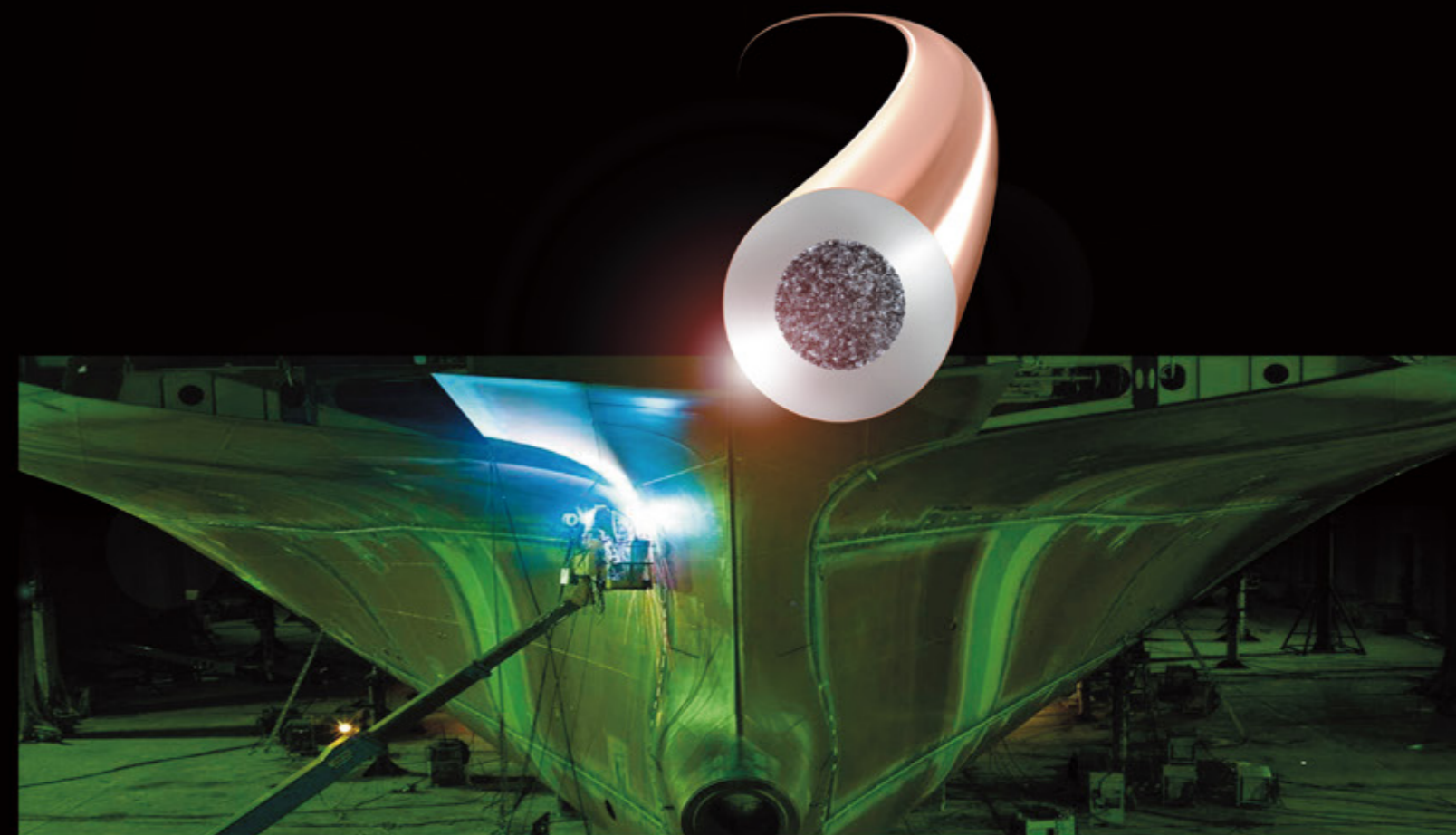




Seamless Flux Cored Wire,

SF-SM wire



Warning!

Fumes and gas may be hazardous to your health. Please take appropriate preventive measures such as the implementation of ventilation as well as wearing a protector for breathing. Arc light is harmful to the eyes and skin. Please use appropriate shielding measures. Please do not touch anything where electricity is activated. It may cause death.

Request to Customers

- 1 Various data of distinctive features such as welding materials, deposited metal, weld metal, etc. shown in this catalog are meant to explain the representative properties and performance of the products and are not to be taken as a guarantee except those which are specified clearly as "Specification".
- 2 In regard to the properties of welded structures, please be careful since design of structures, chemical compositions of steel plates, construction method, welding conditions, ability of constructor, etc. will affect the results.
- 3 Please understand that we are not able to take responsibility for damages caused by the misuse of the technical information written in this catalog.

NIPPON STEEL WELDING & ENGINEERING CO.,LTD.

<https://www.weld.nipponsteel.com>

Head Office

Shingu Bldg, 4-2 Toyo 2-chome, Koto-ku, Tokyo 135-0016 JAPAN
Tel. 81-3-6388-9000 Fax. 81-3-6388-9160

R&D Division

Futtsu Area
In Steel Research Laboratories, Technical Research & Development Bureau,
NIPPON STEEL CORPORATION
20-1 Shintomi, Futtsu-City, Chiba Pref. 293-8511 JAPAN
Tel. 81-439-80-2621 Fax. 81-439-80-2748

Narashino Area

6-1, Higashinarashino 7-chome, Narashino City, Chiba Pref. 275-0001, JAPAN
Tel. 81-47-479-1298 Fax. 81-47-479-4474

Narashino Plant

6-1, Higashinarashino 7-chome, Narashino City, Chiba Pref. 275-0001, JAPAN
Tel. 81-47-479-1171 Fax. 81-47-475-6430

Hikari Plant

2-1 Asae 4-chome, Hikari City, Yamaguchi Pref. 743-0021, JAPAN
Tel. 81-833-71-3390 Fax. 81-833-71-3394

