HYUNDAI WELDING

Rev. 02

S-777MXH X H-14
M-12K
A-3

SUBMERGED ARC WELDING CONSUMABLES
FOR WELDING OF Mild & 490MPa CLASS
HIGH TENSILE STEEL

HYUNDAI WELDING CO., LTD.

❖ Specification

Flux	JIS Z3352	EN ISO 14174	KS B ISO 14174
S-777MXH	S A AB 1	S A AB 1	S A AB 1

Wire	AWS A5.17/A5.23	EN ISO 14171
H-14	A5.17 F7A(P)2-EH14	S4
M-12K	A5.17 F7A(P)Z-EM12K	S2Si
A-3	A5.23 F8A4-EA3-A3	S4Mo
	A5.23 F8P0-EA3-A3	

❖ Applications

Butt and flat welding of miniature LPG tanks, ships ,vehicles, agricultural implements, machinery, boilers, bridges, structural steels.

❖ Characteristics on Usage

Especially insensitive to oil, rust, scale, dirt and primers on the surface to be welded. Slag detachability in narrow groove and resistance to porosity are excellent. As the consumption of flux is low, it is very economical. Applicable to horizontal and flat fillet welding.

❖ Note on Usage

1. Dry the flux at 300~350℃(572~662°F) for 60minutes 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.
4. 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%		
	$Al_2O_3+Fe_2O_3$	MgO+MnO	SiO_2+CaF_2
S-777MXH	35	35	30

Consumable	Particle Size (Mesh)	Type of Flux	B.I	H2O(1000℃)/ CO2(%)
S-777MXH	10 × 48	Agglomerated	0.9	0.01/0.10

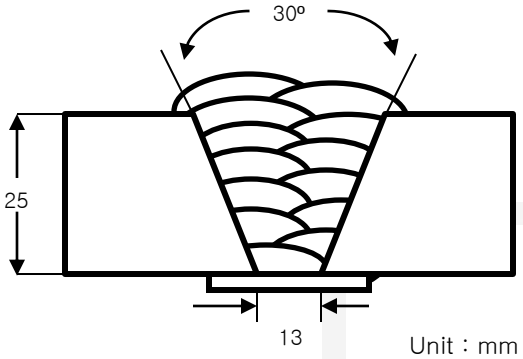
❖ Electrode

Consumable	Dia. (mm)	Chemical Composition, wt%					
		C	Si	Mn	P	S	Mo
H-14	4.0	0.12	0.03	1.93	0.016	0.009	-
AWS A5.17 EH14		0.10-0.20	≤0.10	1.70-2.20	≤0.030	≤0.030	-
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-3	4.0	0.08	0.04	1.85	0.019	0.007	0.50
AWS A5.23 EA3		0.05-0.17	≤0.20	1.65-2.20	≤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	:	SS 400
Particle size	:	10 X 48
Flux type	:	Agglomerated
Amp./ Volt./CPM	:	550 / 30 / 40
Stick-Out(mm)	:	30
Pre-Heat(℃)	:	R.T .
Interpass Temp.(℃)	:	<150
Polarity	:	AC

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule)
		YS(MPa)	TS(MPa)	El(%)	-29℃
S-777MXH X H-14	As welded	590	610	28	82
	620℃x1hr	538	593	30	100
AWS A5.17 F7A(P)2-EH14	-	≥400	490~660	≥ 22	≥27J at -29℃

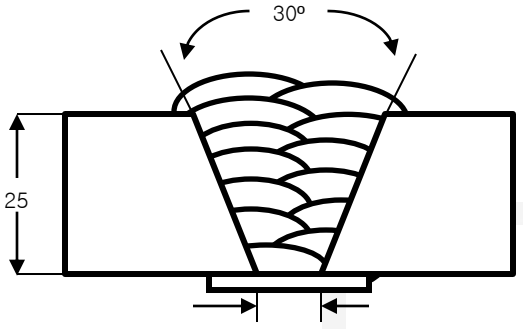
❖ Chemical Analysis of All weld metal(wt%)

