A Quick Guide to Suitable Welding Consumables

■ For Boiler

SMAW

Grade (Type of steel)	DCEP		AC	
	AWS Class.	Product name	AWS Class.	Product name
P1/T1 (0.5Mo)	E7016-A1	CM-A76 CM-B76	E7016-A1	CM-A76 CM-B76
P2/T2	E8016-B1	CM-B86	–	–
P11/T11 (1.25Cr-0.5Mo)	E7015-B2L	CM-B95	–	–
	E8016-B2	CM-A96 CM-A96MBD	E8016-B2	CM-A96 CM-A96MB
	E8018-B2	CM-B98	E8018-B2	CM-B98
P22/T22 (2.25Cr-Mo)	E8015-B3L	CM-B105	–	–
	E9015-B3	CM-A105D CM-B105D	–	–
	E9016-B3	CM-A106ND	E9016-B3	CM-A106N
	E9018-B3	CM-B108	E9018-B3	CM-B108
P23/T23	E9016-G	CM-2CW	E9016-G	CM-2CW
P91/T91 (9Cr)	–	CM-95B9	–	–
	–	CM-96B9	–	CM-96B9
	E9016-G	CM-9Cb	E9016-G	CM-9Cb
P92/T92 P122/T122	E9016-G	CR-12S	E9016-G	CR-12S

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SAW

Grade (Type of steel)	DCEP		AC	
	AWS Class.	Product name	AWS Class.	Product name
P1/T1 (0.5Mo)	–	–	F8P6-EA3-A3 (F9A6)	MF-38/US-40
			F8P6-EA4-A4 (F8A4)	MF-38/US-A4
			F8P6-EG-A4 (F8A4)	MF-38/US-49
P11/T11 (1.25Cr-0.5Mo)	F7PZ-EB2-B2	G-80/US-B2	F7PZ-EB2-B2	G-80/US-B2
	F7PZ-EG-B2	MF-29A/US-511	F7PZ-EG-B2	MF-29A/US-511
	F8P2-EG-B2	PF-200D/US-511ND	F8P2-EG-B2	PF-200/US-511N
P23/T23	–	MF-29A/US-2CW	–	–
P91/T91 (9Cr)	F9PZ-EB9-B9	PF-90B9/US-90B9	F10PZ-EG-G	PF-200S/US-9Cb
P92/T92 P122/T122	–	PF-200S/US-12CRSD	–	–

GMAW and GTAW

Grade (Type of steel)	AWS Class.	Product name	
		GMAW	GTAW
P1/T1 (0.5Mo)	ER70S-A1	MG-S70SA1	TG-S70SA1
	ER80S-G	MG-SM	TG-SM
P2/T2	ER80S-G	MG-CM	–
	–	–	TG-SCM
P11/T11 (1.25Cr-0.5Mo)	ER80S-B2	MG-S80B2F ∗	TG-S80B2
	ER80S-G	MG-S1CM	TG-S1CM
P22/T22 (2.25Cr-1Mo)	ER90S-B3	–	TG-S90B3
	ER90S-G	MG-S2CM MG-S2CMS	TG-S2CM
P23/T23	ER90S-G	MG-S2CW	TG-S2CW (ER80S-G)
P91/T91 (9Cr)	ER90S-B9	MG-S90B9	TG-S90B9
	ER90S-G	MG-S9Cb	TG-S9Cb
P92/T92 P122/T122	ER90S-G	MG-S12CRS	TG-S12CRS

