

For Weather Proof Steel

A guide for selecting welding consumables

Table 1 shows suitable welding consumables for shielded metal arc welding (SMAW), flux cored arc welding (FCAW), gas metal arc welding (GMAW), gas tungsten arc welding (GTAW) and submerged arc welding (SAW) of weather proof steels.

Table 1 Welding consumables for weather proof steel ⁽¹⁾

Steel grade	ASTM	JIS G3114	ASTM	JIS G3114
		A709 Gr.36	SMA400P SMA400W SMA490P SMA490W	A588 A709 Gr.50W A242
SMAW	LBW-52B		LBW-588 LBW-62G	LBW-62G
FCAW	DW-50W		DW-588	-
GMAW	MGW-50TB		MGW-588 (F, H, HF)	MGW-588 (F, H, HF)
GTAW	TGS-588		TGS-588	-
SAW	MF-38 / USW-52B MF-38A / USW-52B MF-53 / USW-52B (HF)		MF-38 / USW-588	MF-38 / USW-62B MF-63 / USW-62B (HF)

Note (1) F, H, and HF designate suitable welding position.

Tips for better welding results

In addition to the tips for mild steel and 490MPa high tensile strength steel, the following notes should be taken into consideration in welding weather proof steels.

- (1) Remove rust and dirt from welding grooves to prevent pits and blowholes in the weld metal.
- (2) Use an appropriate welding procedure taking into account the requirements for the mechanical properties of the weldment, because heat input, interpass temperature and plate thickness affect the cooling rate of welds and, where the cooling rate is excessively low, the tensile strength and notch toughness of the weld decrease.
- (3) Use appropriate preheating according to the type of base metal and the thickness of the work to prevent cold cracking in the weld. Table 2 shows the minimum preheat temperatures used in general applications.

Table 2 Minimum preheat temperatures (°C) for general uses for several steel grades and thicknesses

Steel grade (See Table 1)	Type of welding joint	Welding process	Plate thickness (mm)		
			25 max	Over 25 Up to 38	Over 38 Up to 50
A709 Gr.36 SMA400P SMA400W	Groove Fillet	SMAW	-	50	100
		FCAW, GMAW, GTAW, SAW	-	-	50
A588 A709 Gr.50W A242 SMA490P SMA490W	Groove Fillet	SMAW	50	100	100
		FCAW, GMAW, GTAW, SAW	-	-	50
SMA570P SMA570W	Groove Fillet	SMAW	50	100	100
		SAW, GMAW	50	50	50

- (4) For welding a high-phosphorous weather proof steel (e.g., A242), use lower welding currents and slower welding speeds to prevent hot cracking.

Covered Electrodes for Weather Proof Steel

Brand name	ASME AWS Class.	Type of covering	Pol.	Features	WP	Chemical composition of all-weld metal (%)										Mechanical properties of all-weld metal			
						C	Si	Mn	P	S	Cu	Ni	Cr	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)		
LBW-52	A5.5 E7016-G	Low hydrogen	AC	•Suitable for butt and fillet welding of weather proof steel (with painting) •RC: 300~350°C x0.5~1h	F HF H VU OH	Ex	0.07	0.48	0.82	0.010	0.005	0.31	0.33	-	Ex	490	550	31	-29°C: 130
			DC-EP			Gt	≤0.12	≤0.90	0.30~1.40	≤0.040	≤0.030	0.20~0.60	0.25~0.70	-	Gt	≥390	≥480	≥25	-
LBW-52B	A5.5 E7016-G	Low hydrogen	AC	•Suitable for butt and fillet welding of weather proof steel (without painting) •RC: 350~400°C x1h	F HF H VU OH	Ex	0.05	0.54	0.63	0.010	0.004	0.38	0.20	0.59	Ex	480	570	29	-29°C: 140
			DC-EP			Gt	≤0.12	≤0.90	0.30~1.40	≤0.040	≤0.030	0.30~0.70	0.05~0.70	0.45~0.75	Gt	≥390	≥480	≥25	-
LBW-588	A5.5 E8016-C3	Low hydrogen	AC	•Suitable for butt and fillet welding of ASTM A588 and A242 steel •RC: 350~400°C x1h	F HF H VU OH	Ex	0.07	0.57	1.10	0.010	0.007	-	1.06	-	Ex	520	600	30	-40°C: 120
			DC-EP			Gt	≤0.12	≤0.80	0.40~1.25	≤0.03	≤0.03	-	0.80~1.10	-	Gt	470~550	≥550	≥24	-40°C ≥27
LBW-62G	A5.5 E8018-W2	Low hydrogen	AC	•Suitable for butt and fillet welding of 570MPa class weather proof steel •Applicable for ASTM A588 and A242 steel •RC: 350~400°C x1h	F HF H VU OH	Ex	0.07	0.58	1.02	0.009	0.004	0.35	0.49	0.57	Ex	540	640	29	-18°C: 160
			DC-EP			Gt	≤0.12	0.35~0.80	0.50~1.30	≤0.03	≤0.03	0.30~0.75	0.40~0.80	0.45~0.70	Gt	≥460	≥550	≥19	-18°C ≥27