Consumables	C	Si	Mn	P	S
S-777MXH X H-14	0.08	0.33	1.27	0.021	0.006

Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

Base metal	:	SS 400
Particle size	:	10 X 48
Flux type	:	Agglomerated
Amp./ Volt./CPM	:	550 / 30 / 40
Stick-Out(mm)	:	30
Pre-Heat(℃)	:	R.T .
Interpass Temp.(℃)	:	<150
Polarity	:	AC

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule)
		YS(MPa)	TS(MPa)	El(%)	0℃
S-777MXH X M-12K	As welded	484	568	26.8	80
	620℃x1hr	449	550	30.8	90
AWS A5.17 F7A(P)Z-EM12K	-	≥400	490~660	≥ 22	-

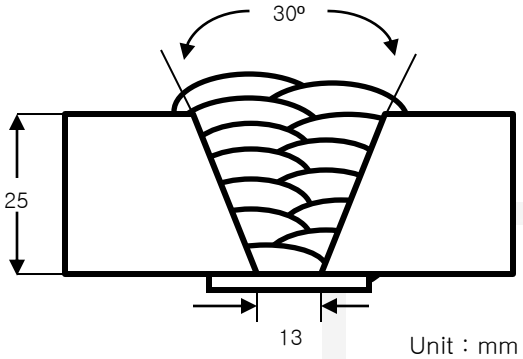
❖ Chemical Analysis of All weld metal(wt%)

Consumables	C	Si	Mn	P	S
S-777MXH X M-12K	0.07	0.40	0.90	0.024	0.020

Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

Base metal	:	SS 400
Particle size	:	10 X 48
Flux type	:	Agglomerated
Amp./ Volt./CPM	:	550 / 30 / 40
Stick-Out(mm)	:	30
Pre-Heat(℃)	:	R.T .
Interpass Temp.(℃)	:	<150
Polarity	:	AC

❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule)
		YS(MPa)	TS(MPa)	El(%)	
S-777MXH X A-3	**As welded**	643	668	26	60
AWS A5.23 F8A4-EA3-A3	**-**	**≥470**	**550~690**	**≥ 20**	**-40℃**

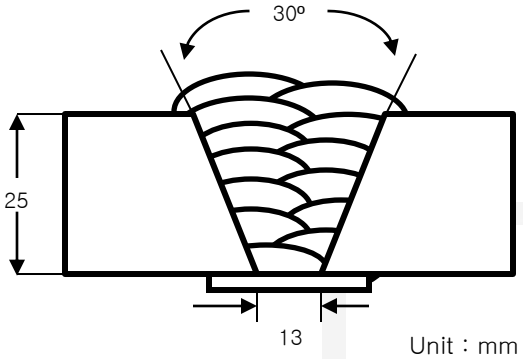
❖ Chemical Analysis of All weld metal(wt%)

Consumables	C	Si	Mn	P	S	Mo
S-777MXH X A-3	0.07	0.35	1.38	0.021	0.012	0.46

Mechanical Properties & Chemical Composition of All Weld Metal

❖ Welding Conditions

Method by AWS Spec.



[Joint Preparation & Layer Details]

Base metal	:	SS 400
Particle size	:	10 X 48
Flux type	:	Agglomerated
Amp./ Volt./CPM	:	550 / 30 / 40
Stick-Out(mm)	:	30
Pre-Heat(℃)	:	R.T .
Interpass Temp.(℃)	:	<150
Polarity	:	AC

❖ Mechanical Properties of All weld metal

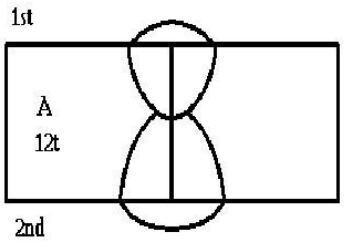
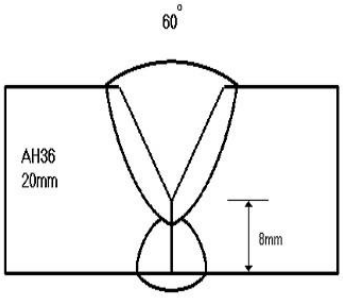
Consumables	PWHT Condition	Tensile Test			CVN Impact Test (Joule)
		YS(MPa)	TS(MPa)	El(%)	
S-777MXH X A-3	**620℃x2hr**	650	680	25	55
AWS A5.23 F8P0-EA3-A3	**-**	**≥470**	**550~690**	**≥ 20**	**-18℃**

