HYUNDAI WELDING

Rev. 03

S-950S X M-12K
A-2
A-2TiB

SUBMERGED ARC WELDING CONSUMABLES
FOR WELDING OF LONGITUDINAL PIPE

2023.02

HYUNDAI WELDING CO., LTD.

❖ Specification

Flux	JIS Z 3352	EN ISO 14174	KS B 14174
S-950S	S A FB1	S A FB1 H5	S A FB1

WIRE	AWS A5.17/A5.23	EN ISO 14171
M-12K	A5.17 F7A(P)8-EM12K	S2Si
A-2	A5.23 F8A(P)5-EA2-A3	S2Mo
	A5.23 F8TA(P)8-EA2	S2Mo
A-2TiB	A5.23 F8TA(P)8-EA2TiB	S2MoTiB

❖ Applications

S-950S is well-suited for longitudinal welded line pipes.

❖ Characteristics on Usage

It is the agglomerated, neutral flux, designed primarily for multi-wire procedures in the production of longitudinal welded line pipes.

❖ Note on Usage

1. Dry the flux at 300~350℃ for 60 minutes before use.

2. When the flux height is excessive, poor bead appearance may occur.

3. Remove rust, scales, oil, paint, water, dirt and slag of tack welds from the groove to obtain sound weld metal.

Welding Consumables

❖ Flux

Consumable	Chemical Composition, wt%			
	SiO2+TiO2	CaO+MgO	Al2O3+MnO	CaF2
S-950S	15	35	30	20

Consumable	Particle Size (Mesh)	Type of Flux	B.I	$H2O_{1000℃}$/ CO2(%)
S-950S	10 × 48	Agglomerated	2.2	0.05/0.60

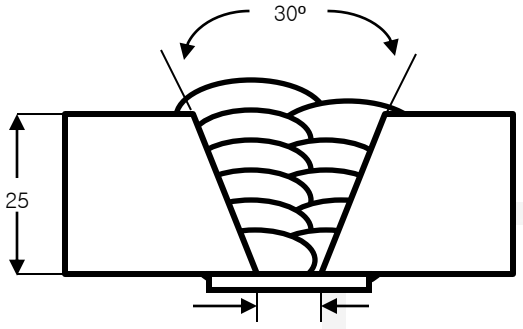
❖ Electrodes

Consumables	Dia. (mm)	Chemical Composition, wt%								
		C	Si	Mn	P	S	Ni	Mo	Ti	B
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	-	-
A-2TiB	4.0	0.06	0.25	1.21	0.009	0.002	-	0.53	0.14	0.012
AWS A5.23 EA2TiB		0.05-0.17	≤0.35	0.95-1.35	≤0.025	≤0.025	-	0.45-0.65	0.05-0.30	0.005-0.030

Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

Base metal	:	A 36
Amp./ Volt./cpm	:	550 / 30 / 40
Stick-Out(mm)	:	30
Pre-Heat(℃)	:	R.T .
Interpass Temp.(℃)	:	<165
Polarity	:	DC+

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule) at -60℃
		YS(MPa)	TS(MPa)	El(%)	
S-950S X M-12K	As welded	459	548	34	100
	620℃ X 1hr	443	538	33	100
AWS A5.17 F7A(P)8-EM12K		≥400	490~660	≥ 22	≥27J @ -60℃

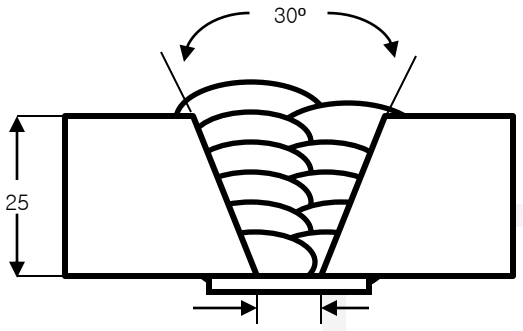
❖ Chemical Composition of All weld metal (wt%)

Consumables	C	Si	Mn	P	S
S-950S M-12K	0.06	0.20	1.50	0.019	0.005

Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

Base metal	:	A 36 (Buttering A-2)
Amp./ Volt./cpm	:	550 / 30 / 40
Stick-Out(mm)	:	30
Pre-Heat(℃)	:	R.T .
Interpass Temp.(℃)	:	<165
Polarity	:	DC+

