

# **S-787TB X H-14**

## **A-3**

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

2019.09



## ❖ Specification

Flux	JIS Z 3352	EN ISO 14174	KS B ISO 14174
S-787TB	S A FB 1	S A FB 1	S A FB 1

Wire	AWS A5.17/A5.23	EN ISO 14171
H-14	A5.17 F7A(P)8-EH14	S4
A-3	A5.23 F8TA8-EA3-A3	S4Mo

## ❖ Applications

Single and multi-layer welding of aluminum-killed steel for low temperature service used in offshore structures, chemical vessels, steel pipes, low temperature service equipments and other structures in cold regions.

## ❖ Characteristics on Usage

Excellent notch toughness at low temperature down to  $-60^{\circ}\text{C}$  ( $-76^{\circ}\text{F}$ ). Suitable for single and multi-layer welding of TMCP steel. Resistance to pockmark and porosity is excellent. Slag detachability in the groove is good.

## ❖ Note on Usage

1. Dry the flux at  $300\sim 350^{\circ}\text{C}$  ( $572\sim 662^{\circ}\text{F}$ ) 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 <sub>2</sub> +TiO <sub>2</sub>	CaO+MgO	Al <sub>2</sub> O <sub>3</sub> +MnO	CaF <sub>2</sub>
S-787TB	15	55	15	15

Consumable	Particle Size (Mesh)	Type of Flux	B.I	H <sub>2</sub> O <sub>000°C</sub> /CO <sub>2</sub> (%)
S-787TB	10 × 48	Agglomerated	2.4	0.03/0.90

### ❖ Electrode

Consumable	Dia. mm (in)	Chemical Composition, wt%					
		C	Si	Mn	P	S	Mo
H-14	4.0(5/32)	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	-
A-3	4.0(5/32)	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

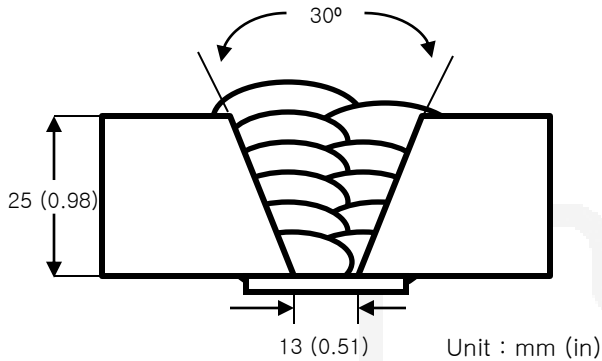
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## Mechanical Properties & Chemical Composition of All Weld Metal

### ❖ Welding Conditions

Method by AWS Spec.



[ Joint Preparation & Layer Details ]

<b>Base metal</b>	: AH 36
<b>Particle size</b>	: 10 X 48
<b>Flux type</b>	: Agglomerated
<b>Amp./ Volt./cpm</b>	: 550 / 30 / 40
<b>Stick-Out mm (in)</b>	: 30 (1.18)
<b>Pre-Heat °C (°F)</b>	: R.T .
<b>Interpass Temp. °C (°F)</b>	: <150 (302)
<b>Polarity</b>	: AC

### ❖ Mechanical Properties of All weld metal

Consumables	PWHT Condition	Tensile Test			CVN Impact Test J (ft-lbs)
		YS MPa(lbs/in <sup>2</sup> )	TS MPa(lbs/in <sup>2</sup> )	EI(%)	
S-787TB X H-14	As-welded	580 (84,200)	620 (90,000)	31	90(66)
	620 °C X 1hr	530 (78,000)	6110 (89,000)	31	80(60)
AWS A5.17 F7A(P)8-EH14		≥ 400(58)	490~660 (70~95)	≥ 22	≥ 27J at -62°C (-80°F)

