

Welding Consumables for Offshore Structures



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 Research Institute
In NIPPON STEEL CORPORATION R&D Center,
20-1 Shintomi, Futtsu-City, Chiba, 293-8511 JAPAN
Tel. +81-439-80-2621 Fax. +81-439-80-2748

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 & Optics Engineering Unit
Plasma Welding Machinery: Tel. +81-47-479-4138 Fax. +81-47-479-2968
Optical Fiber: Tel. +81-47-479-1179 Fax. +81-47-479-4371

Shanghai Rep. Office

Room 403-39, 4th floor, KIRIN PLAZA, Lane 666, Gubei Road,
Changning District, Shanghai, 200336, P.R.CHINA
Tel. +86-21-6230-8925

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

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Quick guide

Applicable welding consumables to YS, TS and CVN requirement

FCAW-G (100%CO₂)

Yield Strength (MPa) ^{Note 1}		305	375	400	420	460	500
Tensile Strength (MPa)		400/560	490/660	510/690	530/680	570/720	610/770
vE (J)		47	47	47	47	47	50
CVN temp. (°C)	0	SF-1			SF-3E		SF-50E
	-20	SF-1E* ¹ , SF-3* ²		SF-3Y			
	-40	SF-3M					
	-60	SF-36E			SF-47E		

*1: Excellent weldability in vertical-up welding, *2: CVN@-30℃

FCAW-G, GMAW (Ar+20%CO₂)

Yield Strength (MPa)		305	375	400	420	460	500	550	620	690
Tensile Strength (MPa)		400/560	490/660	510/690	530/680	570/720	610/770	670/830	720/890	770/940
vE (J)		47	47	47	47	47	50	55	62	69
CVN temp. (°C)	0	SF-1A		SF-3A		SF-50A		SF-65A	SF-80A SM-80A (Metal cored) YM-80A (Solid wire) (Ar+20%CO ₂)	
	-20			SF-3AMSR						
	-40	SM-3A (Metal cored)		<SR>						
	-60	SF-36EA <SR>			SF-3AM		—			

<SR> : Can be applied PWHT

SAW (Multi-run)

Yield Strength (MPa)		305	375	400	420	460	500	550	620	690
Tensile Strength (MPa)		400/560	490/660	510/690	530/680	570/720	610/770	670/830	720/890	770/940
vE (J)		47	47	47	47	47	50	55	62	69
CVN temp. (°C)	0	NF-1/Y-D (AC)* ¹ NB-55E/Y-D (AC)* ²		NB-55E /Y-DM3 (AC)	NB-55L/Y-D (AC) NB-55/Y-CMS	NB-250H/ Y-204B	NB-55/ Y-DMS (AC)	NB-250H/Y-80M (AC)		
	-20									
	-40	NB-55L/Y-D (AC) NB-55/Y-DS								
	-60									

*1: Excellent slag removability in narrow gap welding, *2: Excellent toughness on high heat input welding up to 10kJ/mm
(AC) : To be used AC current polarity only

SMAW

Yield Strength (MPa)		305	375	400	420	460	500	550	620	690
Tensile Strength (MPa)		400/560	490/660	510/690	530/680	570/720	610/770	670/830	720/890	770/940
vE (J)		47	47	47	47	47	50	55	62	69
CVN temp. (°C)	0	S-16	L-55		L-60		L-74S		L-80SN	
	-20									
	-40	L-55SN		L-57SN (8016 type) L-F80 (8018 type)		L-60LT				
	-60									

SMAW for URANAMI Welding

Yield Strength (MPa)		305	375	420	620	690		
Tensile Strength (MPa)		400/560	490/660	530/680	720/890	770/940		
vE (J)		47	47	47	62	69		
CVN temp. (°C)	0	NITTETSU-56		NITTETSU L-60W	L-80SN			
	-20							
	-40							
	-60	—		—				

Quick guide

Applicable welding consumables to CTOD requirement

FCAW-G (100%CO₂)

Yield Strength (MPa)		305	375	400	420	460	500
Tensile Strength (MPa)		400/560	490/660	510/690	530/680	570/720	610/770
CTOD temp. (°C)	-10	SF-3M			SF-3E	SF-47E	SF-50E
	-20	SF-36E					
	-30						
	-40						

FCAW-G (Ar+20%CO₂)

Yield Strength (MPa)		305	375	400	420	460	500	550	620
Tensile Strength (MPa)		400/560	490/660	510/690	530/680	570/720	610/770	670/830	720/890
CTOD temp. (°C)	-10	SF-36EA <SR>		SF-3A, SF-3AMSR <SR>		SF-50A		SF-70A	
	-20	SF-3AM					—		
	-30								
	-40								

SAW (Multi-run)

Yield Strength (MPa)		305	375	400	420	460	500	550
Tensile Strength (MPa)		400/560	490/660	510/690	530/680	570/720	610/770	670/830
CTOD temp. (°C)	-10	NB-55L/Y-D (AC)			NB-55/Y-CMS		NB-250H/ Y-204B	NB-55/ Y-DMS(AC)
	-20							
	-30	NB-55/Y-DS					—	
	-40							

(AC) : To be used AC current polarity only

SMAW

Yield Strength (MPa)		305	375	400	420
Tensile Strength (MPa)		400/560	490/660	510/690	530/680
CTOD temp. (°C)	-10	L-55SN			L-57SN
	-20				
	-30				
	-40				

Trade name and category of Product

Welding process	Trade name	Category of Product
FCAW-G	SF-	Seamless Flux cored wire
	SM-	Seamless Metal cored wire
GMAW	YM-	Solid wire
SAW	NB-	Agglomerated Flux
	NF-	Fused Flux
	Y-	Solid wire
SMAW	L-	Low hydrogen type Stick electrode

Note 1: Yield Strength (0.2% proof stress) is to be determind by the 0.2% offset method in a tensile test.
It should be applied Yield Point, when yield marked in the tensile test.