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule) at -46℃
		YS(MPa)	TS(MPa)	El(%)	
S-950S X A-2	As welded	567	637	28	74
	620℃x1hr	566	642	31	65
AWS A5.23 F8A(P)5-EA2-A3		≥470	550~700	≥ 20	≥27J at -46℃

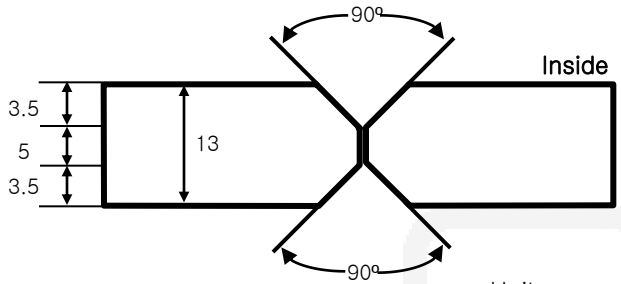
❖ Chemical Composition of All weld metal (wt%)

Consumables	C	Si	Mn	P	S	Mo
S-950S X A-2	0.06	0.20	1.50	0.016	0.001	0.43
AWS A5.23 F8A(P)5-EA2-A3	≤0.15	≤0.80	≤2.10	≤0.030	≤0.030	0.40~ 0.65

Mechanical Properties of Weld Metal (Two-run technique)

❖ Welding Conditions (Two-run technique)

Method by AWS Rules



Unit : mm

[Joint Preparation]

Base metal	:	A516-70
Wire size (mm)	:	4.0
Stick-Out(mm)	:	30
Pre-Heat(℃)	:	R.T .

❖ Welding Conditions (Two-run technique)

Pass	Polarity	Current (A)	Voltage (V)	Speed (cm/min)	Heat input (kJ/cm)
1st (Inside)	AC	700	32	60	22.4
2nd (Outside)	AC	800	33	65	24.3

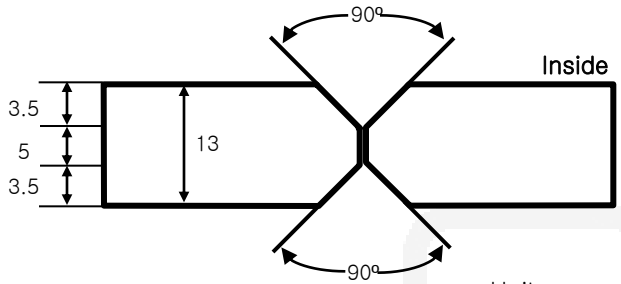
❖ Mechanical Properties of Weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule) at -60℃
		YS(MPa)	TS(MPa)	El(%)	
S-950S X A-2	As welded	553	645	31	70
	620℃x1hr	541	638	31	55
AWS A5.23 F8TA(P)8-EA2	-	≥490	≥550	≥20	≥27J at -60℃

Mechanical Properties of Weld Metal (Two-run technique)

❖ Welding Conditions (Two-run technique)

Method by AWS Rules



Unit : mm

[Joint Preparation]

Base metal	: A516-70
Wire size (mm)	: 4.0
Stick-Out(mm)	: 30
Pre-Heat(℃)	: R.T .

❖ Welding Conditions (Two-run technique)

Pass	Polarity	Current (A)	Voltage (V)	Speed (cm/min)	Heat input (kJ/cm)
1st (Inside)	AC	700	32	60	22.4
2nd (Outside)	AC	800	33	65	24.3

❖ Mechanical Properties of Weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule) at -60℃
		YS(MPa)	TS(MPa)	El(%)	
S-950S X A-2TiB	As welded	610	690	31	160
	620℃x1hr	607	689	31	130
AWS A5.23 F8TA(P)8-EA2TiB	-	≥490	≥550	≥20	≥27J at -60℃

Diffusible Hydrogen Test

❖ Hydrogen content (㎖/100g)

X1	X2	X3	Av.
4.6	4.6	4.1	4.4

* Method by EN ISO 14174 Rules (Gas Chromatography method)