### ❖ Chemical Analysis of All weld metal(wt%)

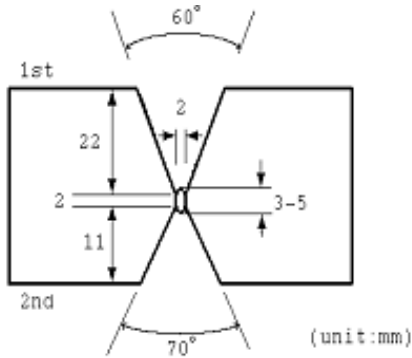
Consumables	C	Si	Mn	P	S	Ti	B
S-787TB X H-14	0.09	0.25	1.53	0.020	0.015	0.020	0.0020

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## Multi-run Welding Test

### ❖ Welding Conditions



[ Joint Preparation & Layer Details ]

- Base metal** : SM490A
- Particle size** : 10 X 48
- Flux type** : Agglomerated
- Stick-Out mm (in)** : 30 (1.18)
- Pre-Heat °C (°F)** : R.T .
- Interpass Temp. °C (°F)** : <200 (392)
- Polarity** : AC

### ❖ Welding Conditions

Position	Pass No.	W/D Process	Filler Metal	Current	Welding Parameter			Interpass Temp. °C (°F)
				Type/ Polarity	Ampere (A)	Voltage (V)	Speed (CPM)	
Face	1	SMAW	S-76LTH	DCRP	160	24	10	< 200 (392)
	2	SAW	S-787TB/H-14	AC	500	28	35	
	3-8			AC	600	32	30	
-	Back gouging (Min. 5R, 35°) completely remove SMAW weld							
Root	9	SAW	S-787TB/H-14	AC	500	28	25	
	10-14			AC	600	32	30	

### ❖ Mechanical Properties of All weld metal

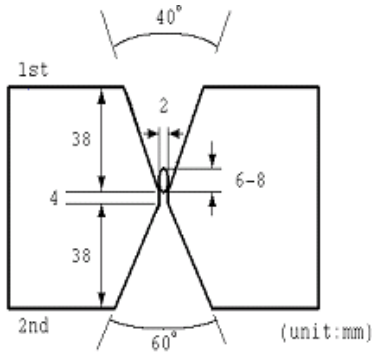
Consumables	Test Location	Temp.	CVN Impact Test J (ft-lbs)			
			X1	X2	X3	Avg.
S-787TB/H-14	Face	-62°C (-80°F)	127 (94)	114 (84)	122 (90)	121 (89)
	Center		117 (86)	123 (91)	121 (89)	120 (86)
	Root		98 (72)	105 (77)	105 (77)	102 (75)

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## Tandem Welding Test

### ❖ Welding Conditions



- Base metal** : API-2H Gr.50
- Particle size** : 10 X 48
- Flux type** : Agglomerated
- Stick-Out mm (in)** : 30 (1.18)
- Pre-Heat °C (°F)** : R.T .
- Interpass Temp. °C (°F)** : <200 (392)
- Polarity** : L : DC+, T : AC

### [ Joint Preparation & Layer Details ]

### ❖ Welding Conditions

Position	Pass No.	W/D Process	Filler Metal	Current	Welding Parameter			Interpass Temp. °C (°F)
				Type/ Polarity	Ampere (A)	Voltage (V)	Speed (CPM)	
Face	1	SMAW	S-76LTH	DCRP	160	24	10	< 200 (392)
	2	SAW	S-787TB/H-14	DC+	450	28	45	
	3			DC+	600	30	45	
	4-6			L (DC+)	700	32	30	
				T (AC)	800	35		
-	Back gouging (Min. 5R, 35°) completely remove SMAW weld							
Root	7-8	SAW	S-787TB/H-14	DC+	450	28	45	
	9-10			DC+	600	30	45	
	11-20			L (DC+)	700	32	30	
				T (AC)	800	35		



## Tandem Welding Test

### ❖ Mechanical Properties of All weld metal

Consumables	Test Location	Temp.	CVN Impact Test J (ft-lbs)			
			X1	X2	X3	Avg.
S-787TB/H-14	Face	-62°C (-80°F)	164 (121)	150 (110)	183 (135)	165 (121)
	Center		96 (71)	103 (76)	110 (81)	103 (76)
	Root		127 (94)	125 (92)	121 (89)	124 (91)