Overview of welding performance

Welding process ^{Note 1}	Shielding gas	Polarity	Brand name	AWS Classification	Typical Heat Input ^{Note 2} (kJ/cm)	Applicable Yield Strength grade(MPa)		Applicable Temp. (°C)		Chemical compositions of deposited/weld metal (wt%) <Typical>					
								CVN≥47J, δ ≥0.25mm		C	Si	Mn	Ni	Cr	Mo
								CVN	CTOD (δ)						
FCAW-G	100% CO ₂	DCEP	SF-1	A5.20 E71T-1C-H4	F, H: 7-20 V-up, OH: 10-25	375		0	—	0.06	0.50	1.40	—	—	—
			SF-1E	A5.20 E71T-1C		375		-20	—	0.06	0.50	1.29	0.30	—	—
			SF-3	A5.20 E71T-12C-H4		375		-30	—	0.04	0.37	1.22	0.35	—	—
			SF-3M	A5.20 E71T-9C-JH4		400		-40	-10	0.04	0.41	1.27	0.36	—	—
			SF-3E	A5.29 E81T1-GC-H4		420		-40	-10	0.05	0.44	1.33	0.39	—	—
			SF-36E	A5.29 E81T1-K2C-H4		400		-60	-20	0.06	0.40	1.60	1.40	—	—
			SF-47E	A5.29 E81T1-Ni1C-JH4		460		-60	-30	0.05	0.49	1.42	1.03	—	—
			SF-50E	A5.29 E91T1-Ni2C-JH4		500		-60	-40	0.05	0.33	1.41	2.42	—	—
	80%Ar+ 20%CO ₂	DCEP	SF-1A	A5.20 E71T-1M-H4	F, H: 7-20 V-up, OH: 10-25	375		-20	—	0.05	0.52	1.22	—	—	—
			SF-3A	A5.20 E71T-9M-JH4		420		-40	-10	0.06	0.48	1.54	0.35	—	—
			SM-3A	A5.18 E70C-GM H4		375		-40	—	0.05	0.66	1.69	—	—	—
			SF-3AMSR	A5.29 E71T1-GM-H4		420		-40	-10 (SR: 620°C, 4hr)	0.05	0.30	1.20	0.96	—	—
			SF-3AM	A5.29 E81T1-Ni1M-H4		460		-60	-40	0.06	0.33	1.26	1.00	—	—
			SF-36EA	A5.29 E81T1-Ni1M-H4		400		-60	-10	0.05	0.33	1.17	0.85	—	—
			SF-50A	A5.29 E91T1-K2M-H4		500		-40	-10	0.05	0.44	1.15	1.72	—	—
			SF-65A	A5.29 E91T1-K2M-H4		550		-40	—	0.06	0.48	1.18	1.78	—	—
			SF-70A	A5.29 E101T1-GM-H4		620		-51	-20	0.07	0.40	1.68	1.65	—	—
			SF-80A	A5.29 E111T1-GM-H4		690		-40	—	0.06	0.38	1.60	2.37	—	0.34
			SM-80A	A5.28 E110C-G-H4		690		-40	—	0.05	0.37	1.38	2.51	0.48	0.42
			GMAW	100% CO ₂		DCEP		YM-55H	A5.28 ER80S-G	F,H: 10-25 V-up: 10-40	400	-40	—	0.08	0.44
YM-60C	A5.28 ER80S-G	500		-20	—		0.07	0.38	1.38				0.35		
YM-60A	A5.28 ER80S-G	500		-40	—		0.06	0.35	1.45				0.38		
YM-80A	A5.28 ER110S-G	690		-40	—		0.07	0.27	1.37		2.88	0.50	0.30		
90%Ar+ 10%CO ₂	YM-69F	A5.28 ER110S-G		10-30	690		-60	—	0.06	0.28	1.30	2.81	0.51	0.31	
SAW	—	AC	NF-1/Y-D	A5.17 F7A4-EH14 F7P2-EH14	15-45	375		-20	—	0.08	0.27	1.30	—	—	—
			NB-55E/Y-D	A5.17 F7A8-EH14	15-45	375		-20	—	0.09	0.18	1.65	—	—	—
			NB-55E/Y-DM3	A5.23 F8A4-EG-G	15-100	400		-40	—	0.10	0.24	1.63	—	—	0.09
			NB-55L/Y-D	A5.23 F7A8-EG-G F7P8-EG-G	15-45	400		-60	-20	0.09	0.22	1.50	—	—	—
			NB-55/Y-DMS	A5.23 F9A8-EA3-G F9P8-EA3-G		550		-60	-20	0.09	0.15	1.57	—	—	0.34
			NB-250H/Y-80M	A5.23 F11A10-EG-M3	15-45	690		-60	—	0.07	0.19	1.41	2.18	0.56	0.52
	—	AC DCEP	NB-55/Y-DS	A5.17 F7A8-EH14 F7P8-EH14	15-45	400		-60	-40	0.08	0.20	1.74	—	—	—
			NB-55/Y-CMS	A5.23 F8A8-EA4-A4 F8P8-EA4-A4	15-45	460		-60	-40	0.09	0.21	1.46	—	—	0.35
			NB-250H/Y-204B	A5.23 F9A8-EG-G F9P8-EG-G	<Two-run> 15-100	500		-60	-10	0.10	0.20	1.71	0.74	—	0.29
			NB-250J/Y-80J	A5.23 F11A10-EG-G	15-45	690		-40	—	0.09	0.22	1.38	2.08	0.57	0.50
SMAW	—	AC DCEP	S-16	A5.1 E7016	10-40	375		-30	—	0.07	0.58	1.10	—	—	—
			NITTETSU-56	A5.1 E7016		375		-40	—	0.06	0.58	1.26	—	—	—
			L-55	A5.1 E7016		375		-30	—	0.07	0.62	1.18	—	—	—
			L-55SN	A5.5 E7016-G		400		-60	-45	0.08	0.37	1.41	0.54	—	—
			NITTETSU L-60W	A5.5 E8016-G		420		-40	—	0.06	0.60	1.22	—	—	—
			L-57SN	A5.5 E8016-G		460		-60	-45	0.06	0.46	1.48	0.54	—	—
			L-F80	A5.5E8018-G		460		-60	—	0.05	0.45	1.51	0.51	—	—
			L-60	A5.5 E8016-G		460		-40	—	0.07	0.51	1.05	0.64	—	0.81
			L-60LT	A5.5 E9016-G		500		-60	—	0.07	0.41	1.51	0.67	—	0.18
			L-74S	A5.5 E10016-G		550		-40	—	0.05	0.37	1.00	3.27	0.33	0.35
			L-80SN	A5.5 E11016-G		690		-60	—	0.05	0.39	1.42	4.56	—	0.52

Note 1: Welding processes are shown in Table 1
Note 2: Heat input should be considered with welding position applied.
Welding positions are shown in Table 2.

Table 1 Welding process

FCAW-G	Flux cored arc welding - Gas Shielded
GMAW	Gas metal arc welding
SAW	Submerged arc welding
SMAW	Shielded metal arc welding

Table 2 Welding position

F	Flat
H	Horizontal
V-up	Vertical-upward
OH	Over head

Approvals (ABS, DNV, LR)

FCAW-G (100%CO₂)

[illegible]

FCAW-G (Ar+20%CO₂)

Brand Name	Approved grade		Polarity	Available size Wire dia. (mm)			Approved grade																<Top/Middle/Bottom indicates Yield Strength (MPa)/Tensile Strength (MPa)/vE (°C)>																								Remark
							305				375				400								420				460				500				550				620				690				
							400/560				490/660				510/690								530/680				570/720				610/770				670/830				720/890				770/940				
1.2	1.4	1.6	0	-20	-40	-60	0	-20	-40	-60	0	-20	-40	-60	0	-20	-40	-60		0	-20	-40	-60	0	-20	-40	-60	0	-20	-40	-60	0	-20	-40	-60	0	-20	-40	-60								
SF-1A	ABS	3Y400SA H5, 2YSA H5	DCEP	X	X		X				X																																				
	DNV	III Y40MS H5	DCEP	X	X	X					X	X			X	X																															
	LR	3YS	DCEP	X	X	X	X	X			X	X																																			
SF-3A	ABS	3YSA H5	DCEP	X	X	X	X	X			X	X																																			
	DNV	IV Y42MS H5	DCEP	X	X	X														X	X	X																									
	LR	4Y40S H5	DCEP	X	X	X					X	X	X		X	X	X																														
SM-3A	ABS	4Y400SA H5	DCEP	X	X						X	X	X		X	X	X																														
	DNV	IV Y40MS H5	DCEP	X	X						X	X	X		X	X	X																														
	LR	4YS H5	DCEP	X	X		X	X	X		X	X	X																																		
SF-36EA	ABS	—																																													
	DNV	V YMS H5 (NV4-4L)	DCEP	X			X	X	X	X	X	X	X	X																																	
	LR	5Y40S H5	DCEP	X							X	X	X	X	X	X	X	X																													
SF-3AMSR	ABS	—																																													
	DNV	IV Y42MS H5	DCEP	X																X	X	X																									
	LR	4Y42S, 4Y42srS H5	DCEP	X																X	X	X																									
SF-3AM	ABS	5YQ460SA H5	DCEP	X	X	X														X	X	X	X	X	X	X	X																				
	DNV	V Y46MS H5 (NV4-4L)	DCEP	X	X	X														X	X	X	X	X	X	X																					
	LR	5Y46S H5	DCEP	X	X	X									X	X	X	X																													
SF-50A	ABS	4YQ500SA		X																X	X	X					X	X	X																		
	DNV	IV Y50MS H5	DCEP	X																X	X	X				X	X	X																			
	LR	4Y50S H5	DCEP	X																X	X	X				X	X	X																			
SF-65A	ABS	—																																													
	DNV	IV Y55YS	DCEP	X																						X	X	X		X	X	X															
	LR	—																																													
SF-80A	ABS	4Y690SA	DCEP	X																																											
	DNV	IV Y69MS	DCEP	X																																											
	LR	4Y69S	DCEP	X																																											
SM-80A	ABS	4YQ690SA H5	DCEP	X																																											
	DNV	IV Y69MS H5	DCEP	X																																											
	LR	—																																													

Approvals (ABS, DNV, LR)

SAW

[illegible]

SMAW

[illegible]

NITTETSU is a registered trademark or trademark of NIPPON STEEL CORPORATION, and our company is licensed.

