

S-717 X M-12K
L-8
A-2

SUBMERGED ARC WELDING CONSUMABLES
FOR WELDING OF
HIGH TENSILE STEEL



❖ Specification

Flux	JIS Z3352	EN ISO 14174	KS B ISO 14174
S-717	S A AB 1	S A AB 1	S A AB 1
Wire	AWS A5.17/A5.23		EN ISO 14171
M-12K	A5.17 F7A(P)6-EM12K		S2Si
L-8	A5.17 F6A(P)4-EL8		S1
A-2	A5.23 F8A0-EA2-A4 A5.23 F8PZ-EA2-A4		S2Mo

❖ Applications

Multi-layer welding of structural steels, offshore structures and thick, windmill, pressure vessels.

❖ Characteristics on Usage

Good weldability for all range of thickness of plate. Excellent impact value and crack-resistibility of welded metal. Inactive type flux is not affected by welding parameter, especially suitable for multi-layer welding of thick plate.

❖ Note on Usage

1. Dry the flux at 300~350°C (572~662°F) for 60minutes before use.
2. For the first layer in groove, keep the current and speed low in the case of multi-layer welding.



Welding consumable for test

❖ Flux

Consumable	Chemical Composition, wt%			
	SiO ₂ +TiO ₂	Al ₂ O ₃ +MnO	CaO+MgO	CaF ₂
S-717	10	30	35	10

Consumable	Particle Size (Mesh)	Type of Flux	B.I	H ₂ O _{1000℃} /CO ₂ (%)
S-717	10 × 48	Agglomerated	1.6	0.05/0.80

❖ Electrode

Consumables	Dia.	Chemical Composition, wt%					
	mm (in)	C	Si	Mn	P	S	Mo
M-12K	4.0(5/32)	0.09	0.20	1.02	0.016	0.006	-
AWS A5.17 EM12K		0.05-0.15	0.10-0.35	0.80-1.25	≤0.030	≤0.030	-
L-8	4.0(5/32)	0.05	0.02	0.52	0.017	0.012	-
AWS A5.17 EL8		≤0.10	≤0.07	0.25-0.60	≤0.030	≤0.030	-
A-2	4.0(5/32)	0.09	0.15	1.00	0.015	0.005	0.48
AWS A5.23 EA2		0.05-0.17	≤0.20	0.95-1.35	≤0.025	≤0.025	0.45-0.65

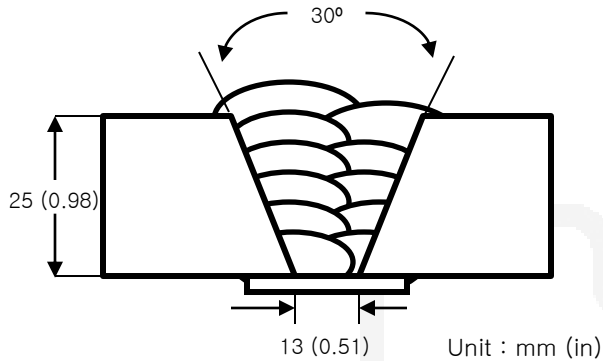
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Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

Base metal	: SS400
Particle size	: 10 x 48
Flux type	: Agglomerated
Amp./ Volt./cpm	: 550 / 30 / 40
Stick-Out mm (in)	: 30 (1.18)
Pre-Heat °C (°F)	: R.T .
Interpass Temp. °C (°F)	: <150 (302)
Polarity	: AC

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test J (ft.-lbs)	
		YS MPa(ksi)	TS MPa(ksi)	EL (%)		
S-717 X M-12K	As-welded	555 (80.5)	614 (89.1)	29.0	-51°C (-60°F)	80 (59)
	620°Cx1hr	493 (71.5)	590 (85.6)	31.2	-51°C (-60°F)	94 (69)
AWS A5.17 F7A(P)6-EM12K	-	≥ 400	490~660	≥ 22	≥ 27J at -51°C	

❖ Chemical Analysis of All weld metal(wt%)

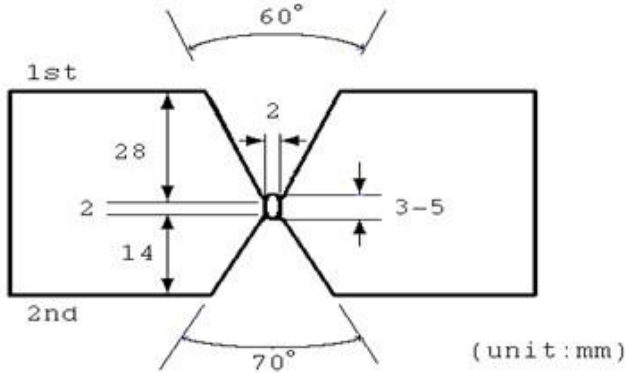
Consumables	C	Si	Mn	P	S
S-717 X M-12K	0.09	0.40	1.55	0.023	0.004

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Multi-run Welding Test (44t)