❖ Chemical Analysis of All weld metal(wt%)

Consumables	C	Si	Mn	P	S	Mo
S-777MXH X A-3	0.07	0.35	1.38	0.021	0.012	0.46

Butt Two-run welding test

❖ Welding Conditions

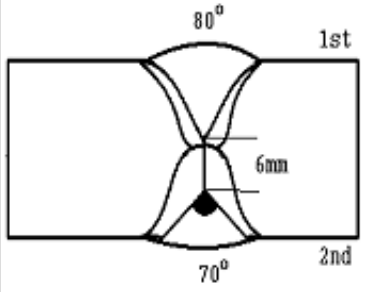
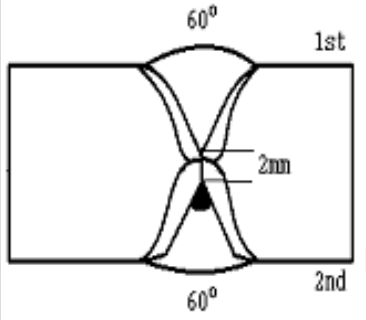
Base Metal	Joint preparation and layer details (B.M. SM 490A)	Wire dia. (mm)	Welding conditions						
			Side	Curr.	Amp. (A)	Volt (V)	Speed (cpm)	Heat input (KJ/cm)	Inter pass temp (℃)
SS400 (12mm)		4.8	1st	AC	700	35	50	29.4	Max. 150
			2nd		800	35	50	33.6	
A36 (20mm)		4.8	1st	AC	850	36	25	73.4	
			2nd		900	36	45	43.2	

❖ Mechanical Properties of All weld metal

Consumables	Base Metal	Tensile Test		Bending test		CVN Impact Test (Joule)
		TS(MPa)	El(%)	Face	Root	0℃
S-777MXH X H-14	SS400	446	Rupture Of B.M.	Good	Good	96
	A36	537	Rupture Of B.M.	Good	Good	77

Butt Two-run welding test

❖ Welding Conditions

Base Metal	Joint preparation and layer details	Wire dia. (mm)	Welding conditions							
			Side	Curr.		Amp. (A)	Volt (V)	Speed (cpm)	Heat input (KJ/cm)	Inter pass temp (℃)
API 5L X65 (16mm)		4.0	1st	AC		700	36	50	30.2	Max. 150
			2nd			700	40	45	37.3	
API 5L X65 (17.5mm)		4.0 ~ 4.8	1st	L	DC+	780	32	110	27.1	
				T	AC	650	38			
			2nd	L	DC+	1050	34	110	35.8	
				T	AC	750	40			

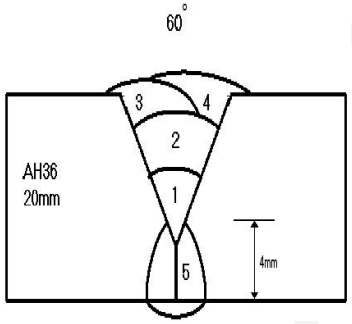
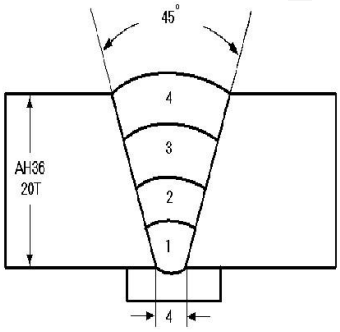
* Note) Sealing bead : GMAW 1 pass (1.2 f → 140A/23V/40CPM)