Narashino Operating Division

6-1, Higashinarashino 7-chome, Narashino City, Chiba Pref. 275-0001, JAPAN

Machinery & Engineering Unit

Tel. 81-47-479-4111 Fax. 81-47-479-1434

Plasma Welding Machinery Unit

Tel. 81-47-479-4138 Fax. 81-47-479-2968

Optical Fiber Unit

Tel. 81-47-479-1179 Fax. 81-47-479-4371

Shanghai Rep. Office

Room 403-39, Fourth floor, KIRIN PLAZA, Lane 666,
Gubei Road, Changning District, Shanghai
200336, P.R.CHINA
Tel.86-21-2216-6561

Russia Rep. Office

406, 7-K, Tallinskaya Str., St.Petersburg, Russia
Tel.+7(812) 242-94-14

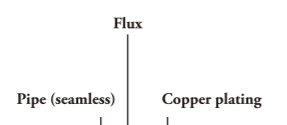
Subsidiary

Thailand

NIPPON STEEL WELDING (THAILAND) CO., LTD.

Eastern Seaboard Industrial Estate Soi 3 Zone A
300/41 T. Tasit A. Pluakdaeng Rayong 21140 THAILAND
Tel. 66-38-656-212 Fax. 66-38-656-233

NIPPON STEEL WELDING & ENGINEERING CO.,LTD.



Seamless Flux Cored Wire,

SF-SM wire

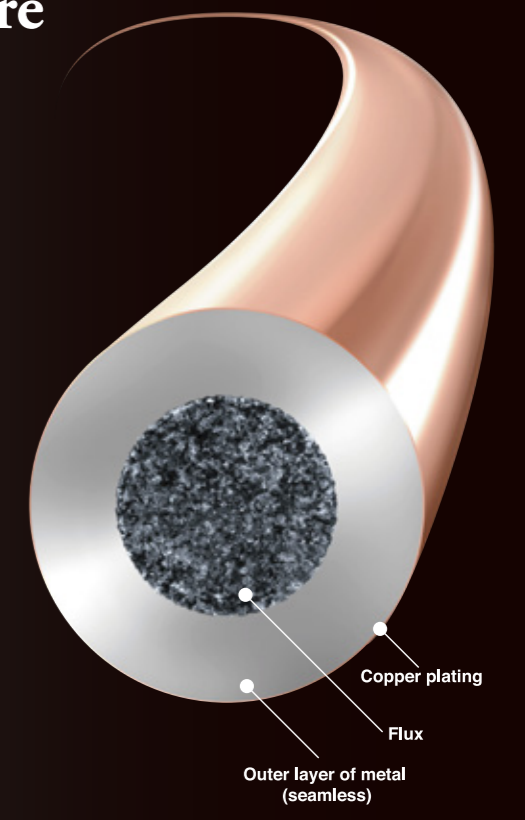
Since sales started in 1981 up until now, our seamless flux cored wires have developed as SF-SM wires through receiving your favor.

Superiority of our SF wire to conventional fold type flux cored wire

- ① Excellent Hygroscopic resistance
- ② Targeting point is extremely stable
- ③ Excellent contact tip abrasion resistance
- ④ Excellent rust prevention

Advanced Technology of our Seamless Flux Cored Wire

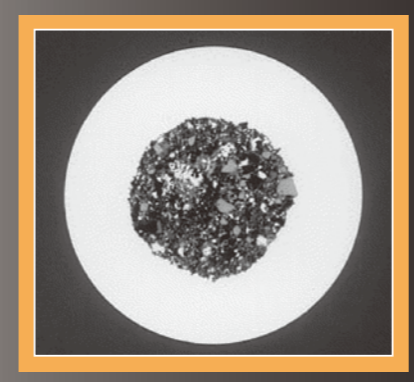
It is our company philosophy to keep improving product quality complying with customer's any needs from the period of company establishment. We are pleased to introduce our innovative feature of Seamless Flux Cored Wire such as low hydrogen content, excellent resistance to moisture absorption, and good targeting properties etc.



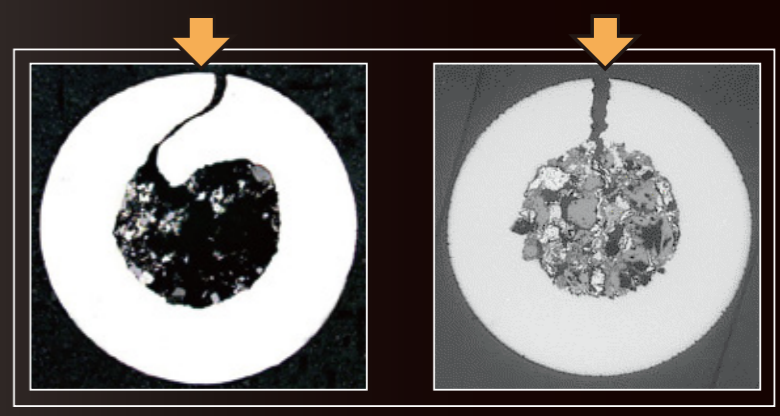
Difference between our SF wire and conventional fold type FC wire

① Copper plated surface

② No seam (opening) in outer layer



Our Seamless Flux Cored Wires
SF wire



Conventional fold type Flux Cored Wires
FC wire



Our Seamless Metal Cored Wires
SM wire

Superiority of our SF wire to conventional fold type FC wire

① Excellent Hygroscopic resistance

The largest advantage of our SF wires is that it is possible to make the hydrogen content of the wire itself extremely low. This can be achieved by (1) it is possible to decrease the amount of moisture (hydrogen source) by high temperature dehydrogenation treatment at the time of wire production and (2) even after the production of wire, moisture absorption from the atmosphere into the wire will not occur since the wire is of seamless structure with no gaps.