GMAW

[illegible]

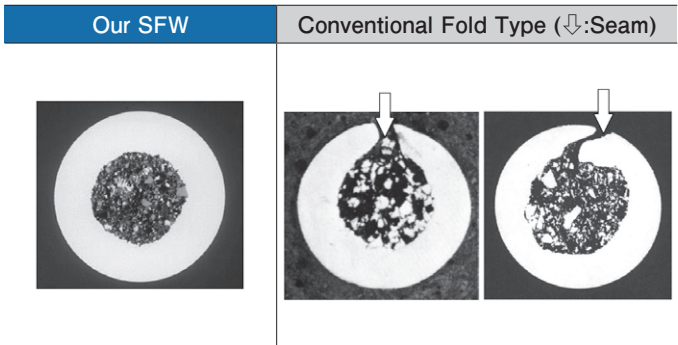
Superiority of "Seamless Flux Cored Wire" (SFW)

Difference between our SFW and conventional fold type

1. Copper plated surface

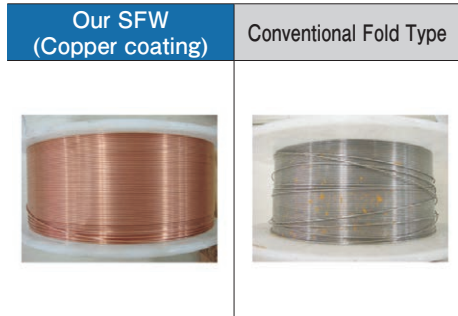


2. No seam in outer layer

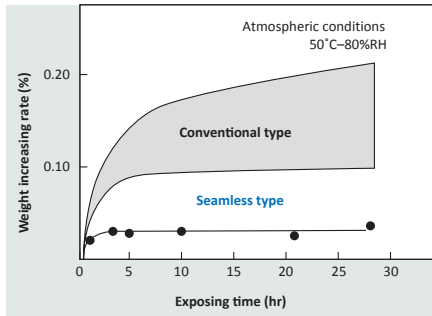


Superiority of our SFW to conventional fold type

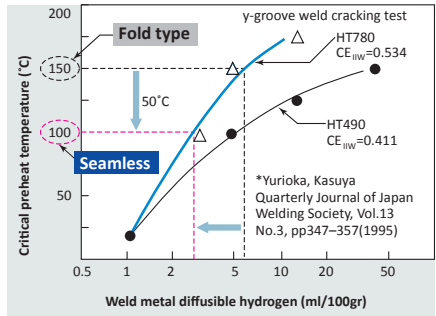
1. Excellent rust prevention



2. Excellent hygroscopic resistance



3. Can decrease preheat temp.



- Customers can store for extended periods of time.
- Can decrease preheat temp.
- There is no need for rework of weld defects like the wormhole porosity or pit.

4. Excellent tip abrasion resistance

Conditions	Our SFW	Conventional Type
Continuous welding 10min × 10times (Accumulating Total 100min) Wire Dia. : 1.2mm Welding Current : 270A		
Abrasion Amount of Top of The Tip*	0.13mm	0.45mm

* : (Circumscribed circle of tip hole after welding)
— (Diameter of the tip hole before welding)

When our SFW is used, the life of the tip is about 3.5 times as long as instances where the conventional fold type is used. (When our SFW is used, the abrasion of the tip is about 1/3.5.)

Reasons the life of the tip is so long are as follows :

- The surface of our SFW is plated with copper and, there fore, friction is small.
- The cross-sectional shape of our SFW is one of point symmetry. Therefore, the wire is fed out straight.

- Can reduce usage of tip

Seamless FCW for -40℃ CVN <YS400-YS420>

For YS400 steel

Process	Brand Name	Specification	Approval
FCAW-G (100%CO ₂)	SF-3M	AWS A5.20 E71T-9C-JH4 ISO 17632-A-T46 4 ZMnNi P C1 2 H5	ABS 4Y400SA H5 DNV IV Y40MS H5 LR 4Y40S H5

For YS420 steel

Process	Brand Name	Specification	Approval
FCAW-G (100%CO ₂)	SF-3E	AWS A5.20 E81T1-GC-H4 ISO 17632-A-T46 4 ZMn P C1 2 H5	ABS 4YQ420SA H5 DNV IV Y42MS H5 LR 4Y42S H5 BV 4Y42HHH, SA4Y42

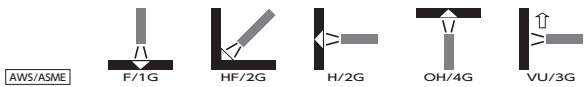
CHARACTERISTICS

- SF-3M and SF-3E are a rutile type seamless flux cored arc welding wires to be used with CO₂ shield gas and designed for shipbuilding and offshore structure welding.
- Weld metal shows excellent toughness in low temperature range down to -40℃.
- Weldability in all position is excellent.



Photo.1 Example of vertical-up fillet welding, SF-3E (200A-13cpm, without weaving)

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

Brand Name	C	Si	Mn	P	S	Ni
SF-3M	0.04	0.41	1.27	0.013	0.003	0.36
SF-3E	0.05	0.42	1.30	0.013	0.004	0.44

MECHANICAL PROPERTIES

Deposited metal, Typical

Brand Name	PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-40℃ Ave. (J)
SF-3M	As welded	515	585	30	112
SF-3E	As welded	545	602	27	115

MECHANICAL PROPERTIES

Butt joint, SF-3M (1.2mm) Typical

Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM) vE-40℃ (J)	CTOD test (WM)		
			Yield Strength (MPa)	Tensile Strength (MPa)		Temp. (℃)	δ (mm)	Fracture mode
KE36 ¹⁾ (T=50mm)	Vertical-up	21.3	591	654	117, 123, 106 Ave. 115	-10	0.73 0.77 0.82	m m m

Note 1) : Manufactured by NIPPON STEEL

For YS420 steel

Process	Brand Name	Specification	Approval
FCAW-G (Ar+20%CO ₂)	SF-3A	AWS A5.20 E71T-9M-JH4 ISO 17632-A-T46 4 ZMnNi P M21 1 H5	ABS 3YSA H5 DNV IV Y42MS H5 LR 4Y40S H5 BV SA4Y42 H5

CHARACTERISTICS

- SF-3A is a rutile type seamless flux cored arc welding wire to be used with Ar+CO₂ shield gas and designed for welding shipbuilding grade E steel.
- Weld metal shows excellent toughness in low temperature down to -40℃.
- Crack resistance and weldability in all position is excellent.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	P	S	Ni
0.05	0.47	1.50	0.013	0.004	0.31

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-40℃ Ave. (J)
As welded	574	639	28	84

MECHANICAL PROPERTIES

Butt joint, Typical

Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)	CTOD test (WM)		
			Yield Strength (MPa)	Tensile Strength (MPa)	vE-40℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
KE36 ¹⁾ (T=50mm)	Vertical-up	30.0	572	645	69, 71, 74 Ave. 71	-10	0.77 0.62 0.69	m m m

Note 1) : Manufactured by NIPPON STEEL

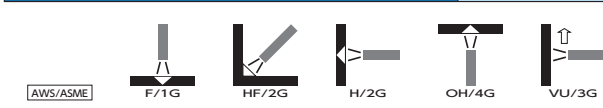
For YS420 steel, PWHT

Process	Brand Name	Specification	Approval
FCAW-G (Ar+20%CO ₂)	SF-3AMSR	AWS A5.29 E71T1-GM-H4 ISO 17632-A-T42 4 ZMnNi P M21 2 H5	DNV IV Y42MS H5 also for PWHT LR 4Y42S, 4Y42srS H5

CHARACTERISTICS

- SF-3AMSR is new type of seamless cored welding wire for low temperature service steel under SR, in using with mixed Ar-CO₂ shielding gas.
- Weld metal shows excellent toughness in low temperature range down to -40℃.
- Crack resistance and weldability in all position is excellent.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	P	S	Ni
0.04	0.28	1.24	0.009	0.004	0.80

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-40℃ Ave. (J)
As welded	505	559	27	137
585℃ × 2.5hr	476	555	28	123

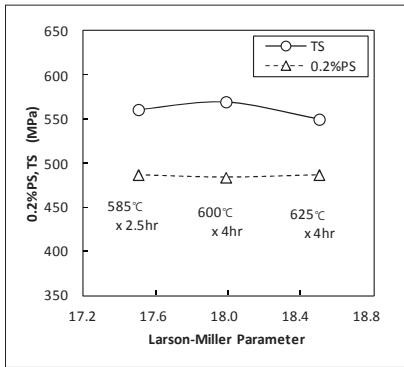


Fig. Tensile properties of deposited metal (PWHT)