Note: Welding tests are as per AWS. Ex: Example (polarity: AC), Gt: Guaranty (polarity: as specified above)

Diameter and Length (mm)

	Dia.	2.6	3.2	4.0	5.0
LBW-52		350	350	400	450
LBW-52B		-	350	400	450
LBW-588		300	350	400	400
LBW-62G		350	350	400	450

Flux Cored Wires for Weather Proof Steel

Brand name	ASME AWS Class.	Type of cored flux	SG	Pol.	Features	WP	Chemical composition of all-weld metal (%)									Mechanical properties of all-weld metal				
							C	Si	Mn	P	S	Cu	Cr	Ni	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)		
DW-50W	-	Rutile	CO ₂	DC-EP	<ul style="list-style-type: none"> Suitable for butt and fillet welding in all positions Applicable for weather proof steel which is used normally without painting 	F HF H VU OH	Ex	0.06	0.35	1.06	0.013	0.008	0.39	0.54	0.38	Ex	510	590	27	0°C: 140
							Gt	≤0.12	≤0.90	0.50~ 1.60	≤0.03	≤0.03	0.30~ 0.60	0.45~ 0.75	0.05~ 0.70	Gt	≥390	≥490	≥20	0°C ≥47
DW-588	A5.29 E81T1 -W2	Rutile	CO ₂	DC-EP	<ul style="list-style-type: none"> Suitable for butt and fillet welding in all positions Applicable for A588 steel which is used normally without painting 	F HF H VU OH	Ex	0.04	0.55	1.14	0.012	0.010	0.41	0.52	0.48	Ex	550	620	27	-29°C: 60
							Gt	≤0.12	0.35~ 0.80	0.50~ 1.30	≤0.03	≤0.03	0.30~ 0.75	0.45~ 0.70	0.40~ 0.80	Gt	≥470	550~ 690	≥19	-29°C ≥27

Note: Welding tests are as per AWS. Ex: Example, Gt: Guaranty

Diameter (mm)	
DW-50W	1.2, 1.4, 1.6
DW-588	1.2

Solid wires for Weather Proof Steel

Brand name	ASME AWS Class.	SG	Pol.	Features	WP	Chemical composition of wire (%)										Mechanical properties of all-weld metal							
						C	Si	Mn	P	S	Cr	Ni	Cu	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	SG					
MGW-50TB	A5.28 ER80S -G	CO ₂	DC-EP	<ul style="list-style-type: none"> •Applicable for weatherproof steel which is used normally without painting •Lower currents are suitable 	F	Ex	0.03	0.77	1.39	0.012	0.010	0.61	0.19	0.45	Ex	450	560	30	0°C: 110	CO ₂			
					HF																		
		H																					
		VU			Gt	≤0.15	0.30~1.20	0.70~1.80	≤0.030	≤0.030	0.50~0.80	0.05~0.70	0.30~0.60	Gt	≥400	≥550	≥19	0°C: ≥47	CO ₂				
		80%Ar-20%CO ₂			OH																		
MGW-588	A5.28 ER80S -G	CO ₂	DC-EP	<ul style="list-style-type: none"> •Applicable for A588 steel which is used normally without painting •Higher currents are suitable 	F	Ex	0.03	0.75	1.37	0.008	0.010	0.66	0.58	0.49	Ex	520	610	27	-5°C: 110	CO ₂			
					HF																		
		H																					
		VU			Gt	≤0.15	0.30~1.20	0.70~1.80	≤0.030	≤0.030	0.50~0.80	0.05~0.70	0.30~0.60	Gt	≥470	≥550	≥19	-5°C: ≥47	CO ₂				
		80%Ar-20%CO ₂			OH																		

