KOBELCO WELDING TODAY

October 2003
Vol.6 (No.4)

The Kobelco Arc: Our Promise to Create the Future

A Big Stride Expected for a New Era at INTIWI

After Mr. Dahlan Gunawan's retirement in 1999, I succeeded him as President Director of P. T. INTAN PERTIWI INDUSTRY (INTIWI).
In the early years of my new assignment, I had so much to learn about the other side of the company which differed so much from the factory side, where I had been stationed as general manager for over two decades. Fortunately, my staff in the head office is already familiar with their work, and daily activities can go on without much difficulty. Besides, the majority of the factory workers have been working for the company for ages, during which they have acquired the tight scrutiny of quality control practiced in the production line. With such talented office staff and competent factory workers, the transition period in my new assignment has passed smoothly and the business is going on as I expect.

During these four years, I have found very good business relationships between our company and Kobe Steel, Thai-Kobe Welding and Kobe Welding Singapore due to their very positive and warm attitudes. Early this year the license agreement with Kobe Steel was renewed, thereby allowing Kobelco welding electrodes to remain as the market leader in Indonesia to respond to demands for high quality products in the welding electrodes market. The license agreement also reflects the strong bond between licensor and licensee built on mutual trust and benefit. With the help of the Technical Development Department of Kobe Steel, INTIWI's production line is now being modified to maximize the production capacity, thereby enhancing the production efficiency.

From the top, my staff and I posing in front of the factory, discussing in a meeting room, and attending the operation for chemical analysis for quality control

In early November 2002, our company celebrated our 25th anniversary. Time really flies—I never felt I had already worked for the company for 25 years since I joined. During the anniversary, we had a small party, at which all factory workers and head office staff had lunch, danced and socialized. Many of the employees joined our company when they were single and now they have families. Workers who are reaching retirement age even recommend their sons or daughters to take up some positions in our company. As such our employees are loyal to INTIWI.

As the Indonesian economy is now showing some sign of recovery, our sales volume has been picking up approximately 80% of the normal sales volume since the currency crisis in 1997. This year's business performance is expected to be quite satisfactory, despite the detrimental effect of a few acts of terrorism that happened locally and the Iraq war, during which the economy was very sluggish. However, we anticipate that sales will be affected temporarily next year, because there will be a national election and new projects may get started. If the election will go on well and a new government will be accepted by the people, we predict that the economy will continue to recover and investors will start coming to Indonesia. Most of the people also would want the economy to recover so as to absorb the many jobless people in the country. We hope that is when we will see demand for welding electrodes surge.

Lastly, when I think of our company's successful trend over a quarter century, I really hope that better futures will come to us, and Kobelco welding electrodes, with unsurpassed innovative quality, will grow its market niche in Indonesia.

Sumarno
President Director, INTIWI

☐ Message from the Editor ☐

General Manager

International Operations Department

Welding Company
Kobe Steel, Ltd.

Dear Readers:

How are you these days? It was unusually cool this summer in Japan. In contrast, the summer in Europe was extremely hot. Nowadays people are facing unconventional weather throughout the world. Earth seems somehow to be changing its nature, affected by extraordinary global events." Everybody loves somebody sometimes…. "If people would love our life-and-death planet, we would be able to sustain the globe in its conventional natural condition because everybody loves such natural things as deep-blue sea, blue sky, and green forest.

KOBELCO's newest plant in China, KOBE WELDING OF TANGSHAN has started to produce solid wires. The Chinese market for welding consumables is growing every year in tandem with the country's economic growth. I believe this company will be able to contribute, with their quality products and technical services, to a lot of fabricators in China. Whenever we promote the globalization of our business, we remind ourselves that globalization accompanies localization. Globalization makes us realize that there are so many different local needs in individual markets. Globalization also requires us to overcome our cross-cultural problems. I am affected in my humanity by different cultures every time when I met people in different countries.

Masakazu Tojo
Editorial Chairman

Calling from Tokyo

Hello, KWT readers worldwide:

Hui Ding is my name. I am engaged in exporting welding consumables to the Chinese market. I entered Kobe Steel and was assigned to the present department 6 years ago, when the first issue of Kobelco Welding Today was just published. Therefore, KWT magazine and I are, so to speak, colleagues in terms of our period of engagement. This magazine is distributed to customers in the Chinese market, where it enjoys a reputation as high as that in other countries. I will maximize the competence of this dependable colleague, expecting expanded sales of welding consumables in China.