∗ Single pass only

■ For Boiler

Process / Polarity	AWS Class.	Product name	Wire/ W.M.	C	Si	Mn	P	S	Cu	Ni	Cr	Mo	V	Nb	Al	N	Mn+Ni	W	Co	X-bar	J-Factor	AC/DC	YS (MPa)	TS (MPa)	EL (%)	IV (℃)	IV (J)	PWHT (℃×hr)
SMAW / DCEP	E8016-B1	CM-B86		0.07	0.48	0.79	0.012	0.006			0.48	0.48										DCEP	590	680	28	0	98	620×1
	E7015-B2L	CM-B95		0.03	0.87	0.71	0.005	0.004			1.20	0.49											470	580	29	0	78	690×1
	E8016-B2	CM-A96MBD		0.06	0.49	0.79	0.006	0.004	0.02	0.02	1.30	0.56								8	102.4		515	617	27	−20	174	690×1
	E8015-B3L	CM-B105		0.03	0.85	0.87	0.006	0.004			2.14	0.95											550	650	25	0	79	690×1
	E9015-B3	CM-A105D		0.10	0.30	0.74	0.004	0.002	0.03	0.14	2.42	1.03								<6.0	62		504	644	28	−40	100	690×8
	E9015-B3	CM-B105D		0.06	0.66	0.73	0.011	0.005	0.02	0.01	2.24	0.95								11.4			566	677	27	−20	56	696×1
	E9016-B3	CM-A106ND		0.11	0.42	0.84	0.004	0.002	0.031	0.14	2.42	1.03								6	75.6		501	635	26	−40	151	690×8
	–	CM-95B9		0.10	0.22	0.84	0.007	0.002	0.02	0.51	8.94	1.02	0.23	0.04	0.002	0.039	1.35						651	768	22	20	74	760×2
SMAW / DCEP or AC	E7016-A1	CM-A76		0.06	0.49	0.79	0.006	0.002	–	–	–	0.49										AC	550	630	29	0	210	620×1
	E7016-A1	CM-B76	W.M.	0.07	0.46	0.77	0.011	0.004			–	0.53										AC	540	620	26	0	200	620×1
	E8016-B2	CM-A96		0.06	0.38	0.72	0.008	0.004			1.31	0.54										AC	570	650	26	0	210	690×1
	E8018-B2	CM-B98		0.07	0.68	0.75	0.012	0.006			1.29	0.52										AC	590	690	26	0	66	690×1
	E9018-B3	CM-B108		0.07	0.68	0.70	0.012	0.007			2.14	0.95										AC	610	720	23	0	106	690×1
	E9016-G	CM-2CW		0.04	0.27	0.84	0.009	0.006	0.02	–	2.39	0.07	0.21	0.02				1.70				DCEP	473	582	28	0	158	747×2
	–	CM-96B9		0.10	0.19	0.85	0.007	0.004	0.03	0.52	9.01	1.05	0.24	0.04	0.002	0.038	1.37					DCEP	657	771	21	20	71	760×2
	E9016-G	CM-9Cb		0.06	0.31	1.51	0.006	0.003	–	0.94	9.11	1.06	0.18	0.03	–	0.030						AC	600	750	25	0	81	750×5
	E9016-G	CR-12S		0.08	0.41	0.94	0.008	0.001	0.02	0.52	9.62	0.23	0.37	0.030		0.05		1.63	1.57			DCEP	645	771	22	0	40	740×8
SMAW / AC	E8016-B2	CM-A96MB		0.06	0.45	0.74	0.007	0.003			1.30	0.54										AC	490	590	30	−18	200	690×1
	E9016-B3	CM-A106N		0.11	0.27	0.79	0.008	0.006		0.19	2.42	1.03								10	117		510	650	28	−29	120	690×8
SAW / DCEP	F8P2-EG-B2	PF-200D/US-511ND	Wire	0.13	0.09	0.92	0.005	0.003	0.10	0.17	1.49	0.56											477	589	27	−29	116	690×4
			W.M.	0.08	0.21	0.82	0.007	0.003	0.09	0.15	1.39	0.56																
	F9PZ-EB9-B9	PF-90B9/US-90B9	Wire	0.11	0.26	0.74	0.004	0.005	0.01	0.51	9.30	1.05	0.23	0.06	<0.001	0.04							582	716	23	20	37	760×2
			W.M.	0.10	0.21	0.92	0.009	0.004	0.01	0.50	9.00	0.97	0.21	0.04	0.01	0.04	1.42											
	–	MF-29A/US-2CW	Wire	0.04	0.14	1.17	0.006	0.005	0.16	–	2.29	0.12	0.26	0.03				1.80					495	596	28	0	128	747×2
			W.M.	0.03	0.23	1.14	0.008	0.004	0.16	–	2.28	0.11	0.23	0.02				1.80										
	–	PF-200S/US-12CRSD	Wire	0.07	0.35	0.74	0.004	0.003	0.01	0.51	9.92	0.35	0.21	0.035		0.040		1.45	1.01				652	775	23	20	31	745×8
			W.M.	0.06	0.24	0.88	0.008	0.004	0.02	0.52	9.48	0.32	0.20	0.03		0.04		1.36	0.98									
SAW / DCEP or AC	F7PZ-EB2-B2	G-80/US-B2	Wire	0.11	0.13	0.57	0.007	0.006	0.11		1.49	0.53										DCEP	425	545	27	20	37	690×1
			W.M.	0.06	0.45	0.83	0.009	0.005	0.12		1.29	0.54																
	F7PZ-EG-B2	MF-29A/US-511	Wire	0.09	0.19	0.60	0.008	0.009			1.51	0.54										AC	440	580	28	0	98	650×20