Note: Welding tests are as per AWS. Ex: Example, Gt: Guaranty

Diameter (mm)	
MGW-50TB	0.9, 1.0, 1.2
MGW-588	1.2, 1.4

TIG Welding Rod and Wire for Weather Proof Steel

Brand Name	ASME AWS Class.	SG	Pol.	Features	Chemical composition of rod and wire (%)								Mechanical properties of all-weld metal					
					C	Si	Mn	P	S	Cr	Ni	Cu	YP (MPa)	TS (MPa)	EL (%)	IV (J)		
TGS-588	A5.28 ER80S -G	Ar	DC-EN	*Applicable for A588 steel which is used normally without painting	Ex	0.10	0.27	0.60	0.007	0.009	0.66	0.65	0.42	Ex	470	570	33	-29°C: 270
					Gt	≤0.12	0.20~0.90	≤1.50	≤0.025	≤0.025	0.45~0.75	0.40~0.80	0.30~0.75	Gt	≥400	≥550	≥10	-29°C: ≥27

Note: Welding tests are as per AWS. Ex: Example, Gt: Guaranty

Diameter (mm)

TGS-588 2.0, 2.4

SAW Flux and Wire Combinations for Weather Proof Steel

Brand name	ASME AWS Class.	Type of flux	Pol.	Features	Chemical composition (%)								Mechanical properties of weld metal					
					C	Si	Mn	P	S	Cu	Cr	Ni	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)		
MF-38/ USW-52B	A5.23 F7A2 -EG-G	Fused	AC	<ul style="list-style-type: none"> •Suitable for butt and flat fillet welding (without painting) •Good impact value •RC: 150~350°Cx1h 	Wire-Ex	0.10	0.03	1.51	0.010	0.008	0.36	0.62	0.14	Ex	490	590	25	-29°C: 76
					Wire-Gt	≤0.15	≤0.10	1.20~ 1.80	≤0.025	≤0.025	0.30~ 0.55	0.50~ 0.80	0.10~ 0.25					
					Weld-Ex	0.05	0.32	1.48	0.017	0.005	0.35	0.51	0.14	Gt	≥400	480~ 660	≥22	-29°C ≥27
MF-38A/ USW-52B	A5.23 F7A2 -EG-G	Fused	AC	<ul style="list-style-type: none"> •Suitable for butt and flat fillet welding (without painting) •Pockmarks hardly occur •RC: 150~350°Cx1h 	Wire-Ex	0.10	0.03	1.51	0.010	0.008	0.36	0.62	0.14	Ex	480	570	26	-29°C: 59
					Wire-Gt	≤0.15	≤0.10	1.20~ 1.80	≤0.025	≤0.025	0.30~ 0.55	0.50~ 0.80	0.10~ 0.25					
					Weld-Ex	0.06	0.39	1.36	0.018	0.006	0.36	0.54	0.15	Gt	≥400	480~ 660	≥22	-29°C ≥27
MF-53/ USW-52B	A5.23 F7A0 -EG-G	Fused	AC	<ul style="list-style-type: none"> •Suitable for fillet welding (without painting) •Excellent bead appearance and good slag removal •RC: 150~350°Cx1h 	Wire-Ex	0.10	0.03	1.51	0.010	0.008	0.36	0.62	0.14	Ex	430	530	23	-18°C: 35
					Wire-Gt	≤0.15	≤0.10	1.20~ 1.80	≤0.025	≤0.025	0.30~ 0.55	0.50~ 0.80	0.10~ 0.25					
					Weld-Ex	0.05	0.58	1.35	0.009	0.007	0.36	0.59	0.18	Gt	≥400	480~ 660	≥22	-18°C ≥27