Therefore, it is not necessary to worry about the wormhole porosity or pit, such as those generated by moisture absorption As shown in the picture.

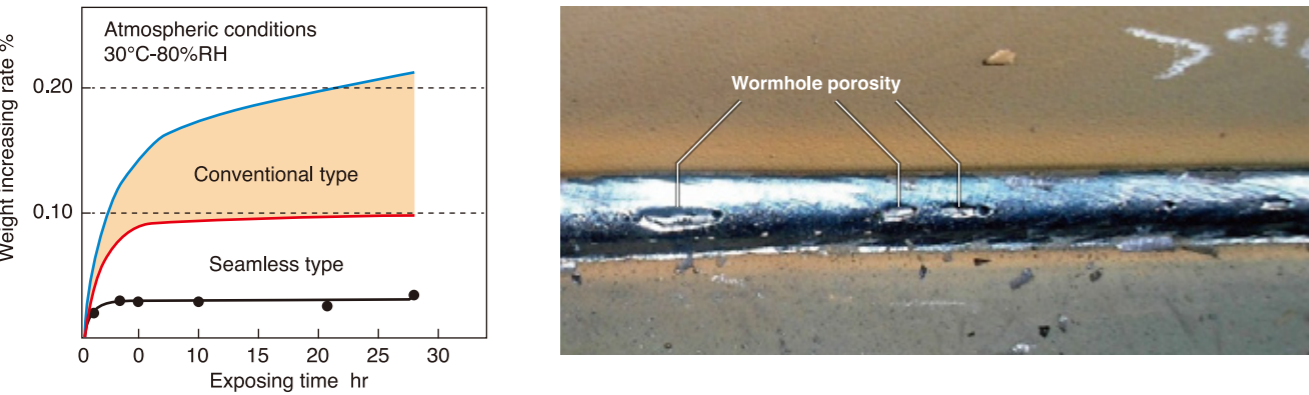


Fig. 1 shows the results of diffusible hydrogen test with various flux cored wires produced as a trial by changing total moisture amount in the wire, Fig.2 shows the relationship between the required preheating temperature determined by calculation and diffusible hydrogen in the wire. As shown,by application of SF wire is a low hydrogen. it will enable a significant reduction of the preheating operation.

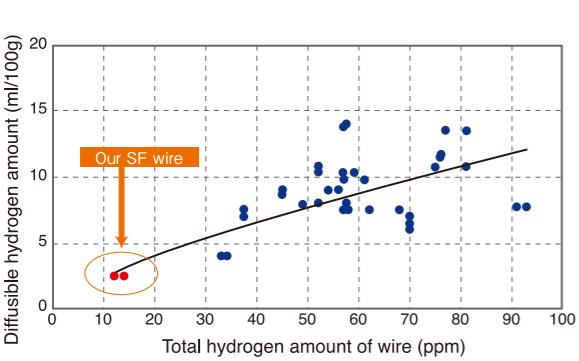


Fig. 1 Relation between total hydrogen amount and diffusible hydrogen amount of flux cored wire (JIS Z 3118 Hydrogen measuring method of steel welded parts)

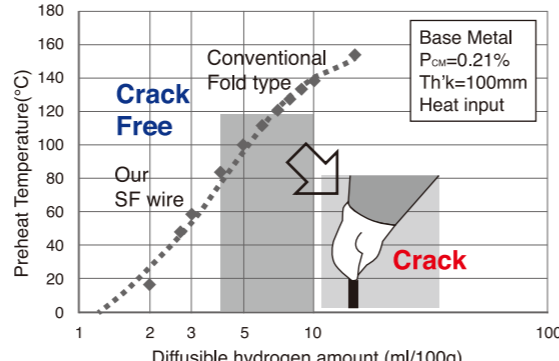


Fig. 2 Relationship between Diffusible hydrogen amount and Preheat temperature(calculated by Cen) ("N. Yurioka and T.Kasuya: "A chart method to determine necessary preheat in steel welding" Welding in the World, vol.35(1995),p327-334)

Customers can used by easy storage for a long time

② Targeting point is extremely stable

The results of targeting property test is shown in Fig. 3. Aiming point is extremely stable even if wire is fed from a fixed torch and slippage amount of targeting point at the tip of wire is measured. Because the cross sectional shape of our SF wire is symmetrical and twisting rigidity is high, the targeting property at the time of wire feeding (rectilinear stability) is excellent.