Two years have passed since I took charge of exporting welding consumables to the Chinese market. Keeping in mind a Japanese proverb,"Perseverance for at least three years brings success," I will make every endeavor to provide customers with more satisfaction through my services.

Have a good day.

Hui Ding
International Operations Dept.
Welding Company
Kobe Steel, Ltd.

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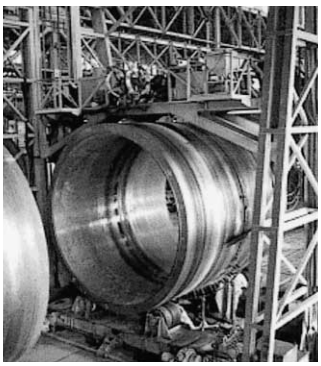
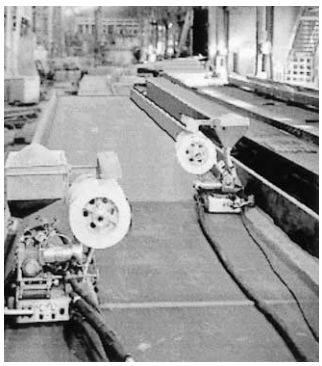


Kobelco SAW Fluxes/Wires Cover a Wide Scope of Heavy Fabrication Industries



Submerged arc welding (SAW), a typical automated welding technique, is widely used for fabricating hulls, pressure vessels, storage tanks, architectural structures, bridges, pipelines, and construction equipment. Its popularity is due to high deposition rates and deep penetration that are beneficial in welding medium-thick and thick sections. The process is limited generally to the flat and horizontal fillet positions because of the flux used to shield the weld puddle. However, with special flux dams, it can be used in the horizontal groove weld position as in joining the shells of cylindrical storage tanks.

The welding consumables required are consumable electrode and granular flux. The electrodes vary in shape—solid wire, flux cored wire, and strip—and in application—carbon steel, low alloy steel, stainless steel, nickel-based alloy, and hardfacing. The fluxes can be classified into three significantly different types: fused, bonded, and agglomerated fluxes.

Three Types of Kobelco SAW Fluxes: Fused, Bonded, and Agglomerated

Fused fluxes are produced by dry mixing aggregated or granular mineral, followed by melting at one thousand or higher degrees Celsius in an electric furnace. The molten material is cooled rapidly to its solid state and processed to produce the desired particle size. Depending on the process, the particles in the fused flux can be glassy or porous. The particles result in a variety of sizes so as to maximize the performance of the flux with varied welding currents.

Bonded fluxes are produced by dry mixing powdered mineral and, if needed by the application, metal. This is followed by wet mixing with bonded agents.

This wet-mixed material is then pelletized, baked at a temperature (e.g. 400-550℃) below its melting point, and then processed to produce the desirable particle sizes.

Agglomerated fluxes are produced with a bonded agent requiring a higher baking temperature (e.g. 700-1000℃). The production process of this type of flux is similar to that of the bonded type except for the binding agent and baking temperature. This is followed by processing to produce the most desirable particle size.

Solid Wires for General Uses; Flux-Cored Wires and Strips for Specific Applications

Kobelco SAW solid wires differ in chemistry and size to respond to demands from such heavy fabrication industries as shipbuilding, steel structure and bridge construction, and pressure vessel, storage tank and pipeline fabrication. Kobelco flux-cored wires for SAW are available for hardfacing steel mill rollers and construction machinery. Strip electrodes available from Kobelco are for stainless steel and nickel-based alloy overlaying and hardfacing.

Higher Efficiency Welding Achieved with Kobelco's Varied SAW Flux-Wire Combinations

Tables 1 through **4** show how Kobelco's diverse SAW fluxes (available for overseas markets) can be combined with different solid wires and flux-cored wires according to the applications. Many fluxes can be combined with different wires for welding several types of base metals, but some fluxes require a specific wire for welding a specific type of base metal. For details of Kobelco SAW flux-wire and flux-strip combinations, please refer to KOBELCO WELDING HANDBOOK.