Note: Welding tests are as per AWS. Wire-Ex: Example of wire, Wire-Gt: Guaranty of wire, Weld-Ex: Example of weld metal
Ex: Example of weld metal (polarity: AC), Gt: Guaranty of weld metal (polarity: AC)

Diameter of wire (mm)	
USW-52B	1.6, 2.0, 2.4, 3.2, 4.0, 4.8

Mesh size of flux	
MF-38	12x65, 20x200, 20xD
MF-38A	12x65, 20x200, 20xD
MF-53	8x48

SAW Flux and Wire Combinations for Weather Proof Steel

Brand name	ASME AWS Class.	Type of flux	Pol.	Features		Chemical composition (%)							Mechanical properties of weld metal					
						C	Si	Mn	P	S	Cu	Cr	Ni	0.2%OS (MPa)	TS (MPa)	EI (%)	IV (J)	
MF-38/ USW-62B	A5.23 F8A2 -EG-G	Fused	AC	<ul style="list-style-type: none"> •Suitable for butt and flat fillet welding (without painting) •Good mechanical properties •RC: 150~350°Cx1h 	Wire-Ex	0.09	0.03	1.54	0.011	0.009	0.38	0.66	0.18	Ex	540	620	25	-29°C: 67
					Wire-Gt	≤0.15	≤0.10	1.20~ 1.80	≤0.025	≤0.025	0.30~ 0.55	0.50~ 0.80	0.10~ 0.25					
					Weld-Ex	0.05	0.32	1.53	0.02	0.006	0.33	0.59	0.18	Gt	≥470	550~ 690	≥20	-29°C ≥27
MF-63/ USW-62B	A5.23 F8A0 -EG-G	Fused	AC	<ul style="list-style-type: none"> •Suitable for fillet welding (without painting) •Good usability in flat and horizontal fillet welding •RC: 150~350°Cx1h 	Wire-Ex	0.09	0.03	1.54	0.011	0.009	0.38	0.66	0.18	Ex	510	600	22	-18°C: 31
					Wire-Gt	≤0.15	≤0.10	1.20~ 1.80	≤0.025	≤0.025	0.30~ 0.55	0.50~ 0.80	0.10~ 0.25					
					Weld-Ex	0.05	0.52	1.36	0.013	0.009	0.31	0.49	0.12	Gt	≥470	550~ 690	≥20	-18°C ≥27
MF-38/ USW-588	A5.23 A8A4 -EW-W	Fused	AC	<ul style="list-style-type: none"> •Suitable for butt and flat fillet welding of ASTM A588 steel •RC: 150~350°Cx1h 	Wire-Ex	0.10	0.30	0.61	0.011	0.009	0.40	0.60	0.65	Ex	480	600	28	-40°C: 64
					Wire-Gt	≤0.12	0.20~ 0.35	0.35~ 0.65	≤0.025	≤0.030	0.30~ 0.80	0.50~ 0.80	0.40~ 0.80					
					Weld-Ex	0.08	0.35	1.06	0.016	0.010	0.37	0.53	0.48	Gt	≥470	550~ 690	≥20	-40°C ≥27
					Weld-Gt	≤0.12	≤0.80	0.50~ 1.60	≤0.035	≤0.030	0.30~ 0.75	0.45~ 0.70	0.40~ 0.80					

Note: Welding tests are as per AWS. Wire-Ex: Example of wire, Wire-Gt: Guaranty of wire, Weld-Ex: Example of weld metal, Weld-Gt: Guaranty of weld metal
Ex: Example of weld metal (polarity: AC), Gt: Guaranty of weld metal (polarity: AC)

■ Diameter of wire (mm)

USW-62B 1.6, 2.0, 2.4, 3.2, 4.0, 4.8

USW-588 1.6, 2.4, 3.2, 4.0, 4.8

■ Mesh size of flux

MF-38 12x65, 20x200, 20xD

MF-63 8x48