			W.M.	0.09	0.25	0.78	0.010	0.007			1.32	0.52																
SAW / AC	F8P6-EA3-A3	MF-38/US-40	Wire	0.13	0.04	1.80	0.008	0.010	0.12			0.52											560	630	29	−51	58	620×1
			W.M.	0.08	0.34	1.58	0.017	0.009	0.12			0.45																
	F8P6-EA4-A4	MF-38/US-A4	Wire	0.09	0.04	1.59	0.010	0.014	0.10			0.52											510	600	29	−51	40	620×1
			W.M.	0.10	0.39	1.35	0.013	0.013	0.11			0.52																
	F8P6-EG-A4	MF-38/US-49	Wire	0.09	0.03	1.58	0.014	0.013	0.10			0.52										AC	510	600	29	−51	40	600×3
			W.M.	0.10	0.37	1.35	0.014	0.014	0.09			0.53																
	F8P2-EG-B2	PF-200/US-511N	Wire	0.08	0.30	0.90	0.004	0.002	0.14	0.17	1.45	0.52											450	560	31	−29	120	690×8
			W.M.	0.08	0.20	0.88	0.007	0.002	0.11	0.15	1.39	0.55																
	F10PZ-EG-G	PF-200S/US-9Cb	Wire	0.08	0.13	1.73	0.007	0.005			8.91	0.90	0.23	0.05									580	710	24	0	68	740×8
			W.M.	0.08	0.12	1.58	0.008	0.004			8.31	0.88	0.21	0.03														
GMAW	ER70S-A1	MG-S70SA1		0.04	0.51	0.99	0.009	0.012	0.16	0.03		0.49											454	531	33	−20	118	620×1
	ER80S-G	MG-SM		0.07	0.59	1.10	0.006	0.009	0.17	–	–	0.55											520	610	25	0	98	AW
	ER80S-G	MG-CM		0.06	0.72	1.62	0.005	0.008	0.22		0.53	0.55								Ti:0.18			510	600	25	0	78	620×1
	ER80S-B2	MG-S80B2F		0.09	0.51	0.59	0.003	0.005	0.26	0.03	1.32	0.52											549	649	28	−18	144	620×1
	ER80S-G	MG-S1CM		0.09	0.55	1.15	0.007	0.009	0.18	–	1.45	0.55										DCEP	570	680	22	0	69	620×1
	ER90S-G	MG-S2CM		0.08	0.56	1.07	0.005	0.009	0.17	–	2.35	1.11											550	670	26	0	110	680×1
	ER90S-G	MG-S2CMS		0.12	0.39	0.85	0.004	0.003	0.14	–	2.27	0.97											600	720	21	−20	120	670×1
	ER90S-G	MG-S2CW		0.04	0.39	1.17	0.003	0.007	0.21	0.50	2.29	0.10	0.29	0.04				1.79					551	644	28	0	150	747×2
	ER90S-B9	MG-S90B9		0.13	0.23	0.71	0.003	0.004	0.02	0.46	8.34	0.93	0.25	0.05	0.01	0.04	1.17						568	716	23	20	64	760×4
	ER90S-G	MG-S9Cb		0.08	0.35	1.59	0.007	0.008	0.01	0.45	8.79	0.88	0.17	0.02									570	700	27	0	98	740×8
	ER90S-G	MG-S12CRS	Wire	0.04	0.40	1.19	0.004	0.006	0.01	0.52	10.10	0.40				0.04		1.59	1.59				592	721	25	20	72	750×8
GTAW	ER70S-A1	TG-S70SA1		0.07	0.58	1.08	0.005	0.008	0.13	0.03	–	0.56	0.30										534	611	32	0	267	620×1
	ER80S-G	TG-SM		0.08	0.54	1.04	0.004	0.007	0.12	0.02	–	0.53											500	580	32	0	280	620×1
	ER80S-G	TG-SCM		0.08	0.22	0.58	0.004	0.008	0.21	0.01	0.64	0.56											470	570	31	0	190	620×1
	ER80S-B2	TG-S80B2		0.11	0.50	0.67	0.004	0.004	0.15	0.01	1.40	0.55											490	625	32	−20	246	620×1
	ER80S-G	TG-S1CM		0.06	0.50	0.99	0.007	0.005	0.11	0.02	1.22	0.54											540	630	28	0	270	690×1
	ER90S-B3	TG-S90B3		0.11	0.64	0.67	0.006	0.006	0.14	0.01	2.44	1.09										DCEN	596	725	27	−20	237	690×1
	ER90S-G	TG-S2CM		0.10	0.26	0.70	0.009	0.008			2.31	1.04								12	115		610	720	28	0	250	690×1
	ER80S-G	TG-S2CW		0.06	0.42	0.43	0.006	0.008	0.17	–	2.34	0.48	0.34	0.03				1.19					494	627	31	0	289	747×2
	ER90S-B9	TG-S90B9		0.11	0.24	0.69	0.004	0.004	0.01	0.53	8.91	0.94	0.23	0.05	0.003	0.042	1.22						706	809	22	0	160	760×2
	ER90S-G	TG-S9Cb		0.07	0.16	0.99	0.008	0.006	–	0.68	8.97	0.90	0.18	0.04	–	0.022							700	780	24	0	240	740×8
	ER90S-G	TG-S12CRS		0.07	0.35	0.74	0.004	0.003	0.01	0.51	9.92	0.35	0.21	0.04				1.45	1.01				686	790	23	0	44	740×8

W.M. = weld metal

X-bar = (10P + 5Sb + 4Sn + As)/100 (ppm), J-Factor = (Si + Mn) × (P + Sn) × 10^4 (%)