❖ Mechanical Properties of All weld metal

Consumables	Base Metal	Tensile Test		Bending test		CVN Impact Test (Joule)
		TS(MPa)	El(%)	Face	Root	-20℃
S-777MXH X A-3	API 5L X65 (16mm)	672	Rupture Of B.M.	Good	Good	75
	API 5L X65 (17.5mm)	639	Rupture Of B.M.	Good	Good	95

Butt Multi-run welding test

❖ Welding Conditions

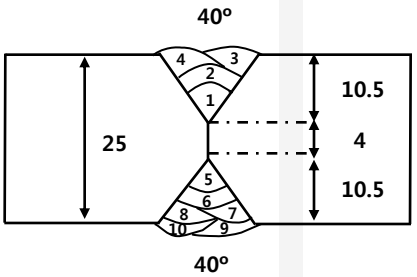
Base Metal	Joint preparation and layer details (B.M. SM 490A)	Wire dia. (mm)	Welding conditions						
			Side	Curr.	Amp. (A)	Volt (V)	Speed (cpm)	Heat input (KJ/cm)	Inter pass temp (℃)
AH36 (20mm) 60°		4.0	1st (1~4)	AC	550	30	40	24.8	Max. 150
			2nd		650	34	45	29.5	
AH36 (20mm) 45°		FCAW (E71T-1) 1.2	1	DC+	230	28	22	17.6	
			2		280	32	32	16.8	
		4.8	3	AC	700	32	30	44.8	
			4		800	38	30	60.8	

❖ Mechanical Properties of All weld metal

Consumables	Base Metal	Tensile Test		Bending test		CVN Impact Test (Joule)
		TS(MPa)	El(%)	Face	Root	-20℃
S-777MXH X H-14	AH36 60°	562	Rupture Of B.M.	Good	Good	102
	AH36 45°	554	Rupture Of B.M.	Good	Good	109

Butt Multi-run welding test

❖ Welding Conditions

Base Metal	Joint preparation and layer details (B.M. SM 570-TMC)	Wire dia. (mm)	Welding conditions						
			Pass	Curr.	Amp. (A)	Volt (V)	Speed (cpm)	Heat input (KJ/cm)	Inter pass temp (℃)
SM570-TMC		4.0	1	DC+	550	30	40	24.8	Max. 150
			2~4		650	34	45	29.5	
			Back gouging						
			5		550	30	40	24.8	
			6~10		650	34	45	29.5	

❖ Mechanical Properties of All weld metal

Consumables	Base Metal	Tensile Test		Bending test		CVN Impact Test (Joule)		
		TS(MPa)	El(%)	Face	Root	-0℃	-10℃	-20℃
S-777MXH X A-3	SM570-TMC	652	Rupture Of B.M.	Good	Good	103	82	75

Diffusible Hydrogen Content

❖ Welding Conditions

Wire	:	**H-14**	**Amp.(A) / Volts(V)**	:	525/28
Diameter(mm)	:	4.0	**Stick-Out(mm)**	:	30
Flow Rate(ℓ /min.)	:	-	**Welding Speed**	:	42 CPM
Welding Position	:	1G	**Current Type & Polarity**	:	AC

❖ Result(㎖/100g Weld Metal)

X1	X2	X3	X4
6.12	**5.86**	**6.02**	**5.66**

Average Hydrogen Content **5.91** ***㎖ / 100g Weld Metal***

Approvals

❖ Authorized Approval Details

Consumables	KR	ABS	LR	BV	DNV	GL	NK
S-777MXH X H-14	2T 2YT 3M 3YM 1.2~6.4	2T 2YT 3M 3YM 1.2~6.4	2T 2YT 3M 3YM 1.2~6.4	A2T A2YT A3M A3YM 1.2~6.4	IIYTH10 IIIymh10 1.2~6.4	2YT 3YM 1.2~6.4	KAW3M KAW53M KAW2T KAW52T 1.2~6.4
S-777MXH X H-14 (2 Pole)	–	3YM 1.2~3.2	3M 3YM 1.2~3.2	A3YM 1.2~3.2	–	3YM 1.2~3.2	–