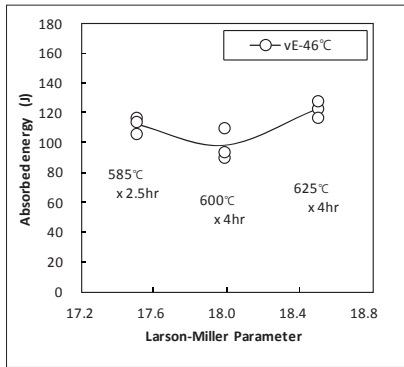


Fig. Charpy impact properties of deposited metal (PWHT, vE-46℃)

MECHANICAL PROPERTIES

Butt joint, Typical

Steel	Welding position	Heat Input kJ/cm	PWHT	Tensile test (WM)		Charpy impact test (WM)	CTOD test (WM)		
				Yield Strength (MPa)	Tensile Strength (MPa)	vE-40℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
EH40 ¹⁾ (T=50mm)	Vertical-up	19.3	As welded	515	587	120, 109, 101 Ave. 110	-10	0.37 0.43	m m
			620℃ x 4hr	489	579	82, 92, 79 Ave. 84	-10	0.55 0.54	m m

Note 1) : Manufactured by NIPPON STEEL

For YS500 steel

Process	Brand Name	Specification	Approval
FCAW-G (Ar+20%CO ₂)	SF-50A	AWS A5.29 E91T1-K2M-H4 ISO 17632-A-T50 4 ZMn1.5Ni P M21 2 H5	ABS 4YQ500SA DNV IV Y50MS H5 LR 4Y50S H5

CHARACTERISTICS

- SF-50A is a rutile type seamless flux cored arc welding wire to be used with Ar+20%CO₂ shield gas and designed for offshore structure welding.
- Weld metal shows excellent toughness in low temperature range down to -40℃.
- Crack resistance and weldability in all position is excellent.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	P	S	Ni
0.05	0.50	1.20	0.015	0.005	1.71

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-40℃ Ave. (J)
As welded	604	661	24	112

MECHANICAL PROPERTIES

Butt joint, Typical

Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)	CTOD test (WM)		
			Yield Strength (MPa)	Tensile Strength (MPa)	vE-40℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
YS500 ¹⁾ (T=63.5mm)	Vertical-up	19.9	630	686	117, 112, 107 Ave. 112	-10	0.31 0.28 0.37	m m m
	Horizontal	12.3	617	672	90, 94, 104 Ave. 96	-10	0.38 0.43 0.42	m m m

Note 1) : Manufactured by NIPPON STEEL

For YS620 steel

Process	Brand Name	Specification	Approval
FCAW-G (Ar+20%CO ₂)	SF-65A	AWS A5.29 E91T1-K2M-H4 ISO 18276-A-T55 4 ZMn1.5Ni P M21 2 H5	DNV IV Y55 MS PRS 4Y55S

CHARACTERISTICS

- SF-65A is a rutile type seamless flux cored arc welding wire to be used with Ar+20%CO₂ shield gas and designed for offshore structure welding.
- Weld metal shows excellent toughness in low temperature range down to -40℃.
- Crack resistance and weldability in all position is excellent.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	P	S	Ni
0.06	0.48	1.18	0.011	0.005	1.78

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-40℃ Ave. (J)
As welded	605	671	23	89

MECHANICAL PROPERTIES

Butt joint, Typical

Steel	Welding position	Transverse Tensile test		Charpy impact test
		Tensile Strength (MPa)	Position of Fracture	vE-40° C
YS550 (T=20mm)	Flat	652	Base Metal	89, 83, 83 Ave. 85
	Horizontal	671	Base Metal	106, 103, 92 Ave. 100
	Vertical-up	662	Base Metal	73, 63, 68 Ave. 68

Seamless FCW for -60℃ CVN <YS400>

For YS400 steel

Process	Brand Name	Specification	Approval
FCAW-G (100%CO ₂)	SF-36E	AWS A5.29 E81T1-K2C-H4 ISO 17632-A-T46 6 ZMn1.5Ni P C1 2 H5	ABS 3YSA H5*MG DNV V YMS H5 LR 5Y40S H5 BV SA5YM H5

*Manufacturer's guaranteed min.34J at -60℃

For YS400 steel, PWHT

Process	Brand Name	Specification	Approval
FCAW-G (Ar+20%CO ₂)	SF-36EA	AWS A5.29 E81T1-Ni1M-H4 ISO 17632-A-T46 4 ZMnNi R M21 2 H5	DNV V YMS H5 (NV4-4L) LR 5Y40S H5

CHARACTERISTICS

- SF-36E is a rutile type seamless flux cored arc welding wire to be used with CO₂ shield gas.
Weld metal shows excellent toughness in low temperature range down to -60℃ as-welded condition.
- SF-36EA is a semi-basic type seamless flux cored arc welding wire to be used with Ar+20%CO₂ shield gas.
Weld metal shows excellent toughness in low temperature range around -50℃ in SR condition.
- Crack resistance and weldability in all position is excellent.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

Brand Name	C	Si	Mn	P	S	Ni
SF-36E	0.04	0.44	1.31	0.013	0.004	1.43
SF-36EA	0.07	0.34	1.25	0.014	0.004	0.83

MECHANICAL PROPERTIES

Deposited metal, Typical

Brand Name	PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-60℃ Ave. (J)
SF-36E	As welded	561	625	26	72
SF-36EA	As welded	562	625	29	134 (-40℃)
	580℃×3hr	526	607	31	113 (-40℃)

MECHANICAL PROPERTIES

Butt joint, Typical

Steel	Brand Name (Shielding gas)	Welding position	Heat Input kJ/cm	PWHT	Tensile test (WM)		Charpy impact test (WM)		CTOD test (WM)		
					Yield Strength (MPa)	Tensile Strength (MPa)	Temp. (℃)	vE (J)	Temp. (℃)	δ (mm)	Fracture mode
EH36 ¹⁾ (T=60mm)	SF-36E (CO ₂)	Vertical -up	23.0	As welded	566	633	-60	84, 69, 76 Ave. 76	-10	0.39 0.47	m m
									-20	0.46 0.47	m m
YS420 ¹⁾ (T=60mm)	SF-36EA (Ar+20%CO ₂)	Vertical -up	20.2	580℃ × 4hr	528 525	623 614	-40	98, 95, 112 Ave. 102	-10	0.76 0.83	m m

Note 1) : Manufactured by NIPPON STEEL

Seamless FCW for -60℃ CVN <YS460>

For YS460 steel

Process	Brand Name	Specification	Approval
FCAW-G (100%CO ₂)	SF-47E	AWS A5.29 E81T1-Ni1C-JH4 ISO 17632-A-T46 6 ZMn1Ni P C1 2 H5	ABS 5Y400SA H5*MG DNV V Y46MS H5 LR 3Y47S H5

*T.S. : 500~720N/mm², min. Y. S. : 460N/mm², EL. : 22%

CHARACTERISTICS

- SF-47E is a rutile type seamless flux cored arc welding wire to be used with CO₂ shield gas and designed for shipbuilding and offshore structure welding.
- Weld metal shows excellent toughness in low temperature range down to -60℃.
- Crack resistance and weldability in all position is excellent.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	P	S	Ni
0.05	0.45	1.28	0.013	0.003	0.99

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-60℃ Ave. (J)
As welded	550	615	29	80

MECHANICAL PROPERTIES

Butt joint, Typical

Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)	CTOD test (WM)		
			Yield Strength (MPa)	Tensile Strength (MPa)	vE-60℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
YS420 ¹⁾ (T=100mm)	Vertical-up	22.0	639	692	73, 85, 65 Ave. 77	-30	0.75 0.55 0.93	m u m

Note 1) : Manufactured by NIPPON STEEL

Seamless FCW for -60℃ CVN <YS460>

For YS460 steel

Process	Brand Name	Specification	Approval
FCAW-G (Ar+20%CO ₂)	SF-3AM	AWS A5.29 E81T1-Ni1M-H4 ISO 17632-A-T46 6 ZMn1Ni P M21 2 H5	ABS 5YQ460SA H5 DNV V Y46MS H5 (NV4-4L) LR 5Y46S

CHARACTERISTICS

- SF-3AM is a rutile type seamless flux cored arc welding wire to be used with Ar+20%CO₂ shield gas and designed for shipbuilding and offshore structure welding.
- Weld metal shows excellent toughness in low temperature range down to -60℃.
- Crack resistance and weldability in all position is excellent.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	P	S	Ni
0.05	0.34	1.32	0.012	0.004	0.97

