90S-B3			
	GMAW	BÖHLER CM 2-IG		A5.28: ER90S-G	21952-A: W CrMo 2 Si		
		Union I CrMo 910		A5.28: ER90S-G	21952-A: G CrMo 2 Si		
	FCAW	BÖHLER CM 2-IG		A5.28: ER90S-G	21952-A: G CrMo 2 Si		
		Union MV CrMo 910		A5.28: E91 T1-B3M	17634-A: T CrMo 2 M M 2 H5		
	BÖHLER CM 2 Ti-FD	A5.29: E91T1-B3M		17634-A: T ZCrMo2 P M 1			

# Joining 2/4

	Alloy Group	Base Material Examples ASTM / EN	Welding Process	Product Name	Classification AWS	Classification EN ISO
Bainitic Steels	2 1/4 Cr; 1 Mo	T/P22 / 10CrMo9-10	SAW wire	Union S 1 CrMo 2	A5.23: EB3R	24598: S CrMo2
				BÖHLER CM 2-UP	A5.23: EB3	24598: S CrMo2
			SAW flux	UV 420 TTR		14174: SA FB 1 65 DC
				UV 305		14174: SA AR 1 76 AC H5
	2 1/4 Cr; 0,5 Mo; 1,5 W; V; Nb; B	T/P23 / 7CrWVMoNb9-6	SMAW	Thermanit P 23	A5.5: E9015-G	3580-A: E ZCrWV 2 1,5 B 4 2 H5
				BÖHLER FOX P 23	A5.5: E9015-G	3580-A: E ZCrWV 2 1,5 B 4 2 H5
			GTAW	Union I P23	A5.28: ER90S-G	21952-A: W ZCrWV 2 1,5
				BÖHLER P 23-IG	A5.28: ER90S-G	21952-A: W ZCrWV 2 1,5
			SAW wire	Union S P23	A5.23: EG	24598-A: S Z CrWV 2 1,5
				BÖHLER P 23-UP	A5.23: EG	24598-A: S Z CrWV 2 1,5
			SAW flux	UV P23		14174: SA FB 1 55 AC
				UV 305 (only single layer)		14174: SA AR 1 76 AC H5
				BÖHLER BB 430		14174: SA FB 1 55 AC
				BÖHLER BB 305 (only single layer)		14174: SA AR 1 76 AC H5
	2 1/4 Cr; 1 Mo; V; Ti; B	T/P24 / 7CrMoVTiB10-10	SMAW	Thermanit P 24	A5.5: E9015-G	3580-A: E ZCrMo2WVNb B 4 2 H5
				BÖHLER FOX P 24	A5.5: E9015-G	3580-A: E ZCrMo2VNb B 4 2 H5
			GTAW	Union I P24	A5.28: ER90S-G	21952-A: W ZCrMo2VTi/Nb
				BÖHLER P 24-IG	A5.28: ER90S-G	21952-A: W ZCrMo2VTi/Nb
SAW wire			Union S P24	A5.23: EG	24598-A: S ZCrMo2VNb	
			BÖHLER P 24-UP	A5.23: EG	24598-A: S ZCrMo2VNb	
SAW flux			UV P 24		14174: SA FB 1 55 AC	
			UV 305		14174: SA AR 1 76 AC H5	
			BÖHLER BB 430		14174: SA FB 1 55 AC	