❖ Welding Conditions



- Base metal** : BS4360 Gr. 50D
- Particle size** : 12 X 60 (ASME)
- Flux type** : Agglomerated
- Stick-Out mm (in)** : 44 (1.73)
- Pre-Heat(°C)** : R.T .
- Interpass Temp. °C (°F)** : <150 (302)
- Polarity** : DC+, AC

[Joint Preparation & Layer Details]

❖ Electrode shooting arrangement

Polarity	Shooting arrangement	Stick-out mm (in)
1 Pole DC+		30 (1.18)
2 Poles DC+, AC		30 (1.18)
3 Poles DC+, AC, AC		30~35 (1.18~1.38)

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❖ Welding Conditions

Joint preparation and layer details (B.M. BS4360 Gr.50D 44mm)	P O L E S	Welding conditions							Inter pass temp (°C)
		Side	Polarity		Amp. (A)	Volt (V)	Speed (CPM)	Heat input (kJ/cm)	
<p>1st 2nd SMAW 21-23 (unit:mm)</p>	1	1	L	DC+	500	32	40	16.0	Max. 300
		2~14	L	DC+	600	36	50	25.9	
		Back gouging (Min. 5R, 35°) Completely remove SMAW weld							
		15	L	DC+	500	32	40	16.0	
		16~2 3	L	DC+	600	36	50	25.9	
		<p>1st 2nd SMAW 21-23 (unit:mm)</p>	2	1	L	DC+	500	32	
2~10	L T			DC+ AC	600 700	33 35	80	33.2	
Back gouging (Min. 5R, 35°) Completely remove SMAW weld									
11	L			DC+	500	32	40	16.0	
12~1 7	L T			DC+ AC	600 700	33 35	80	33.2	
<p>1st 2nd SMAW 21-23 (unit:mm)</p>	3			1	L	DC+	500	32	40
		2~7	L T1 T2	DC+ AC AC	600 650 700	33 35 38	90	46.1	
		Back gouging (Min. 5R, 35°) Completely remove SMAW weld							
		8	L	DC+	500	32	40	16.0	
		9~14	L T1 T2	DC+ AC AC	600 650 700	33 35 38	90	46.1	

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❖ Mechanical Properties of All weld metal

Consumables	Poles	Tensile Test			CVN Impact Test (Joule)	
		YS MPa(ksi)	TS MPa(ksi)	EL (%)	0°C (32°F)	-20°C (-4°F)
S-717 X M-12K	1	512 (74.3)	577 (83.7)	28.4	104 (77)	76 (56)
	2	508 (73.7)	574 (83.3)	27.2	105 (77)	78 (58)
	3	544 (78.9)	601 (87.2)	30.0	106 (78)	85 (63)

❖ Chemical Analysis of All weld metal(wt%)

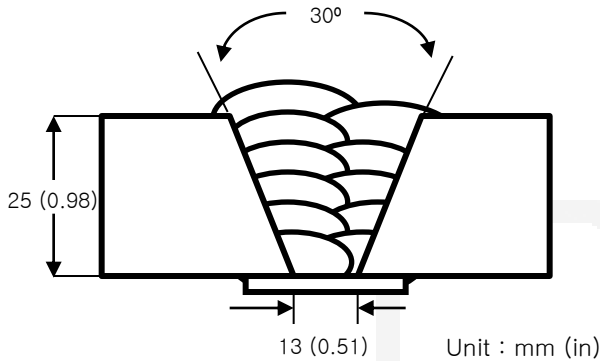
Consumables	Poles	C	Si	Mn	P	S
S-717 X M-12K	1	0.08	0.54	1.47	0.025	0.018
	2	0.09	0.44	1.47	0.024	0.015
	3	0.10	0.43	1.44	0.024	0.014



Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

- Base metal** : SS400
- Particle size** : 10 x 48
- Flux type** : Agglomerated
- Amp./ Volt./cpm** : 550 / 30 / 40
- Stick-Out mm (in)** : 30 (1.18)
- Pre-Heat °C (°F)** : R.T .
- Interpass Temp. °C (°F)** : <150 (302)
- Polarity** : DC+

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test J (ft·lbs)	
		YS MPa(ksi)	TS MPa(ksi)	EL (%)	-40°C (-40°F)	-51°C (-60°F)
S-717 X L-8	As-welded	435 (63.1)	514 (74.5)	35.6	141 (104)	97 (72)
	620°Cx1hr	407 (59.0)	500 (72.5)	37.4	170 (125)	127 (94)
AWS A5.17 F6A(P)4-EL8	-	≥ 330	410~550	≥ 22	≥ 27J at -40°C	

❖ Chemical Analysis of All weld metal(wt%)

Consumables	C	Si	Mn	P	S
S-717 X L-8	0.078	0.20	1.08	0.024	0.004

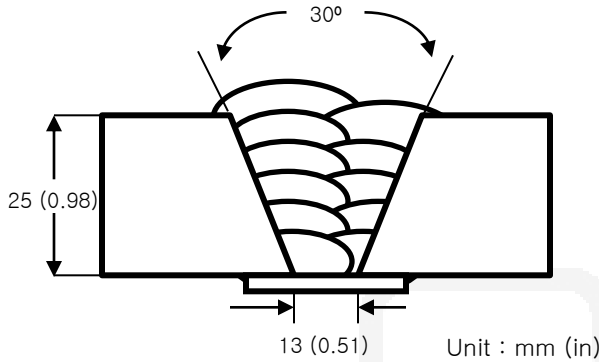
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Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Rules



