

S-900SP X M-12K A-2

SUBMERGED ARC WELDING CONSUMABLES
FOR WELDING OF API Line-pipe



S-900SP X M-12K A-2

❖ Specification

WIRE	AWS A5.17/A5.23	EN 756
M-12K	A5.17 F7A4-EM12K	S 42 4 CS S2Si
A-2	A5.23 F9A2-EA2-G	S 50 3 CS S2Mo

❖ Applications

The flux is widely used for Oil and gas line pipe fabrication through X70, X80 grade

❖ Characteristics on Usage

S-900SP is well-suited for longitudinal seam welding.

It is the neutral flux which is also suitable for use in multiple pass welding with mild steel and low alloy electrodes.

❖ Note on Usage

1. Dry the flux at 300~350°C for 60 minutes before use.
2. When the flux height is excessive, poor bead appearance may occur.
3. Use welding current and speed as low as possible at the first layer of groove to avoid cracking.



Welding Consumables for Test

❖ Flux

Consumable	Chemical Composition, wt%			
	SiO ₂ +TiO ₂	CaO+MgO	Al ₂ O ₃ +MnO	CaF ₂
S-900SP	15	50	25	10

Consumable	Particle Size (Mesh)	Type of Flux	B.I	H ₂ O _{1000℃} /CO ₂ (%)
S-900SP	12 × 60	Agglomerated	2.1	0.05/0.60

❖ Electrodes

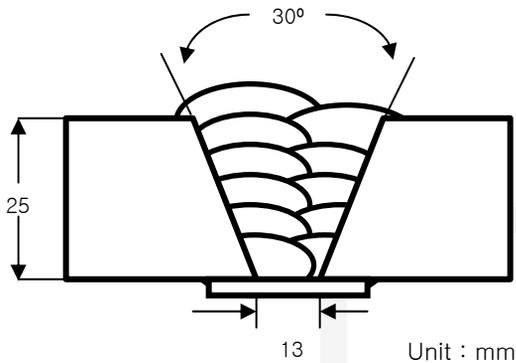
Consumables	Dia. (mm)	Chemical Composition, wt%					
		C	Si	Mn	P	S	Mo
M-12K	4.0	0.09	0.20	1.12	0.012	0.008	-
AWS A5.17 EM12K		0.05-0.15	0.10-0.35	0.80-1.25	≤0.030	≤0.030	-
A-2	4.0	0.09	0.15	1.00	0.015	0.005	0.48
AWS A5.23 EA2		0.05-0.17	≤0.20	0.95-1.35	≤0.025	≤0.025	0.45-0.65



Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

Base metal	: AH 36
Particle size	: 12 X 60 (ASME)
Flux type	: Agglomerated
Amp./ Volt./cpm	: 550 / 30 / 40
Stick-Out(mm)	: 30
Pre-Heat(°C)	: R.T .
Interpass Temp.(°C)	: <150
Polarity	: AC

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule)
		YS(MPa)	TS(MPa)	EI(%)	-40°C
S-900SP X M-12K	As-welded	542	588	30.8	140
AWS A5.17 F7A4-EM12K	-	≥ 400	490~660	≥ 22	≥ 27J at -40°C

❖ Chemical Analysis of All weld metal(wt%)

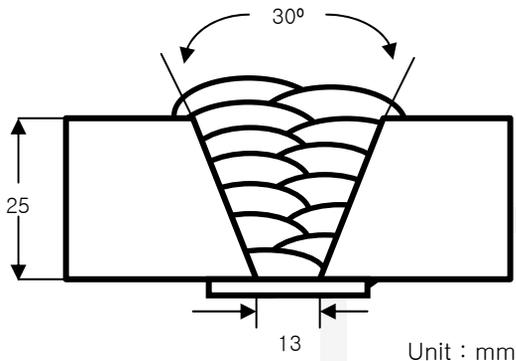
Consumables	C	Si	Mn	P	S
S-900SP X M-12K	0.090	0.35	1.56	0.028	0.005



Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

Base metal	: AH 36
Particle size	: 12 X 60 (ASME)
Flux type	: Agglomerated
Amp./ Volt./cpm	: 550 / 30 / 40
Stick-Out(mm)	: 30
Pre-Heat(°C)	: R.T .
Interpass Temp.(°C)	: <150
Polarity	: DC(+)