			BÖHLER BB 305 (only single layer)		14174: SA AR 1 76 AC H5	
Martensitic Steels	9 Cr; 1 Mo; V; Nb	SMAW	Thermanit Chromo 9 V	A5.5: E9015-B9	3580-A: E CrMo9 1 B 4 2 H5	
			Thermanit Chromo T 91 (root)	A5.5: E9018-B9	3580-A: E CrMo9 1 B 4 2 H5	
			BÖHLER FOX C 9 MV	A5.5: E9015-B9	3580-A: E CrMo9 1 B 4 2 H5	
		GTAW	Thermanit MTS 3	A5.28: ER90S-B9	21952-A: W CrMo 9 1	
			BÖHLER C 9 MV-IG	A5.28: ER90S-B9	21952-A: W CrMo 9 1	
		GMAW	Thermanit MTS 3	A5.28: ER90S-B9	21952-A: G CrMo 9 1	
			BÖHLER C 9 MV-IG	A5.28: ER90S-B9	21952-A: G CrMo 9 1	
		FCAW	Thermanit MTS 3-PW	A5.29: E91T1-B9M	17634-B: T 69 T1-1M-9C1MV	
			BÖHLER C 9 MV Ti-FD	A5.28: E91T1-B9M	17634-B: T 69 T1-1M-9C1MV	
		SAW wire	Thermanit MTS 3	A5.23: EB9	24598-A: S CrMo9 1	
	BÖHLER C 9 MV-UP		A5.23: EB9	24598-A: S CrMo9 1		
	SAW flux	Marathon 543		14174: SA FB 2 55 DC H5		
		BÖHLER BB 910		14174: SA FB 2 55 DC H5		
	9 Cr; 0,5 Mo; 1,5 W; V; Nb	T/P92 / X10CrW-MoVNB9-2	SMAW	Thermanit MTS 616	A5.5: (E9015-B9 mod.)	3580-A: E ZCrMoWVNb 9 0,5 2 B 4 2 H5
				BÖHLER FOX P 92	A5.5: (E9015-B9 mod.)	3580-A: E ZCrMoWVNb 9 0,5 2 B 4 2 H5
			GTAW	Thermanit MTS 616	A5.28: (ER90S-B9 mod.)	21952-A: W ZCrMoWVNb 9 0,5 1,5
				BÖHLER P 92-IG	A5.28: (ER90S-B9 mod.)	21952-A: W ZCrMoWVNb 9 0,5 1,5
			GMAW	Thermanit MTS 616	A5.28: (ER90S-B9 mod.)	21952-A: G ZCrMoWVNb 9 0,5 1,5
				BÖHLER P 92-IG	A5.28: (ER90S-B9 mod.)	21952-A: G ZCrMoWVNb 9 0,5 1,5
			FCAW	Thermanit MTS 616-PW	A5.29: E91T1-GM	17634-A: T ZCrWMo9VNb P M 1
BÖHLER P 92 Ti-FD				A5.29: E91T1-GM	17634-A: T ZCrWMo9VNb P M 1	
SAW wire			Thermanit MTS 616	A5.23: EB9 (mod.)	24598-A: S ZCrMoWVNb 9 0,5 1,5	
			BÖHLER P 92-UP	A5.23: EB9 (mod.)	24598-A: S ZCrMoWVNb 9 0,5 1,5	
SAW flux	Marathon 543		14174: SA FB 2 55 DC H5			
	BÖHLER BB 910		14174: SA FB 2 55 DC H5			