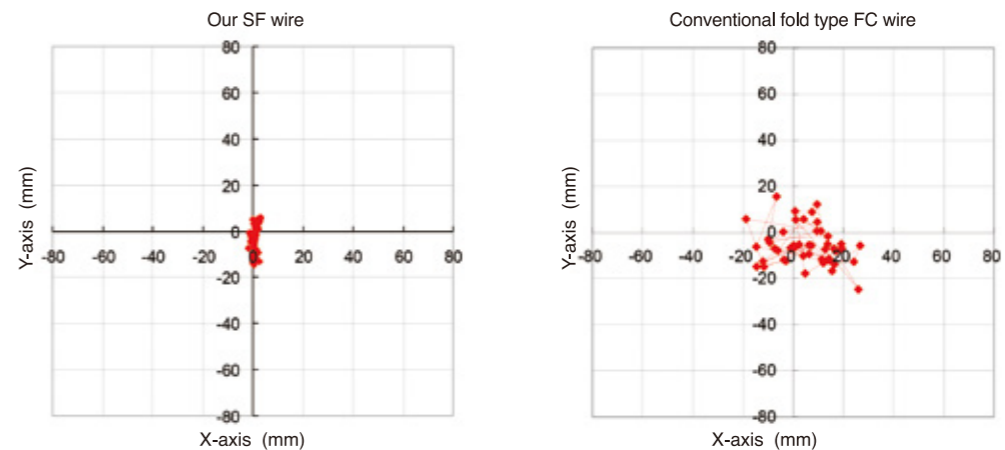
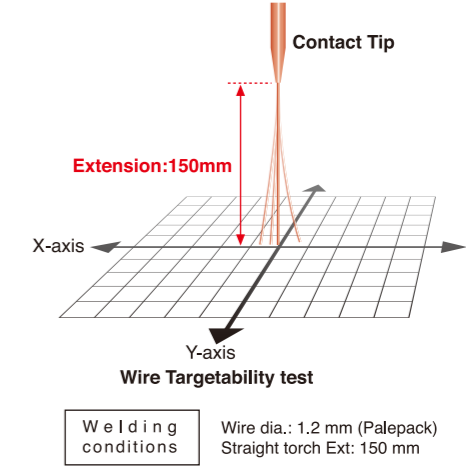
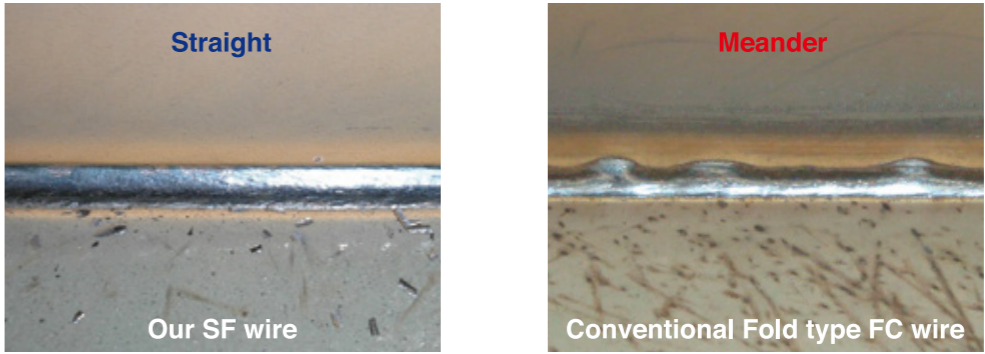


Fig. 3 Targeting property of wire

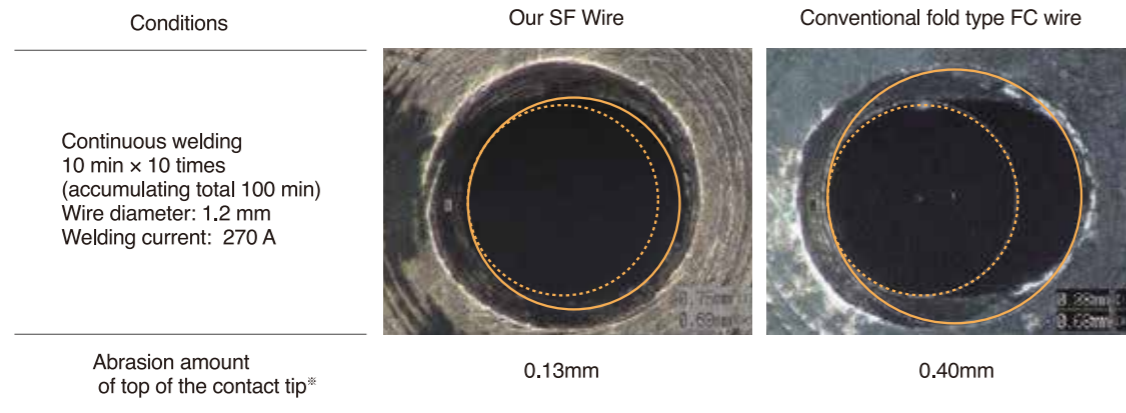
In all production sites of welded members such as high speed horizontal fillet welding in shipbuilding and bridge construction, multi-layer welding in construction and off-shore structures, and so on, wire feeding property and targeting performance (accuracy in aiming position of wire tip) have a direct connection with the quality of welded parts such as bead shape, existence of welding defects, etc.



Horizontal fillet welding bead

Best Choice for Automatic Welding

③ Excellent contact tip abrasion resistance



When our SF wire is used, the life of contact tip is about 3.5 times as long as the case where conventional fold type FC wire is used. (When our SF wire is used, abrasion of contact tip is about 1/3.5.)

The reason the long life of contact tip is long is as follows:

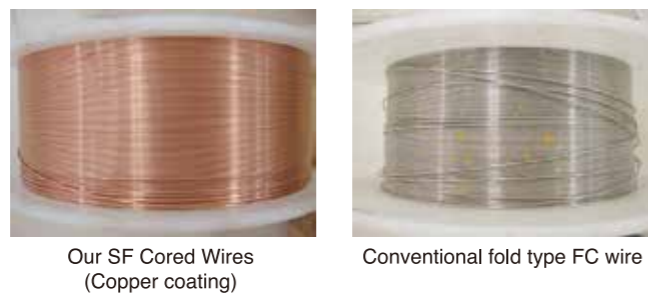
- a) The surface of our SF wire is plated with copper, and therefore, friction is small.
- b) Cross-sectional shape of our SF wire is point symmetry. Therefore, the wire is fed out straight.

Less contact tip abrasion & life of tip is longer

④ Excellent rust prevention

Rusting resistance of our SF wire is greater than the conventional fold type FC wires. Because the surface of our SF wire is copper coated. Therefore, storage control is easier even if at a coastal welding sites and after the unpacking of wire.