Table 1. Kobelco flux/wire varieties for mild steel, high tensile steel, low temp. steel and heat-resistant low-alloy steel

Flux brand (1)	Flux/wire AWS class.	Wire brand (2)	Intended usage and features		Flux size (Mesh)
			Base metal	Features (3)	
AF-490	F7A4-EM12K F6P6-EM12K	**US-12K**	Mild steel, 490MPa HT steel	■For multi-pass welding ■Only DC-EP is applicable	10×48
G-50	F7A2-EH14	**US-36**		■For thin plates with high speeds ■DC-EP is better for sheet metals	8×48, 12×65 12×150, 20×D
G-60	F7A2-EH14			■For thin or medium-thick plates with high speeds	12×65, 12×150
G-80	F7A2-EH14 F6P2-EH14			■For multi-pass welding of medium or heavy thick plates ■Good mechanical properties	12×65, 12×120, 20×200, 32×200, 20×D
MF-300	F7A6-EH14 F7P6-EH14	**US-36**		■For multi-pass welding of Medium or heavy thick plates ■Excellent slag removal and good mechanical properties	20×200, 20×D
MF-33H	F7A6-EH14 F7P6-EH14	**US-36**	Mild steel, 490MPa HT steel	■Good performance in horizontal vertical welding of storage tanks ■DC-EP current is suitable	12×150
	F8A6-EG-A4 F8P6-EG-A4	**US-49**	550-610MPa HT steel	■Good performance in horizontal vertical welding of storage tanks ■DC-EP current is suitable	
	F7A6-EH14 F7P6-EH14	**US-49A**	Low temp. steel	■Good performance in horizontal vertical welding of storage tanks ■DC-EP current is suitable	
MF-38	F7A6-EH14 F7P6-EH14	**US-36**	Mild steel 490MPa HT steel	■For multi-pass welding of medium or heavy thick plates ■Excellent mechanical properties	12×65, 20×200, 20×D
	F7A2-EG-G	**USW-52B**	Weather proof steel	■For non-postweld-painting applications ■Good impact value	
	F8A2-EG-G	**USW-62B**		■For non-postweld-painting applications ■Good mechanical properties	
	F8A4-EW-W	**USW-588**		■Suitable for ASTM A588 steel	
	F8A4-EG-A4 F8P6-EG-A4	**US-49**	550-590MPa HT steel, Heat-resist. low-alloy steel	■Suitable for 0.5% Mo steel	
	F8A4-EA4-A4 F8P6-EA4-A4	**US-A4**		■Suitable for 0.5% Mo steel	
	F9A6-EA3-A3 F8P6-EA3-A3	**US-40**	550-610MPa HT steel, Heat-resist. low-alloy steel	■Suitable for 0.5% Mo steel	
	F7A6-EH14 F7P6-EH14	**US-49A**	Low temp. steel	■Excellent impact value at −40℃ or higher	
	—	**US-36**	Mild steel	■For FAB one-side welding with FAB-1 backing and RR-2 metal powder	20×200
	—	**US-49**	490MPa HT steel	■For FAB one-side welding with FAB-1 backing and RR-2 metal powder	
MF-38A	F7A2-EG-G	**USW-52B**	Weather proof steel	■For non-postweld-painting applications ■Good bead appearance	12×65, 20×200 20×D
MF-53	F7A0-EH14	**US-36**	Mild steel, 490MPa HT steel	■Excellent bead appearance and slag removal in fillet welding	8×48
	F7A0-EG-G	**USW-52B**	Weather proof steel	■For non-postweld-painting applications ■Excellent bead appearance and slag removal in fillet welding	
MF-63	F8A0-EG-G	**USW-62B**	Weather proof steel	■For non-postweld-painting applications ■good usability in fillet welding	8×48

Note: (1) The initial letter of brand names designates the type of flux—A: agglomerated, and G/M: fused.
(2) Solid wire. (3) Unless polarity is otherwise mentioned, AC current is recommended.