[Joint Preparation & Layer Details]

Base metal	: SM570
Particle size(mesh)	: 10 X 48
Flux type	: Agglomerated
Amp./ Volt./CPM	: 550 / 30 / 40
Stick-Out mm (in)	: 30 (1.18)
Pre-Heat °C(°F)	: RT
Interpass Temp. °C (°F)	: <164(327)
Polarity	: DC+

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test J (ft-lbs)	
		YS MPa(ksi)	TS MPa(ksi)	EL (%)	0°C (32°F)	-18°C (0°F)
S-717 X A-2	As welded	558 (80.9)	646 (93.7)	29.4	89 (66)	48 (35)
	620°Cx1hr	549 (79.6)	640 (92.8)	29.5	49 (36)	27 (20)
	550°Cx20hr	553 (80.2)	642 (93.1)	28.8	56 (41)	22 (16)
AWS A5.23 F8A0-EA2-A4 AWS A5.23 F8PZ-EA2-A4		≥ 470	550~690	≥ 20	≥ 27J at -18°C Not specified	

❖ Chemical Analysis of All weld metal(wt%)

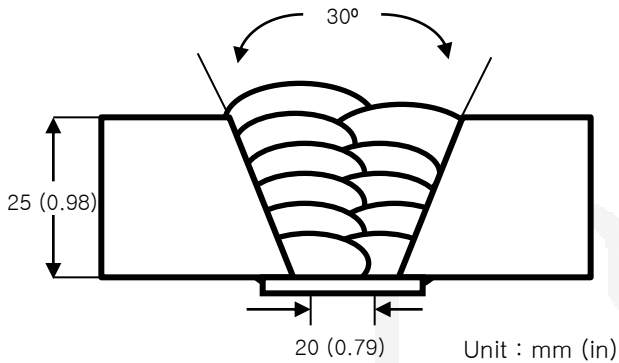
Consumables	C	Si	Mn	P	S	Mo
S-717 X A-2	0.08	0.35	1.58	0.023	0.005	0.49
AWS A5.23 A4	≤ 0.15	≤ 0.80	≤ 1.60	≤ 0.030	≤ 0.030	0.40- 0.65

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Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions



[Joint Preparation & Layer Details]

- Base metal** : SM570
- Particle size(mesh)** : 10 X 48
- Flux type** : Agglomerated
- Amp./ Volt./CPM** : L(DC+) 750 / 30 / 60
T(AC) 700 / 32
- Stick-Out mm (in)** : 30 (1.18)
- Pre-Heat °C (°F)** : R.T .
- Interpass Temp. °C (°F)** : <164(327)
- Polarity** : Tandem DC+, AC

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test J (ft·lbs)	
		YS MPa(ksi)	TS MPa(ksi)	EL (%)	0°C (32°F)	-18°C (0°F)
S-717 X A-2	As welded	542 (78.6)	650 (94.3)	32.2	75 (55)	59 (44)

❖ Chemical Analysis of All weld metal(wt%)

Consumables	C	Si	Mn	P	S	Mo
S-717 X A-2	0.09	0.24	1.39	0.022	0.005	0.42

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Diffusible Hydrogen Content

❖ Welding Conditions

wire	: M-12K	Amps(A) / Volts(V)	: 625/30
Diameter(mm)	: 4.0(5/32)	Stick-Out(mm)	: 30
Flow Rate(ℓ /min.)	: -	Welding Speed	: 60 cpm
Welding Position	: 1G	Current Type & Polarity	: DC(+)

❖ Result(ml/100g Weld Metal)

X1	X2	X3	X4
6.40	6.35	6.05	6.24

Average Hydrogen Content 6.26 ml / 100g Weld Metal



Approvals

❖ Authorized Approval Details

Consumables	KR	ABS	LR	BV	DNV	GL	NK	MRS
S-717 X M-12K	3M 3YM 2.4~6.4	3M 3YM 2.4~6.4	3YM 2.4~6.4	A3M A3YM 2.0~6.4	IIIYM 2.0~6.4	3YM 2.0~6.4	KAW53M 2.0~6.4	3YM 1.2~6.4
	CWB			TUV			CE-Mark	
S-717 X M-12K	CSW W48-06 F49A5-EM12K CSW W48-06 F49P5-EM12K 1.2~6.4			EN 756 S2Si (Wire) EN 760 SA A B 1 (Flux) 1.6~5.0			EN 756 S2Si (Wire) EN 760 SA A B 1 (Flux) 1.6~5.0	
	DB							
S-717 X M-12K	S2Si DIN EN 756 (M-12K) S A AB 1 DIN EN 760 (S-717) 1.2~6.4							