**Superiority of our SF wire to conventional fold type FC wire
Excellent rust prevention**



Our SF wire is coated by Copper to prevent rust

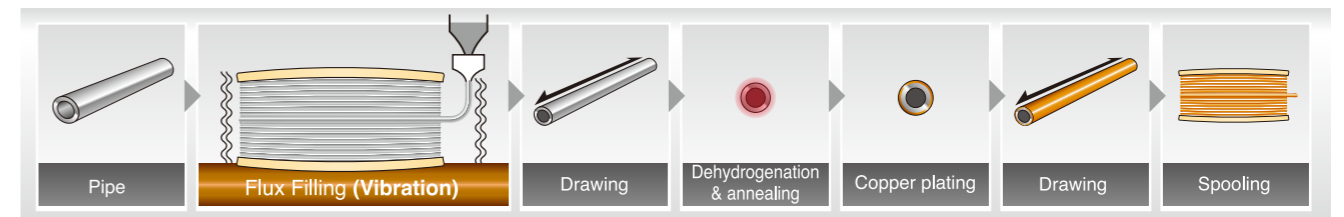
Production process

Difference between our SF wire and other Seamless FC wire

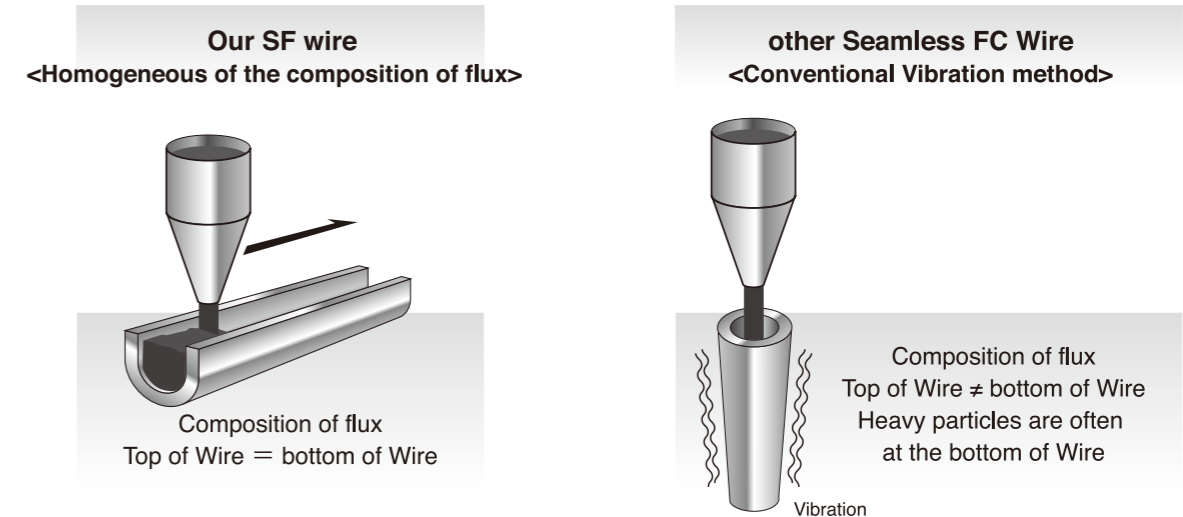
a) Our SF wire filled with flux homogeneously



b) Other Seamless FC wire filled with flux by vibration from top to bottom.



Superiority of our SF wire to other Seamless FC wire



Although we produced SF wire by this Conventional Vibration method 20years ago, after that we developed our filling method with flux, for stable quality of our SF wire.



The most remarkable features of SF wire when used with CO₂ or Mixed gas shielding are the following.

- Weldability in all positions are excellent
- Arc is stable, spatters are few and bead is smooth with good shape and appearance
- Easy slag removability
- Diffusible hydrogen content is as low as solid wire and crack resistance is excellent
- Adjusting once a certain proper welding current within a wide range of amperage and voltage for each size of wire shown in Figure 4, there is no need to re-adjust the current position by position in all-position welding.
- High deposition rates can save labor costs by reducing welding time - Figure 5.