## Diffusible Hydrogen Content

### ❖ Welding Conditions

wire	:	H-14	Amp.(A) / Volts(V)	:	625/30
Diameter(mm)	:	4.0	Stick-Out(mm)	:	30
Welding Position	:	1G	Welding Speed	:	60 cpm
			Current Type & Polarity	:	DC(+)

### ❖ Result(ml/100g Weld Metal)

X1	X2	X3	X4
6.3	6.1	7.2	6.9

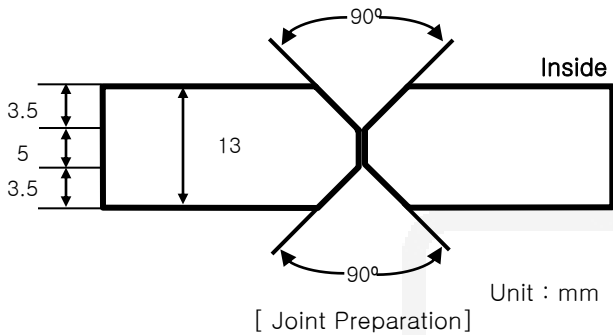
**Average Hydrogen Content 6.6 ml / 100g Weld Metal**



## Mechanical Properties & Chemical Composition of All Weld Metal

### ❖ Welding Conditions (Two-run technique)

Method by AWS Rules



<b>Base metal</b>	: A516-70
<b>Particle size</b>	: 10 X 48
<b>Flux type</b>	: Agglomerated
<b>Stick-Out mm (in)</b>	: 30 (1.18)
<b>Pre-Heat °C (°F)</b>	: R.T .
<b>Interpass Temp. °C (°F)</b>	: <150 (302)
<b>Polarity</b>	: AC

### ❖ Welding Conditions (Two-run technique)

Pass	Polarity	Current (A)	Voltage (V)	Speed (cm/min)	Heat input (kJ/cm)
Inside 1st	AC	650	33	58	22.2
Outside 2nd	AC	750	33	60	24.7

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

Consumables	PWHT Condition	Tensile Test			CVN Impact Test J (ft-lbs)
		YS MPa(ksi)	TS MPa(ksi)	EI(%)	
S-787TB X A-3	As-welded	539 (78)	631(91)	24.4	145(107)
AWS A5.23 F8TA8-EA3		≥ 490(70)	≥ 550(80)	≥ 20	≥ 27J at -62°C (-80°F)

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## Approvals

### ❖ Authorized Approval Details

Consumables	KR	ABS	LR	BV	DNV	GL	NK
S-787TB X H-14	3T,3YT 4Y40M 1.2~6.4	3T,3YT 5Y400M 1.2~6.4	3YT 5Y40M 1.2~6.4	A5Y40M A3T,A3YM 1.2~6.4	V Y40M H10 NV4-4L 1.2~5.0	6Y40M 3YT 1.2~6.4	KAWL3TM KAW54Y40M 1.2~6.4
S-787TB X H-14 (2Pole)	-	3T,3YT 5Y400M 1.2~6.4	3YT 5Y40M 1.2~6.4	-	V Y40M H10 NV4-4L 1.2~5.0	6Y40M 3YT 1.2~6.4	-

Consumables	KR	ABS	LR	BV	DNV	GL	NK
S-787TB X A-3	3T H10 3.2~4.8	5YT H10 3.2~4.8	4YT H10 3.2~4.8	A5YT HH 3.2~4.8	V YT H10 NV4-4L 3.2~4.8	-	KAWL3T H10
S-787TB X A-3 (2Pole)	-	5YT H10 3.2~4.8	4YT H10 3.2~4.8	A5YT HH 3.2~4.8	V YT H10 NV4-4L 3.2~4.8	-	KAWL3T H10