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule)
		YS(MPa)	TS(MPa)	EI(%)	-40°C
S-900SP X M-12K	As-welded	525	575	28.4	106
	620°C X 1hr	495	582	30.2	94
AWS A5.17 F7A4-EM12K	-	≥ 400	490~660	≥ 22	≥ 27J at -40°C

❖ Chemical Analysis of All weld metal(wt%)

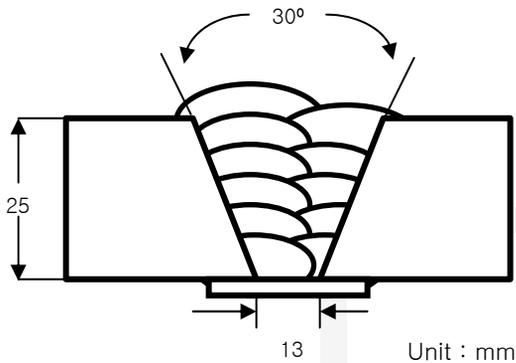
Consumables	C	Si	Mn	P	S
S-900SP X M-12K	0.080	0.39	1.67	0.027	0.004



Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

Base metal	: AH 36
Particle size	: 12 X 60 (ASME)
Flux type	: Agglomerated
Amp./ Volt./cpm	: 550 / 30 / 40
Stick-Out(mm)	: 30
Pre-Heat(°C)	: R.T .
Interpass Temp.(°C)	: <150
Polarity	: AC

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule)
		YS(MPa)	TS(MPa)	EI(%)	-29°C
S-900SP X A-2	As-welded	650	670	24.4	61
AWS A5.23 F9A2-EA2-G	-	≥ 540	620~760	≥ 17	≥ 27J at -29°C

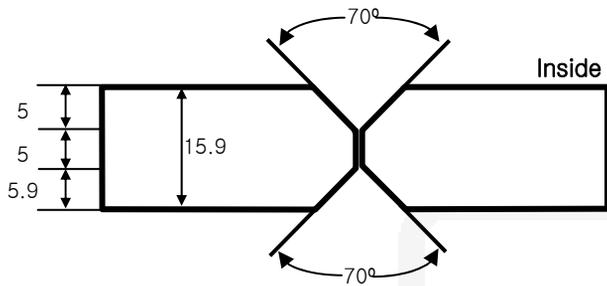
❖ Chemical Analysis of All weld metal(wt%)

Consumables	C	Si	Mn	P	S	Mo
S-900SP X A-2	0.097	0.26	1.51	0.021	0.007	0.359



Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions



Unit : mm

[Joint Preparation]

Base metal	: API 5L X70
Particle size process	: 12 X 60 (ASME)
Wire size (mm)	: 4.0
Stick-Out(mm)	: L : 25, T : 30
Pre-Heat(°C)	: R.T .

❖ Welding Conditions

Pass	Polarity	Current (A)	Voltage (V)	Speed (cm/min)
Inside 1st	(L) DC+	980	34	100
	(T) AC	800	38	
Outside 2nd	(L) DC+	1000	39	110
	(T) AC	780	40	

❖ Mechanical Properties of Butt weld(Two-run technique)

Consumables	Notch location	CVN Impact Test (Joule)				
		Temp. (°C)	X1	X2	X3	Ave.
S-900SP X A-2	Center	0	172	177	180	176
		-10	170	182	167	173

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Diffusible Hydrogen Content

❖ Welding Conditions

Method by JIS Z3118

wire	: A-2	Amps(A) / Volts(V)	: 625/30
Diameter(mm)	: 4.0	Stick-Out(mm)	: 30
Flow Rate(ℓ /min.)	: -	Welding Speed	: 60 cpm
Welding Position	: 1G	Current Type & Polarity	: AC, DC(+)

❖ Result(ml/100g Weld Metal)

Polarity	X1	X2	X3	X4	Av.
AC	9.35	8.17	8.95	8.85	8.83
DC+	5.88	5.93	9.96	5.50	6.82