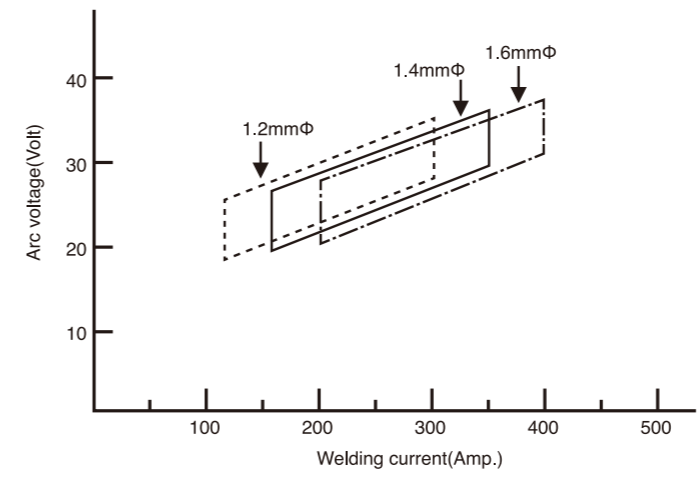
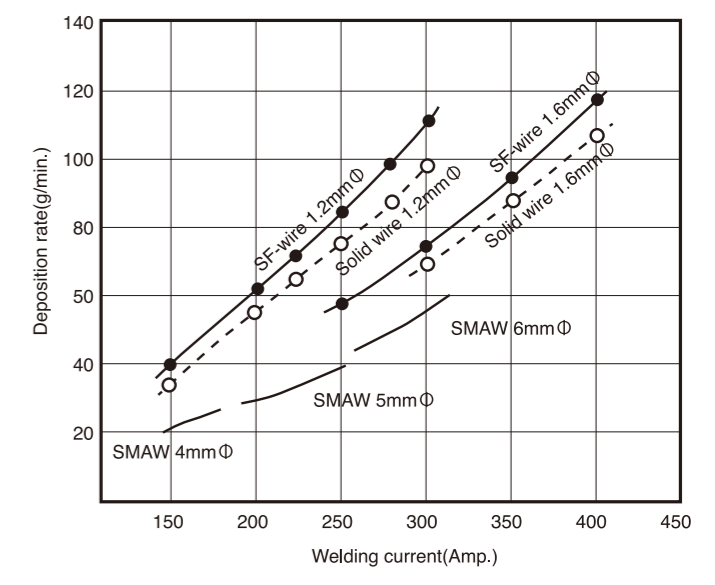
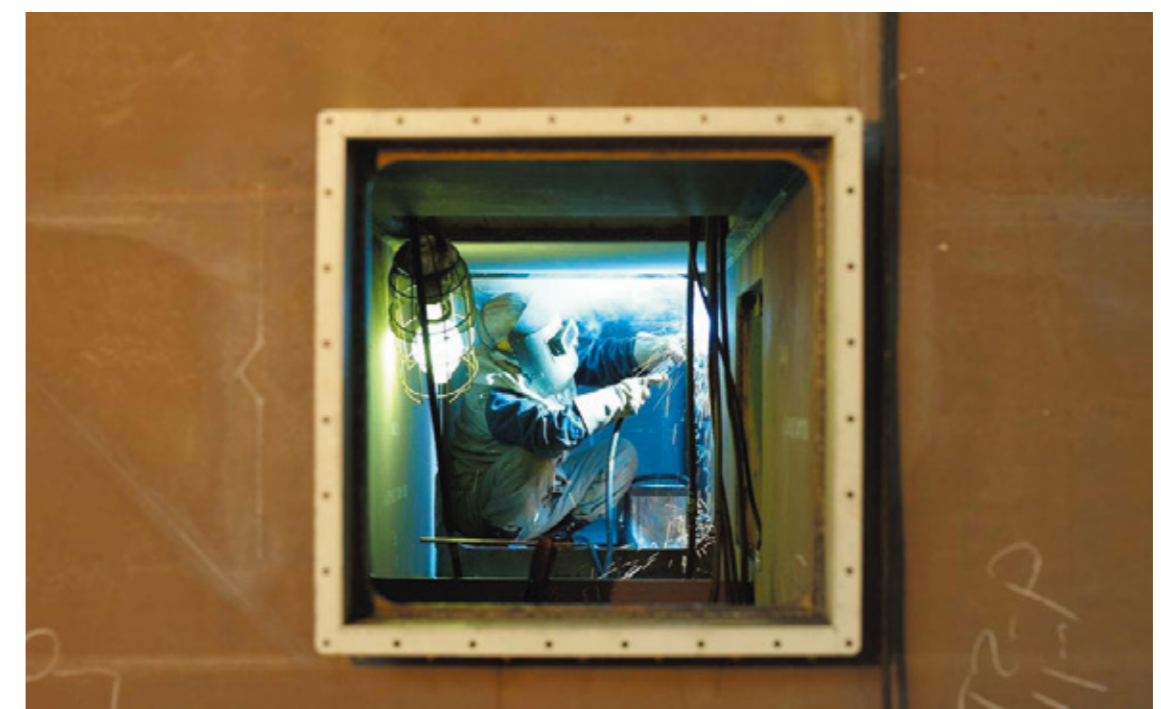


Fig. 4 Proper ranges of welding current and arc voltage for each size SF wire.



-wire extension: 25mm, shielding gas: CO₂.

Fig. 5 A comparison on deposition rates between SF wire, conventional solid wire and electrode



SF-SM wire series

Flux

Pipe (seamless)

SF-SM wire series complete the evolving from our SF-1 in 1981, the starting point of seamless flux cored wires, to high performance and high quality merchandise. We will keep on delivering highly functional products to comply with the requests of our customers from now on also.