# Joining 3/4

	Alloy Group	Base Material Examples ASTM / EN	Welding Process	Product Name	Classification AWS	Classification EN ISO		
Martensitic Steels	9 Cr; 1 Mo; 1 W; V; Nb	T/P911 / X11CrMoWVNb9-1-1	SMAW	Thermanit MTS 911	A5.5: E9015-B9 (mod.)	3580-A: E ZCrMoWVNb 9 1 1 B 4 2 H5		
				BÖHLER FOX C 9 MVW	A5.5: E9015-B9 (mod.)	3580-A: E ZCrMoWVNb 9 1 1 B 4 2 H5		
			GTAW	Thermanit MTS 911	A5.28: ER90S-B9 (mod.)	21952-A: W ZCrMoWVNb 9 1 1		
				BÖHLER C 9 MVW-IG	A5.28: ER90S-B9 (mod.)	21952-A: W ZCrMoWVNb 9 1 1		
			GMAW	Thermanit MTS 911	A5.28: ER90S-B9 (mod.)	21952-A: G ZCrMoWVNb 9 1 1		
				BÖHLER C 9 MVW-IG	A5.28: ER90S-B9 (mod.)	21952-A: G ZCrMoWVNb 9 1 1		
			SAW wire	Thermanit MTS 911	A5.23: EB9 (mod.)	24598-A: S ZCrMoWVNb 9 1 1		
				BÖHLER C 9 MVW-UP	A5.23: EB9 (mod.)	24598-A: S ZCrMoWVNb 9 1 1		
	SAW flux	Marathon 543		14174: SA FB 2 55 DC H5				
		BÖHLER BB 910		14174: SA FB 2 55 DC H5				
	11 Cr; 0,5 Mo; 1,5 W; 1 Co; V; Nb	VM12-SHC / X12CrCoWVNb11-2-2	SMAW	Thermanit MTS 5 CoT	A5.5: E9015-B9 (mod.)	3580-A: E ZCrCoW11 2		
				BÖHLER FOX C12 CoW	A5.5: E9015-B9 (mod.)	3580-A: E ZCrCoW11 2		
			GTAW	Thermanit MTS 5 CoT	A5.28: ER110S-G	21952-A: W ZCrCoW 11 2 2		
				BÖHLER C12 CoW-IG	A5.28: ER110S-G	21952-A: W ZCrCoW 11 2 2		
	10 Cr; 1 Mo; V	-- / X20CrMoV11-1	SMAW	Thermanit MTS 4		3580-A: E CrMoW 12 B 4 2 H5		
				BÖHLER FOX 20 MVW		3580-A: E CrMoW 12 B 4 2 H5		
			GTAW	Thermanit MTS 4 Si		21952-A: W CrMoW 12 Si		
				BÖHLER 20 MVW-IG		21952-A: W CrMoW 12 Si		
			GMAW	Thermanit MTS 4 Si		21952-A: G CrMoW 12 Si		
				BÖHLER 20 MVW-IG		21952-A: G CrMoW 12 Si		
SAW wire			Thermanit MTS 4		24598-A: S CrMoW 12			
			BÖHLER 20 MVW-UP		24598-A: S CrMoW 12			
SAW flux	Marathon 543		14174: SA FB 2 55 DC H5					
	UV 420 TT		14174: SA FB 1 65 DC H5					
BÖHLER BB 24			14174: SA FB 1 65 DC H5					
			14174: SA FB 1 65 DC H5					
9 Cr; 1,5 Mo; 1 Co; V; Nb	CB2 (GX13CrMo-CoVNb9-2-1)	SMAW	Thermanit MTS 5 Co 1	A5.5: E9015-G	3580-A: E Z CrCoMoV 10 1 1 B 42 H5			
		FCAW	BÖHLER CB 2 Ti-FD	A5.29: E91T1-GM	17634-A: T ZCrMoCo9VNbNB P M 1			
Austenitic Steels	18 Cr; 9 Ni; 3 Cu; Nb	304HCu	SMAW	Thermanit 304 H Cu	A5.4: E308H-15 (mod.)	3581-A: EZ1816 Cu H B22		
				BÖHLER FOX E 304 H Cu	A5.4: E308H-15 (mod.)	3581-A: E Z 18 16 1 Cu H B 2 2		
			GTAW	Thermanit 304 H Cu		14343-A: W Z 18 16 1 Cu H		
				BÖHLER ER 304 H Cu-IG	A5.9: ER308H (mod.)	14343-A: W Z 18 16 1 Cu H		
	25 Cr; 21 Ni; Nb	310N (HR3C)	SMAW	(Thermanit 310N)* or Thermanit 617		14172: E Ni 6117		
				BÖHLER FOX NIBAS 617	A5.11: E NiCrCoMo-1 (mod.)	14172: E Ni 6117		
			GTAW	(Thermanit 310N)* or Thermanit 617		18274: S Ni 6617		
				BÖHLER NIBAS 617-IG	A5.14: ER NiCrCoMo-1	18274: S Ni 6117		
			18 Cr; 10 Ni; Nb	347H FG	SMAW	(Thermanit 310N)* or Thermanit 617		18274: S Ni 6617
						BÖHLER FOX NIBAS 617	A5.11: E NiCrCoMo-1 (mod.)	14172: E Ni 6117
GTAW	(Thermanit 310N)* or Thermanit 617		18274: S Ni 6617					
	BÖHLER NIBAS 617-IG	A5.14: ER NiCrCoMo-1	18274: S Ni 6617					