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-60℃ Ave. (J)
As welded	544	605	30	103

MECHANICAL PROPERTIES

Butt joint, Typical

Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)	CTOD test (WM)		
			Yield Strength (MPa)	Tensile Strength (MPa)	vE-60℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
EH36 ¹⁾ (T=60mm)	Flat	14.6	577	635	125, 120, 112 Ave. 119	-40	0.77 1.07 0.89	m m m
	Vertical-up	18.5	609	666	109, 109, 112 Ave. 110	-40	0.63 0.82 0.73	m m m

Note 1) : Manufactured by NIPPON STEEL

Seamless FCW for -60℃ CVN <YS460>

For YS460 steel

Process	Brand Name	Specification	Approval
FCAW-G (Ar+20%CO ₂)	SM-47A	AWS A5.28 E80C-Ni1-H4 ISO17632-A-T 46 6 1Ni M M21 1 H5	ABS 5YQ460SA H5 DNV V Y46MS H5 LR 5Y46S

CHARACTERISTICS

- SM-47A is a metal type seamless flux cored arc welding wire to be used with Ar+CO₂ shield gas and designed for shipbuilding and offshore structure welding.
- Weld metal shows excellent toughness in low temperature range down to -60℃.
- Crack resistance and weldability in all position including URANAMI welding are excellent.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	P	S	Ni
0.07	0.62	1.38	0.013	0.009	0.92

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE Ave. (J)	
				-60℃	-40℃
As welded	539	627	26	85	112

MECHANICAL PROPERTIES

Deposited metal, Typical

Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)		CTOD test (WM)		
			Yield Strength (MPa)	Tensile Strength (MPa)	Temp. (℃)	vE (J)	Temp. (℃)	δ (mm)	Fracture mode
YS420 (T=60mm)	Flat	16.2	584	660	-40	134	-10	0.94	m
					-60	115		0.91 0.95	m m

Seamless FCW for -60℃ CVN <YS500>

For YS500 steel

Process	Brand Name	Specification	Approval
FCAW-G (100%CO ₂)	SF-50E	AWS A5.29 E91T1-Ni2C-JH4 ISO 17632-A-T50 6 ZMn2.5Ni P C1 2 H5	ABS 5YQ500SA H5 DNV V Y50MS H5 BV SA5Y50M

CHARACTERISTICS

- SF-50E is a rutile type seamless flux cored arc welding wire to be used with CO₂ shield gas and designed for shipbuilding and offshore structure welding.
- Weld metal shows excellent toughness in low temperature range down to -60℃.
- Crack resistance and weldability in all position is excellent.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	P	S	Ni
0.05	0.27	1.26	0.012	0.003	2.10

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-60℃ Ave. (J)
As welded	606	654	28	94

MECHANICAL PROPERTIES

Butt joint, Typical

Steel	Welding position	Heat Input kJ/cm	Location of specimen	Tensile test (WM)		Charpy impact test (WM)		CTOD test (WM)		
				Yield Strength (MPa)	Tensile Strength (MPa)	vE-60℃ (J)	vE-40℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
YS420 ¹⁾ (T=100mm)	Vertical-up	24.2	1st side	626	685	87, 76, 90 Ave. 84	123, 123, 106 Ave. 117	-10	0.92	m
			Mid Thick.	—	—	49, 61, 56 Ave. 55	79, 92, 98 Ave. 90		0.86	m
			2nd side	608	670	74, 76, 79 Ave. 76	106, 103, 112 Ave. 107		0.93	m

Note 1) : Manufactured by NIPPON STEEL

Seamless FCW for -40℃ CVN <YS690>

For YS690 steel

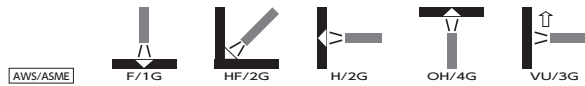
Process	Brand Name	Specification	Approval		
FCAW-G (Ar+20%CO ₂)	SF-80A	AWS A5.29 E111T1-GM-H4 ISO 18276-A-T 69 4 ZMn2.5NiMo P M21 2 H5	ABS 4Y690SA H5 DNV IV Y69MS H5 LR 4Y69S H5	BV SA4Y69 H5 CCS 4Y69SM H5 NK KSW4Y69G(M2) H5	
	SM-80A	AWS A5.28 E110C-G-H4 ISO 18276-A-T 69 4 ZMn2.5NiCrMo M M21 2 H5	ABS 4Y690SA H5 DNV IV Y69MS H5		

CHARACTERISTICS

- SF-80A is a rutile type seamless flux cored arc welding wire to be used with Ar+CO₂ shield gas and designed for shipbuilding and offshore structure welding.
- SM-80A is a metal type seamless flux cored arc welding wire to be used with Ar+CO₂ shield gas and designed for shipbuilding and offshore structure welding.
- These weld metals show high tensile strength for YS690 steel and excellent toughness down to -40℃.
- Crack resistance and weldability are excellent.

WELDING POSITIONS

SF-80A



SM-80A



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

Brand Name	C	Si	Mn	P	S	Ni	Cr	Mo
SF-80A	0.06	0.38	1.60	0.010	0.004	2.37	—	0.34
SM-80A	0.05	0.37	1.38	0.013	0.005	2.51	0.48	0.42

MECHANICAL PROPERTIES

Deposited metal, Typical

Brand Name	PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-40℃ Ave. (J)
SF-80A	As welded	755	803	24	86
SM-80A	As welded	761	821	22	91

MECHANICAL PROPERTIES

Deposited metal, Typical

Brand Name	Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)
				Yield Strength (MPa)	Tensile Strength (MPa)	vE-60℃ (J)
SF-80A	WEL-TEN™ 780EX (T=38mm)	Vertical-up	1st: 16.5	795	825	79, 76, 74 Ave. 76
			2nd: 16.7	763	809	76, 79, 76 Ave. 77
SM-80A	WEL-TEN™ 780EX (T=20mm)	Flat	14.0	826	841	101, 98, 87 Ave. 95
			17.4	755	812	84, 82, 87 Ave. 84

WEL-TEN is a trademark of NIPPON STEEL CORPORATION.

SMAW (Stick Electrode) for -60℃ <YS305-YS460>

For YS400 steel

Process	Brand Name	Specification	Approval
SMAW	L-55SN	AWS A5.5 E7016-G	ABS 3Y H5 DNV 5Y H5 LR 5Y40m H15

For YS420 - YS460 steel

Process	Brand Name	Specification	Approval
SMAW	L-57SN	AWS A5.5 E8016-G	ABS 5Y420 H5 DNV 5Y46 H5

CHARACTERISTICS

- L-55SN and L-57SN are extra low hydrogen type electrodes for low temperature service steel.
- They are suitable for welding of offshore structures and structures to be used frigid areas since these weld metals show excellent toughness around -50℃.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

Brand Name	C	Si	Mn	P	S	Ni
L-55SN	0.08	0.37	1.41	0.011	0.007	0.54
L-57SN	0.06	0.46	1.48	0.010	0.002	0.54

MECHANICAL PROPERTIES

Deposited metal, Typical

Brand Name	PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-50℃ Ave. (J)
L-55SN	As welded	517	573	31	154
	620℃ × 1hr	484	543	33	162
L-57SN	As welded	535	612	26	144 (-60℃)

MECHANICAL PROPERTIES

Butt joint, Typical

Brand Name	Steel	Welding position	Heat Input kJ/cm	Charpy impact test (WM)	CTOD test (WM)		
				vE-50℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
L-55SN	BS4360 -50D (T=25mm)	Flat	35.0	130, 157, 142 Ave. 143	-45	0.37 0.73 0.53	u u u
		Vertical-up	32.0	126, 91, 123 Ave. 113	-45	0.77 0.88 0.28	m m u
L-57SN		Vertical-up	40.0	129, 103, 64 Ave. 99	-45	0.32 1.24 0.30	u m u

SMAW (Stick Electrode) for -60℃ CVN <YS500-YS550>

For YS550 steel

Process	Brand Name	Specification	Approval
SMAW	L-60LT	AWS A5.5 E9016-G	ABS 5YQ550 H5 DNV 5Y55 H5 BV 5Y50 H5, 5Y55 H5

CHARACTERISTICS

- L-60LT is an extra low hydrogen type electrode with high resistance to moisture absorption.
- Weld metal shows excellent toughness around -50℃ and CTOD properties.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	P	S	Ni	Mo
0.07	0.41	1.51	0.013	0.002	0.67	0.18