Main Applicable steel materials	AWS Classification*		Shielding gas	Brand name	Wire diameter (mm)	Application	Chemical composition of deposited metal (% , Typical)										Mechanical properties of deposited metal (Typical)							
							C	Si	Mn	P	S	Ni	Mo	Cu	Cr	N	Yield strength(MPa)	Tensile strength(MPa)	Elongation(%)	Absorbed energy vEt, (J)				
Carbon steel	A5.20	A5.36	E71T1-C	E71T1-C1A0-CS1	CO ₂	SF-1	1.2 1.4 1.6	All Position	0.06	0.50	1.40	0.015	0.010	—	—	—	—	—	—	520	580	28	0°C, 91	
			E71T1-C	E71T1-C1A2-CS1	CO ₂	SF-1E	1.2 1.4	All Position, down to -20°C, -30°C	0.06	0.50	1.29	0.014	0.005	0.30	—	—	—	—	—	—	593	611	28	-20°C, 93
			E71T1-C	E71T1-C1A2-CS2	CO ₂	SF-3	1.2 1.4	All Position, down to -30°C	0.05	0.42	1.30	0.013	0.004	0.44	—	—	—	—	—	—	545	600	27	-30°C, 105
		E71T1-9C-J	E71T1-C1A4-CS1	CO ₂	SF-3M	1.2 1.4	All Position, down to -40°C	0.05	0.42	1.30	0.013	0.004	0.44	—	—	—	—	—	—	545	600	27	-40°C, 115	
		E71T1-1M	E71T1-M21A2-CS1	Ar+20%CO ₂	SF-1A	1.2 1.4 1.6	All Position, down to -20°C, -30°C	0.05	0.52	1.22	0.013	0.008	—	—	—	—	—	—	—	530	575	25	-20°C, 60	
		E71T1-9M-J	E71T1-M21A4-CS1	Ar+20%CO ₂	SF-3A	1.2 1.4 1.6	All Position, down to -40°C	0.05	0.46	1.48	0.014	0.005	0.33	—	—	—	—	—	—	597	616	25	-40°C, 87	
	E70T1-C	E70T1-C1A0-CS1	CO ₂	SM-1F	1.2 1.4 1.6	Exclusively used for Fillet welding, Primer resistant	0.05	0.53	1.50	0.016	0.011	—	—	—	—	—	—	—	510	585	27	0°C, 85		
	A5.18	A5.36	E70C-GC	E70T15-C1A0-CS1	CO ₂	SM-1	1.2 1.4 1.6 2.0	Metal type, High efficiency flat welding	0.05	0.72	1.28	0.015	0.006	—	—	—	—	—	—	460	560	30	0°C, 70	
			E70C-GM	E70T15-M21A2-CS1	Ar+20%CO ₂	SM-1A	1.2 1.4 1.6	Metal type, High efficiency flat welding	0.04	0.45	1.60	0.011	0.013	—	—	—	—	—	—	480	560	30	0°C, 110	
E70C-GM			E71T15-M21A4-CS1	Ar+20%CO ₂	SM-3A	1.2 1.4	Metal type, High efficiency, down to -40°C	0.05	0.66	1.69	0.008	0.013	—	—	—	—	—	—	500	570	29	-40°C, 72		
Low-Alloy steel	A5.29	A5.36	E81T1-GC	E81T1-C1A4-CS1	CO ₂	SF-3E	1.2 1.4	All Position, YS420 down to -40°C	0.05	0.42	1.30	0.013	0.004	0.44	—	—	—	—	—	545	600	27	-40°C, 115	
			E81T1-GC	E81T1-C1A8-K2-H4	CO ₂	SF-36E	1.2 1.4	All Position, YS400 down to -60°C	0.05	0.43	1.29	0.010	0.003	1.31	—	—	—	—	—	570	610	29	-60°C, 76	
			E81T1-Ni1C-J	E81T1-C1A8-Ni1-H4	CO ₂	SF-47E	1.2	All Position, YS460 down to -60°C	0.05	0.46	1.31	0.012	0.004	0.96	—	—	—	—	—	543	602	28	-60°C, 70	
			E91T1-Ni2C-J	E91T1-C1A8-Ni2-H4	CO ₂	SF-50E	1.2	All Position, YS500 down to -60°C	0.04	0.25	1.21	0.012	0.003	2.30	—	—	—	—	—	563	626	25	-60°C, 85	
			E71T1-GM	E71T1-M21A6-K6-H4 E71T1-M21P6-K6-H4	Ar+20%CO ₂	SF-3AMSR	1.2	All Position, YS420 down to -50°C in As-welded and PWHT condition	0.05	0.27	1.18	0.012	0.004	0.72	—	—	—	—	—	—	496 (AW) 478 (PWHT)	553 (AW) 557 (PWHT)	32 (AW) 32 (PWHT)	-40°C, 145 (AW) -40°C, 137 (PWHT)
			E81T1-GM	E81T1-M21A6-K6-H4 E81T1-M21P6-K6-H4	Ar+20%CO ₂	SF-36EA	1.2	All Position, YS400 down to -50°C in As-welded and PWHT condition	0.07	0.34	1.31	0.009	0.004	0.87	—	—	—	—	—	—	561 (AW) 552 (PWHT)	615(AW) 634 (PWHT)	26 (AW) 26 (PWHT)	-40°C, 140 (AW) -40°C, 92 (PWHT)
			E81T1-GM	E81T1-M21A8-Ni1-H4	Ar+20%CO ₂	SF-3AM	1.2 1.4 1.6	All Position, YS460 down to -60°C	0.05	0.33	1.28	0.010	0.003	0.89	—	—	—	—	—	552	612	27	-40°C, 130 -60°C, 79	
			E91T1-GM	E91T1-M21A4-K2-H4	Ar+20%CO ₂	SF-50A	1.2	All Position, YS500 down to -40°C	0.06	0.49	1.21	0.015	0.004	1.68	—	—	—	—	—	627	681	23	-40°C, 101	
			E101T1-GM	E101T1-M21A4-K2-H4	Ar+20%CO ₂	SF-70A	1.2	All Position, YS620 down to -40°C	0.06	0.44	1.75	0.012	0.004	1.88	—	—	—	—	—	730	765	22	-40°C, 88	
			E111T1-GM	E111T1-M21A4-G-H4	Ar+20%CO ₂	SF-80A	1.2	All Position, YS690 down to -40°C	0.06	0.38	1.60	0.010	0.004	2.37	0.34	—	—	—	—	755	803	24	-40°C, 86	
	E111T1-K3M-H4	E111T1-M21A2-K3-H4	Ar+20%CO ₂	SF-80AM	1.2	All Position, YS690 down to -20°C, -30°C	0.06	0.44	1.64	0.013	0.004	2.14	0.30	—	—	—	—	819	848	20	-20°C, 73			
	A5.28	A5.36	E80C-G	E80T15-M21A8-Ni1-H4	Ar+20%CO ₂	SM-47A	1.2 1.4	Metal type, YS460 down to -60°C	0.07	0.56	1.20	0.012	0.008	0.88	—	—	—	—	—	539	627	26	-60°C, 85	
			E110C-G	E110T15-M21A4-G-H4	Ar+20%CO ₂	SM-80A	1.2	Metal type, YS690 down to -40°C	0.05	0.37	1.38	0.013	0.005	2.51	0.42	—	0.48	—	761	821	22	-40°C, 91		