\* under development

# Joining 4/4

	Alloy Group	Base Material Examples ASTM / EN	Welding Process	Product Name	Classification AWS	Classification EN ISO
Ni-Base Alloys	22 Cr; 9 Mo; 12 Co; 0,3 Ti; 1 Al; Ni balance	Alloy 617	SMAW	<b>Thermanit 617</b>	A5.11: E NiCrCoMo-1 (mod.)	14172: E Ni 6117
				<b>BÖHLER FOX NIBAS 617</b>	A5.11: E NiCrCoMo-1 (mod.)	14172: E Ni 6117
			GTAW	<b>Thermanit 617</b>	A5.14: ER NiCrCoMo-1	18274: S Ni 6617
				<b>BÖHLER NIBAS 617-IG</b>	A5.14: ER NiCrCoMo-1	18274: S Ni 6617
			GMAW	<b>Thermanit 617</b>	A5.14: ER NiCrCoMo-1	18274: S Ni 6617
				<b>BÖHLER NIBAS 617-IG</b>	A5.14: ER NiCrCoMo-1	18274: S Ni 6617
			SAW wire	<b>Thermanit 617</b>	A5.14: ER NiCrCoMo-1	18274: S Ni 6617
				<b>BÖHLER NIBAS 617-UP</b>	A5.14: ER NiCrCoMo-1	18274: S Ni 6617
	SAW flux	<b>Marathon 444</b>		14174: SA FB 2 AC		
		<b>BÖHLER BB 444</b>		14174: SA FB 2 AC		
	20 Cr; 6 Mo; 20 Co; 2 Ti; 0,5 Al; Ni-base	Alloy 263	SMAW	<b>Thermanit 263*</b>		
			GTAW	<b>Thermanit 263</b>		
	Dissimilar welds		SMAW	<b>Thermanit Nicro 82</b>	A5.11: E NiCrFe-3 (mod.)	14172: E Ni 6082
				<b>BÖHLER FOX NiCr 70 Nb</b>	A5.11: E NiCrFe-3 (mod.)	14172: E Ni 6082
				<b>Thermanit Nicro 182</b>	A5.11: E NiCrFe-3	14172: E Ni 6182
				<b>BÖHLER FOX NiCr 70/15</b>	A5.11: E NiCrFe-3	14172: E Ni 6182
				<b>Thermanit 617</b>	A5.11: E NiCrCoMo-1 (mod.)	14172: E Ni 6117
				<b>BÖHLER FOX NIBAS 617</b>	A5.11: E NiCrCoMo-1 (mod.)	14172: E Ni 6117
			GTAW	<b>Thermanit Nicro 82</b>	A5.14: ER NiCr-3	18274: S Ni 6082
				<b>BÖHLER NiCr 70 Nb-IG</b>	A5.14: ER NiCr-3	18274: S Ni 6082
<b>Thermanit 617</b>				A5.14: ER NiCrCoMo-1	18274: S Ni 6617	
GMAW			<b>BÖHLER NIBAS 617-IG</b>	A5.14: ER NiCrCoMo-1	18274: S Ni 6617	
			<b>Thermanit Nicro 82</b>	A5.14: ER NiCr-3	18274: S Ni 6082	
			<b>BÖHLER NiCr 70 Nb-IG</b>	A5.14: ER NiCr-3	18274: S Ni 6082	
			<b>Thermanit 617</b>	A5.14: ER NiCrCoMo-1	18274: S Ni 6617	
			<b>BÖHLER NIBAS 617-IG</b>	A5.14: ER NiCrCoMo-1	18274: S Ni 6617	

\* under development

# voestalpine Böhler Welding

## Böhler Welding know-how joins steel

Customers in over 120 countries join the expertise of voestalpine Böhler Welding (formerly the Böhler Welding Group). Focused on filler metals, voestalpine Böhler Welding offers extensive technical consultation and individual solutions for industrial welding and soldering applications. Customer proximity is guaranteed by 40 subsidiaries in 28 countries, with the support of 2,200 employees, and through more than 1,000 distribution partners worldwide.



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