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-50℃ Ave. (J)
As welded	600	680	26	180

MECHANICAL PROPERTIES

Butt joint, Typical

Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)	CTOD test (WM)		
			Yield Strength (MPa)	Tensile Strength (MPa)	vE-40℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
YS360 (T=32mm)	Flat	22.6	645	727	119, 120, 120 Ave. 126	-2	0.31 1.19 0.52	u m u

Quick Guide

Overview

Approvals

Superiority of Seamless FCW

FCAW-G

SMAW

SAW

YS690 grade

Supply Record

SMAW for -60℃ CVN <YS690>

For YS690 steel

Process	Brand Name	Specification	Approval	
SMAW	L-80SN	AWS A5.5 E11016-G	ABS 5YQ690MW DNV 5 Y69 H5 LR 5Y69m H5	BV 5Y69 H5 CCS 5Y69 H5 NK KMW5Y69 H5

CHARACTERISTICS

- L-80SN is a extra low hydrogen type electrode for low temperature service steel.
- It is suitable for welding of offshore structures and structures to be used frigid areas since weld metal shows excellent toughness down to -80℃.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical				
C	Si	Mn	Ni	Mo
0.05	0.36	1.39	4.64	0.48

MECHANICAL PROPERTIES

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-80℃ Ave. (J)	vE-60℃ Ave. (J)
As welded	760	860	20	90	110

MECHANICAL PROPERTIES

Brand Name	Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)
				Yield Strength (MPa)	Tensile Strength (MPa)	vE-60℃ (J)
L-80SN	WEL-TEN™ 780 (T=75mm)	Horizontal	20.5 (AC)	830	858	85, 85, 93 Ave. 88
		Vertical-up	32.6 (AC)	735	783	78, 70, 68 Ave. 72
	EQ70 (T=50mm)	Horizontal	1st: 9-22 (DCEP)	853	878	90, 87, 88 Ave. 88
			2nd: 9-16 (DCEP)	830	862	103, 104, 69 Ave. 92

WEL-TEN is a trademark of NIPPON STEEL CORPORATION.

SAW for -60℃ CVN (Multi-run) <YS305-YS400>

Quick Guide

Overview

Approvals

Superiority of Seamless FCW

FCAW-G

SMAW

SAW

YS690 grade

Supply Record

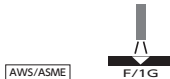
SAW for -60℃ CVN (Multi-run) <YS305-YS400>

Process	Brand Name	Specification	Approval	
SAW (Multi-run)	NB-55 & Y-DS	AWS A5.17 F7A8-EH14 F7P8-EH14	ABS 3Y400M *MG DNV V YM H5 (NV4-4L) LR 5Y40M H10	BV A5Y40M

CHARACTERISTICS

- NB-55 is a Ti-B type agglomerated flux and assures excellent low temperature toughness and CTOD both as welded and after stress relief annealing.
- Satisfactory weldability and weld metal properties are obtained with heat input of less than 50kJ/cm.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Polarity; AC, Typical				
C	Si	Mn	P	S
0.11	0.16	1.77	0.017	0.002

MECHANICAL PROPERTIES

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-62℃ Ave. (J)
As welded	593	642	30	192
620℃ × 1hr	520	595	31	92

MECHANICAL PROPERTIES

Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)	CTOD test (WM)		
			Yield Strength (MPa)	Tensile Strength (MPa)	vE-60℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
KE36 ¹⁾ (T=50mm)	Flat	42.0 (AC)	449	545	181, 214, 167 Ave. 187	-40	0.95 0.94 0.95	m m m

Note 1) : Manufactured by NIPPON STEEL

SAW for -60℃ CVN (Two-run) <YS305-YS355>

Process	Brand Name	Specification	Approval
SAW (Two-run)	NB-55 & Y-DM	AWS A5.23 F8A8-EA3-G	DNV V YT (NV4-4L) BV 5YT

CHARACTERISTICS

- Two-run welding of low temperature service steels for offshore structures, ships and LPG storage tanks.
- Weld metal shows excellent toughness in low temperature range down to -60℃.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Polarity; AC, Typical

C	Si	Mn	P	S	Mo
0.09	0.12	1.62	0.009	0.002	0.35

MECHANICAL PROPERTIES

Deposited metal, Polarity; AC, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-60℃ Ave. (J)
As welded	570	660	26	62
620℃×2hr	550	630	28	48

MECHANICAL PROPERTIES

Butt joint, Polarity; DCEP, Typical

Steel	Groove type	Pass	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM) vE-55℃ (J)
				Yield Strength (MPa)	Tensile Strength (MPa)	
BV410LF (T=13mm)	I	1st (BP)	24.2 (DCEP)	510	598	153, 162, 181 Ave. 165
		2nd (FP)	28.8 (DCEP)			

Table Recommended groove type and maximum heat input

Process	Plate Thickness T (mm)	Recommended Groove type	Max. Heat input (kJ/cm)
SAW (Single)	8≤T≤14	I	1st (BP): 32.6 2nd (FP): 32.6
	14<T≤25	Y	1st (BP): 50 2nd (FP): 50

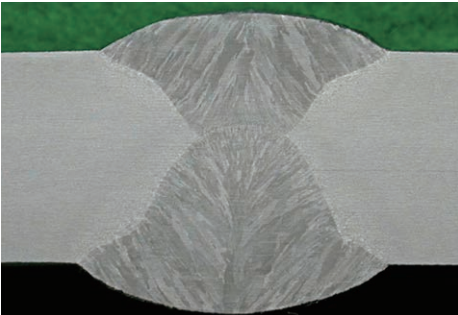


Photo. Macro structure of I-Butt joint (T=13mm)

SAW for -60℃ CVN (Multi-run) <YS305-YS400>

Process	Brand Name	Specification	Approval
SAW (Multi-run)	NB-55L & Y-D	AWS A5.23 F7A8-EG-G F7P8-EG-G	ABS 3YM *MG DNV V YM (NV4-4L) LR 4Y40M H15

*Manufacturer's guaranteed min.40J at -60℃

CHARACTERISTICS

- NB-55L is a Ti-B type bonded flux and assures excellent low temperature toughness and CTOD both as welded and after stress relief annealing.
- Satisfactory weldability and weld metal properties are obtained with heat input of less than 50kJ/cm.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Polarity; AC, Typical

C	Si	Mn	P	S
0.09	0.20	1.51	0.015	0.007

MECHANICAL PROPERTIES

Deposited metal, Polarity; AC, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-60℃ Ave. (J)
As welded	520	580	34	192
620℃×1hr	490	570	33	100

MECHANICAL PROPERTIES

Butt joint, Polarity; AC, Typical

Table Weldability test results in accordance with API RP2Z and EN10225, NB-55L/Y-D

Steel	Heat input (kJ/cm)	Transverse Tensile test		Charpy impact test (WM)		CTOD test (WM)		
		Tensile Strength (MPa)	Break Point	Lacation of specimen	vE-40℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
API 2W ¹⁾ Gr.50 (T=100mm)	45.0 (AC)	536	BM	Cap	215, 187, 198 Ave. 200	-10	0.95 1.00 1.00	m m m
				Mid Thick.	278, 286, 372 Ave. 312			
				Root	360, 305, 354 Ave. 340			
API 2W ¹⁾ Gr.60 (T=100mm)	45.0 (AC)	582	BM	Cap	100, 85, 88 Ave. 91	-20	0.95 0.94 0.93	m m m
				Mid Thick.	431, 322, 327 Ave. 360			
				Root	354, 324, 387 Ave. 355			
EN10225 ¹⁾ grade S460 G1/G2+M (T=100mm)	50.0 (AC)	579	BM	Cap	95, 86, 99 Ave. 93	-20	0.99 0.98 0.98	m m m
				Mid Thick.	203, 198, 200 Ave. 200			
				Root	261, 265, 269 Ave. 265			
	50.0 (AC) *PWHT 580℃ x4hr	549	BM	Cap	170, 174, 178 Ave. 174	-20	0.99 1.00 0.99	m m m
				Mid Thick.	239, 245, 263 Ave. 249			
				Root	265, 282, 272 Ave. 273			

Note 1) : Manufactured by NIPPON STEEL

*Reference: NIPPON STEEL's Pre-qualification test data of Offshore Structural Steel Plates.