550-590MPa class steel	A5.29	A5.36	E81T1-GC	E81T1-C1A0-CS1	CO ₂	SF-55	1.2 1.4	All Position, TS 550MPa class	0.05	0.45	1.17	0.009	0.006	—	0.16	—	—	—	532	609	29	0°C, 101		
			E81T1-GC	E81T1-C1A2-K11	CO ₂	SF-60	1.2	All Position, TS 590MPa class	0.05	0.50	1.47	0.011	0.005	0.53	—	—	—	—	589	621	25	-5°C, 101		
			E80T1-GC	E80T1-C1A0-G	CO ₂	SM-60F	1.2 1.4 1.6	Exclusively used for Fillet welding, Primer resistant, TS 590MPa class	0.06	0.56	1.83	0.016	0.008	—	—	—	—	—	610	660	25	-5°C, 75		
			E81T1-GM	E81T1-M21A2-K11	Ar+20%CO ₂	SF-60A	1.2	All Position, TS 590MPa class	0.05	0.36	1.35	0.009	0.005	0.41	—	—	—	—	560	620	29	-5°C, 130		
Fire Resisting steel	—	A5.36	—	E81T1-C1A0-G	CO ₂	SF-50FR	1.2 1.4 1.6	All Position, TS 400-520MPa class	0.04	0.34	1.18	0.009	0.004	0.15	0.33	—	—	—	550 (RT) 280 (600°C)	610 (RT) 340 (600°C)	27 (RT) 32 (600°C)	0°C, 78		
			—	E80T15-C1A0-D1	CO ₂	SM-50FR	1.2 1.4 1.6	Metal type, High efficiency flat welding, TS 400-520MPa class	0.04	0.53	1.45	0.012	0.004	—	0.42	—	—	—	580 (RT) 330 (600°C)	640 (RT) 380 (600°C)	26 (RT) 31 (600°C)	0°C, 77		
Corrosion Resisting steel	—	A5.36	—	E71T1-C1A0-G	CO ₂	SF-50W	1.2 1.4	For Atmospheric Corrosion steel, TS 490MPa class	0.04	0.35	0.80	0.015	0.008	0.44	—	0.34	0.47	—	500	580	26	0°C, 100		
			—	E70T1-C1A0-G	CO ₂	SM-50FW	1.2 1.4 1.6	For Atmospheric Corrosion steel, TS 490MPa class, Fillet welding	0.05	0.32	1.10	0.014	0.005	0.50	—	0.45	0.48	—	510	590	27	0°C, 74		
			—	E81T1-C1A0-W2	CO ₂	SF-60W	1.2 1.4	For Atmospheric Corrosion steel, TS 590MPa class	0.05	0.50	1.18	0.012	0.005	0.61	—	0.42	0.51	—	630	685	22	-5°C, 113		
			—	E81T1-C1A0-G	CO ₂	SF-55RS	1.2	For Sea Water Corrosion resisting steel "MARILOY S.G"	0.04	0.34	1.07	0.017	0.007	—	0.09	0.33	0.86	—	580	640	26	0°C, 54		
			—	E81T1-C1AZ-G	CO ₂	SF-1ST	1.2	For Sulfuric Acid and Hydrochloric Acid Dew-point Corrosion-resistant steel "S-TEN 1"	0.05	0.60	1.41	0.012	0.013	—	—	0.39	(Sb:0.1)	—	580	640	27	0°C, 47		
Stainless steel Duplex steel	—	A5.22	—	E308LT0-1	CO ₂ , Ar+20%CO ₂	SF-308L	0.8 0.9 1.2 1.6	SUS 304L, 304	0.03	0.76	1.39	0.026	0.006	11.0	—	—	20.0	—	—	528	581	44	—	
			—	E309LT0-1	CO ₂ , Ar+20%CO ₂	SF-309L	0.8 0.9 1.2 1.6	Dissimilar joints such as stainless steel and mild steel etc.	0.03	0.85	1.49	0.025	0.007	12.2	—	—	23.2	—	—	551	581	42	—	
			—	E309LMoT0-1	CO ₂ , Ar+20%CO ₂	SF-309MoL	0.9 1.2 1.6	Dissimilar joints such as Mo containing steel and mild steel etc.	0.03	0.67	1.03	0.025	0.006	13.2	2.53	—	23.9	—	—	726	581	27	—	
			—	E316LT0-1	CO ₂ , Ar+20%CO ₂	SF-316L	0.8 0.9 1.2 1.6	SUS 316L, 316	0.03	0.70	1.19	0.027	0.007	12.1	2.45	—	18.3	—	—	551	581	43	—	
			—	E308LT1-1	CO ₂ , Ar+20%CO ₂	SF-308LP	1.2	SUS 304L, 304, All Position	0.03	0.45	1.05	0.030	0.006	10.1	—	—	19.7	—	—	581	581	49	—	
			—	E308LT1-1	CO ₂ , Ar+20%CO ₂	SF-308LK	1.2	SUS 304L, 304, All Position, High strength and high toughness specification	0.03	0.38	1.23	0.017	0.004	9.1	—	—	19.9	—	—	646	581	35	-196°C, 41	
			—	E309LT1-1	CO ₂ , Ar+20%CO ₂	SF-309LP	1.2	Dissimilar joints such as stainless steel and mild steel etc., All Position	0.03	0.57	1.53	0.024	0.005	12.3	—	—	24.2	—	—	570	581	38	—	
			—	E316LT1-1	CO ₂ , Ar+20%CO ₂	SF-316LP	1.2	SUS 316L, 316, All Position	0.03	0.54	1.39	0.031	0.002	12.2	2.90	—	18.3	—	—	577	581	36	—	
			—	—	CO ₂	SF-2120	1.2	S82122, S32101 Lean Duplex Stainless steel	0.04	0.61	1.02	0.022	0.007	10.1	0.93	—	26.7	0.10	—	793	581	26	—	
			—	E2209T0-1	CO ₂	SF-DP8	1.2	SUS329J3L, S31803 Duplex Stainless steel	0.03	0.63	1.01	0.020	0.004	10.5	2.82	0.42	25.7	0.17	—	860	581	27	—	
			—	—	CO ₂ , Ar+20%CO ₂	SF-DP3	1.2	SUS 329J4L Duplex Stainless steel	0.03	0.63	1.01	0.020	0.004	10.5	2.82	0.42	25.7	0.17	—	860	581	27	—	
—	E2594T0-1	CO ₂	SF-DP3W	1.2	S32750 Super Duplex Stainless steel	0.03	0.60	1.12	0.021	0.006	9.5	3.67	0.41	26.0	0.22	—	916	581	24	—				
—	E309LT0-3	None	SF-N309L	1.2	Self shield metal arc welding of flux cored wire Dissimilar joints such as stainless steel and mild steel etc.	0.03	0.65	1.50	0.005	0.007	12.6	0.10	0.13	24.3	—	—	661	581	32	-20°C, 37				

* AWS A5.20 and A5.29 were replaced into AWS A5.36 on the end of 2015.