SAW for -60℃ CVN (Multi-run) <YS460>									
Quick Guide	Process		Brand Name		Specification		Approval		
	SAW (Multi-run)		NB-55 & Y-CMS		AWS A5.23 F8A8-EA4-A4 F8P8-EA4-A4		ABS 5Y400M *MG DNV V Y46M LR 5Y46M H10		
Overview	*T.S. : 570~690N/mm ² , min. Y. S. : 460N/mm ² , EL. : 22%								
	CHARACTERISTICS								
Approvals	• Multi-layer welding of low temperature service steels for offshore structures, ships and LPG storage tanks. • Weld metal shows excellent toughness in low temperature range down to -60℃.								
	WELDING POSITIONS								
Superiority of Seamless FCW	AWS/ASME 								
	CHEMICAL COMPOSITION		Deposited metal (wt%), Polarity; AC, Typical						
FCAW-G	C	Si	Mn	P	S	Mo			
	0.08	0.13	1.36	0.010	0.004	0.40			
SMAW	MECHANICAL PROPERTIES		Deposited metal, Polarity; AC, Typical						
	PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-60℃ Ave. (J)				
SAW	As welded	560	620	23	87				
	620℃ × 2hr	530	590	25	160				
YS690 grade	MECHANICAL PROPERTIES		Butt joint, Polarity; DCEP, Typical						
	Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)		CTOD test (WM)	
Supply Record				Yield Strength (MPa)	Tensile Strength (MPa)	vE-60℃ (J)	Temp. (℃)	δ (mm)	Fracture mode
	KE36 ¹⁾ (T=50mm)	Flat	42.0 (DCEP)	541	598	98, 128, 153 Ave. 126	-40	0.76 0.79 0.19	u u u
Note 1) : Manufactured by NIPPON STEEL									

SAW for -60℃ CVN (Multi-run) <YS500>												
Quick Guide	Process		Brand Name		Specification		Approval					
	SAW (Multi-run)		NB-250H & Y-204B		AWS A5.23 F9A8-EG-G F9P8-EG-G		ABS 5YQ500M H5 DNV V Y50M H5 BV A5Y50M H5					
Overview												
	CHARACTERISTICS											
Approvals	• NB-250H is a high basic type bonded flux and assures excellent low temperature toughness (impact and CTOD properties) both as welded and after stress relieving annealing. • Slag is easy to remove even in narrow grooves. • Satisfactory weldability and weld metal properties are obtained with heat input of less than 45kJ/cm.											
	WELDING POSITIONS											
Superiority of Seamless FCW	AWS/ASME 											
	CHEMICAL COMPOSITION		Deposited metal (wt%), Polarity; AC, Typical									
FCAW-G	C	Si	Mn	P	S	Ni	Mo					
	0.06	0.32	1.74	0.011	0.002	0.85	0.35					
SMAW	MECHANICAL PROPERTIES		Deposited metal, Polarity; AC, Typical									
	PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-62℃ Ave. (J)							
SAW	As welded	674	708	28	138							
	620℃ × 1hr	633	673	28	106							
YS690 grade	MECHANICAL PROPERTIES		Butt joint, Polarity; AC, Typical									
	Table Weldability test results in accordance with EN10225											
Supply Record	Steel	Heat input (kJ/cm)	PWHT	Tensile test (WM)		Charpy impact test (WM)		CTOD test (WM)				
				Yield Strength (MPa)	Tensile Strength (MPa)	Location of specimen	vE-40℃ (J)	Temp. (℃)	δ (mm)	Fracture mode		
YS690 grade	prEN10225 ¹⁾ S500M3z (T=70mm)	35.0 (AC)	As-welded	615	681	Cap	192, 211, 197 Ave. 200	-10	0.97 0.98 1.01	m m m		
						Mid Thick.	256, 230, 230 Ave. 239					
						Root	256, 173, 223 Ave. 217					
			580℃ 4hr	603	676	Cap	216, 192, 218 Ave. 209	-10	0.97 0.97 0.96	m m m		
						Mid Thick.	235, 239, 244 Ave. 239					
						Root	237, 251, 239 Ave. 242					
			Note 1) : Manufactured by NIPPON STEEL									
			*Reference: NIPPON STEEL's Pre-qualification test data of Offshore Structural Steel Plates.									

SAW for -60℃ CVN (Multi-run) <YS550>

Process	Brand Name	Specification	Approval
SAW (Multi-run)	NB-55 & Y-DMS	AWS A5.23 F9A8-EA3-G F9P8-EA3-G	NK KAW4Y46M

CHARACTERISTICS

- NB-55 is a Ti-B type bonded flux and assures excellent low temperature toughness and CTOD both as welded and after stress relief annealing.
- Satisfactory weldability and weld metal properties are obtained with heat input of less than 45kJ/cm.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Polarity; AC, Typical

C	Si	Mn	P	S	Mo
0.09	0.12	1.62	0.009	0.002	0.35

MECHANICAL PROPERTIES

Deposited metal, Polarity; AC, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-60℃ Ave. (J)
As welded	570	660	26	62
620℃ × 2hr	550	630	28	48

MECHANICAL PROPERTIES

Butt joint, Polarity; AC, Typical

Table Weldability test results in accordance with API RP 2Z

Steel	Heat input (kJ/cm)	Transverse Tensile test		Charpy impact test (WM)		CTOD test (WM)		
		Tensile Strength (MPa)	Break Point	Lacation of specimen	vE-40°C (J)	Temp. (°C)	δ (mm)	Fracture mode
SMYS550 ¹⁾ (T=76.2mm)	45.0 (AC)	650 649	BM BM	Surface 2mm	177, 184, 213 Ave. 191	-10	>1.25 0.99	m u
				1/4t	263, 271, 262 Ave. 265		>1.25	m
SMYS414 ¹⁾ (T=76.2mm)	45.0 (AC)	560 561	BM BM	—	—	-20	>1.38 >1.38	m m

Note 1) : Manufactured by NIPPON STEEL

*Reference: NIPPON STEEL's Pre-qualification test data of Offshore Structural Steel Plates.

SAW for -60℃ CVN <YS690>

For YS690 steel

Process	Brand Name	Specification	Approval	
SAW (Multi-run) (AC/DC)	NB-250J & Y-80J	AWS A5.23 F11A10-EG-G	ABS 3.2-4.0Φ: 5YQ690M H5 4.8Φ: 4YQ690M H5* DNV V Y69M H5 LR 5Y69M H5	BV A4Y69M H5 CCS 4Y69M MG* H5 NK KAW4Y69M H5

CHARACTERISTICS

- NB-250J is a agglomerated flux and assures high tensile strength for YS690 steel and excellent low temperature toughness down to -60℃.
- It is minimize the diffusible hydrogen content in weld metal, therefore crack resistance is extremely high.
- Slag removabiliy is excellent even in narrow grooves.

WELDING POSITIONS



CHEMICAL COMPOSITION

Deposited metal (wt%), Typical

C	Si	Mn	Ni	Cr	Mo
0.08	0.20	1.43	2.17	0.56	0.52

MECHANICAL PROPERTIES

Deposited metal, Typical

PWHT	Yield Strength (MPa)	Tensile Strength (MPa)	Elongation (%)	vE-60℃ Ave. (J)	vE-40℃ Ave. (J)
As welded	759	859	24	64	103

MECHANICAL PROPERTIES

Deposited metal, Typical

Brand Name	Steel	Welding position	Heat Input kJ/cm	Tensile test (WM)		Charpy impact test (WM)	
				Yield Strength (MPa)	Tensile Strength (MPa)	Temp. (℃)	vE (J)
NB-250J & Y-80J	WEL-TEN™ 780 (T=60mm)	Flat	40.2 (DCEP)	720	870	-40	101, 84, 101 Ave. 95
						-60	82, 74, 79 Ave. 78

WEL-TEN is a trademark of NIPPON STEEL CORPORATION.

Welding consumables for YS690 grade

Process	Brand Name	Polarity	Specification	Approval	
FCAW-G (Ar+20%CO ₂)	SF-80A	DCEP	AWS A5.29 E111T1-GM-H4	ABS 4Y690SA H5 DNV IV Y69MS H5 LR 4Y69S H5	BV SA4Y69 H5 CCS 4Y69SM H5 NK KSW4Y69G(M2) H5
	SM-80A	DCEP	AWS A5.28 E110C-G-H4	ABS 4Y690SA H5 DNV IV Y69MS H5	
SMAW	L-80SN	AC/ DCEP	AWS A5.5 E11016-G	ABS 5YQ690MW DNV 5 Y69 H5 LR 5Y69m H5	BV 5Y69 H5 CCS 5Y69 H5 NK KMW5Y69 H5
SAW	NB-250H & Y-80M	AC	AWS A5.23 F11A10-EG-M3	ABS 5YQ690M DNV V Y69 BV A5Y69M	NK KAW4Y69M KAW4Y69H-VE47M-60T
	NB-250J & Y-80J	AC/ DCEP	AWS A5.23 F11A10-EG-G	ABS 3.2-4.0Φ: 5YQ690M H5 4.8Φ: 4YQ690M H5* DNV V Y69M H5 LR 5Y69M H5	BV A4Y69M H5 CCS 4Y69M MG* H5 NK KAW4Y69M H5
GMAW (Ar+20%CO ₂)	YM-80A	DCEP	AWS A5.28 ER110S-G	ABS 4YQ690SA DNV IV Y69MS	CCS 4Y69S NK KSW4Y69G(M2)
GMAW (Ar+10%CO ₂)	YM-69F	DCEP	AWS A5.28 ER110S-G	ABS 5YQ690SA DNV VY69MS BV SA5Y6M	

*min. AV. CVN 47J at -60℃

MECHANICAL PROPERTIES	Butt Joint, Typical
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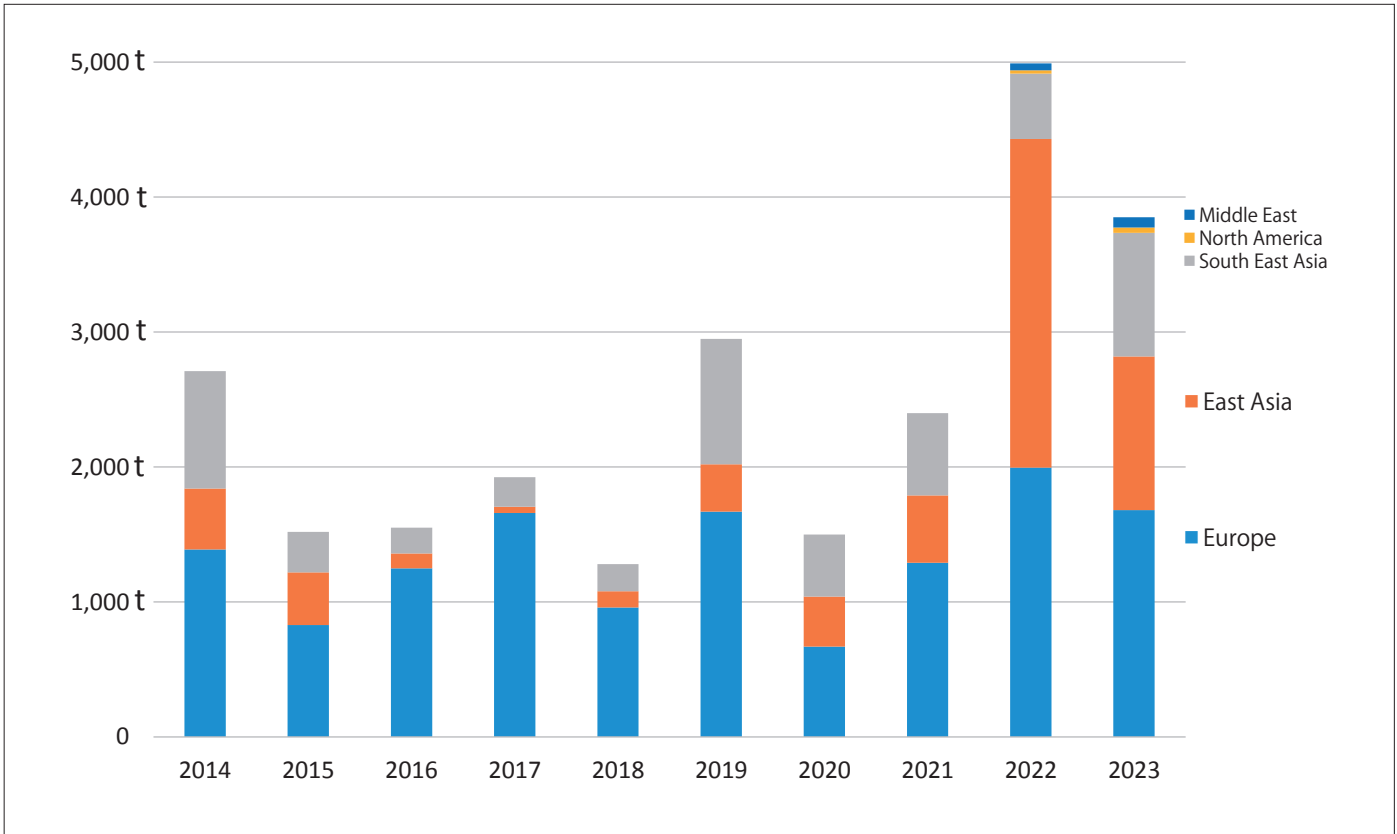
Table Mechanical properties of weld metal

Process	Brand Name	Steel	Welding position	Heat Input (kJ/cm)	Tensile test (WM)		Charpy impact test (WM)	
					Yield Strength (MPa)	Tensile Strength (MPa)	Temp. (℃)	vE (J)
FCAW-G (Ar+20%CO ₂)	SF-80A	WEL-TEN™ 780EX (T=38mm)	Vertical-up	1st: 16.5	795	825	-40	79, 76, 74 Ave. 76
				2nd: 16.7	763	809	-40	76, 79, 76 Ave. 77
	SM-80A	WEL-TEN™ 780EX (T=20mm)	Flat	14.0	826	841	-40	101, 98, 87 Ave. 95
				17.4	755	812	-40	84, 82, 87 Ave. 84
SMAW	L-80SN	WEL-TEN™ 780 (T=75mm)	Horizontal	20.5 (AC)	830	858	-60	85, 85, 93 Ave. 88
			Vertical-up	32.6 (AC)	735	783	-60	78, 70, 68 Ave. 72
		EQ70 (T=50mm)	Horizontal	1st: 9-22 (DCEP)	853	878	-60	90, 87, 88 Ave. 88
				2nd: 9-16 (DCEP)	830	862	-60	103, 104, 69 Ave. 92
SAW	NB-250H & Y-80M	WEL-TEN™ 780 (T=75mm)	Flat	39.6 (AC)	744	818	-40	148, 119, 145 Ave. 138
	NB-250J & Y-80J	WEL-TEN™ 780 (T=60mm)	Flat	40.2 (DCEP)	720	870	-40 -60	101, 84, 101 Ave. 95 82, 74, 79 Ave. 78
GMAW	YM-80A (Ar+20%CO ₂)	WEL-TEN™ 780 (T=75mm)	Vertical-up	30.0	698	898	-40	73, 76, 74 Ave. 74
	YM-69F (Ar+10%CO ₂)	WEL-TEN™ 780 (T=75mm)	Vertical-up	30.0	815	910	-60	103, 95, 103 Ave. 100

WEL-TEN is a trademark of NIPPON STEEL CORPORATION.

Supply record of our welding consumable

〈Supply record of Welding Consumables for Offshore Structures〉
-from 2014 to 2023, 10 years-



〈Typical supply products by area〉

Area	Main products		
	Welding Method		Brand Name
Europe	FCAW	For All-position type	SF-3AM, SF-80A, SF-1E, SF-50A
		For Metal type	SM-47A, SM-3A, SM-80A
East Asia	FCAW	For All-position type	SF-3A, SF-47E, SF-3E, SF-36EA, SF-3AM
		For Metal type	SM-3A
	GMAW		YM-80A
	SAW		NB-250J(Flux) x Y-80J (Wire)
South East Asia	SMAW		L-80SN
	FCAW		SF-3E, SF-1E, SF-3M, SF-80A
Middle East	FCAW	For All-position type	SF-1E
		For Metal type	L-80SN, L-55SN
North America	SMAW		SF-1E

〈Typical Customer List〉

China	CIMC Raffles Offshore Engineering (QMW) Offshore Oil Engineering (COOEC) Qingdao McDermott Wuchuan ZPMC
Denmark	Bladt Industries A/S
Germany	EEW Group
Indonesia	PT McDermott Indonesia
Norway	Aker Solutions AS
Singapore	Seatrium
United States	Seatrium Amfels