Table 1 (cont.). Kobelco flux/wire varieties for mild steel, high tensile steel, low temp. steel and heat-resistant low-alloy steel

Flux brand (1)	Flux/wire AWS class.	Wire brand (2)	Intended usage and features		Flux size (Mesh)
			Base metal	Features (3)	
PFH-45	F6A4-EL8	**US-43**	Mild steel, 490MPa HT steel	■For single-pass-double-sided or multi-pass welding ■Excellent bead appearance with high currents	10×48
PFH-55E	F7A4-EH14	**US-36**		■For single-pass-double-sided or multi-pass welding ■Good bead appearance and excellent impact value	10×48
PFH-55AS	F7A8-EH14 F7P8-EH14	**US-36J**	Low temp. steel	■Only DC-EP current is applicable ■Excellent impact value at −60℃ or higher and CTOD at −20℃ or higher	10×48
PFH-55LT	F7A8-EH14 F7P8-EH14	**US-36**		■Only AC current is applicable ■Excellent impact value at −60℃ or higher and CTOD at −50℃ or higher	10×48
PFH-60A	F7A4-EL8	**US-43**	Mild steel, 490MPa HT steel	■For single-pass-double-sided or multi-pass welding ■Excellent bead appearance with high currents	10×48
PFH-80AK	F12A10-EG-G	**US-80LT**	780MPa HT steel	■Only AC current is applicable ■Excellent impact value at −80℃ or higher	10×48
	F11A4-EG-G	**US-80BN**		■Excellent bead appearance and slag removal ■Only AC current is applicable	
PFH-80AS	F11A10-EG-G	**US-80LT**	780MPa HT steel	■Only DC-EP current is applicable ■Excellent impact value at −80℃ or higher	10×48
PFH-203	F7P15-ENi3-Ni3	**US-203E**	3.5%Ni steel	■Excellent impact value at −100℃ or higher after PWHT	10×48
PFI-50	—	**US-43**	Mild steel, 490MPa HT steel	■For FCB one-side welding with PHI-50R or MF-1R backing flux	10×48
PFI-52E	—	**US-36**		■For FAB one-side welding with FAB-1 backing and RR-2 metal powder	10×48
PFI-55E	—	**US-36**		■For FCB one-side welding with PHI-50R or MF-1R backing flux	10×48
MF-27	F9P4-EG-G	**US-56B**	Mn-Mo steel, Mn-Mo-Ni steel	■Excellent crack resistance and notch toughness	48×D
MF-29A	F7PZ-EG-B2	**US-511**	1-1.25%Cr-0.5%Mo steel	■AC current is suitable ■Good crack resistance	48×D
	F8P2-EG-B3	**US-521**	2.25%Cr-1%Mo steel	■AC current is suitable ■Good crack resistance	
PF-200	F8P2-EG-B2	**US-511N**	1-1.25%Cr-0.5%Mo steel	■AC current is suitable ■Excellent notch toughness	10×48
	F9P2-EG-B3	**US-521S**	2.25%Cr-1%Mo steel	■AC current is suitable ■Excellent notch toughness	
	F9P4-EG-G	**US-56B**	Mn-Mo steel, Mn-Mo-Ni steel	■Excellent crack resistance and notch toughness	
PF-200S	F7P2-EG-B6	**US-502**	5%Cr-0.5%Mo steel	■Good crack resistance	10×48
	F10PZ-EG-G	**US-9Cb**	9%Cr-1%Mo-Nb-V steel	■AC current is suitable ■Excellent creep rupture strength	
PF-500	—	**US-521H**	2.25%Cr-1%Mo-V steel	■AC current is suitable ■Excellent creep rupture strength	10×48
PF-500D	—	**US-521HD**	2.25%Cr-1%Mo-V steel	■Excellent high temp. properties with DC-EP currents	10×48

Note: (1) The initial letter of brand names designates the type of flux— P: bonded, and M: fused. (2) Solid wire
(3) Unless polarity is otherwise mentioned, AC current is recommended.

Table 2. Kobelco flux/wire varieties for stainless steels

Flux brand (1)	Wire brand (2)	Wire AWS class.	Intended usage and features		Flux size (Mesh)
			Base metal	Features (3)	
PFS-1	US-308	ER308	304 steel	■Good crack resistance	12×65
	US-308L	ER308L	304L steel	■Better corrosion resistance	
	US-309	ER309	309 and 309S steel	■Good weldability	
	US-309L	ER309L	309 and 309S steel	■Good weldability	
	US-317L	ER317L	316LN and 317L steel	■Good weldability	
	US-347	ER347	347 and 321 steel	■Good weldability	
PFS-1LT	US-308L	ER308L	304 and 304L steel	■Excellent notch toughness	12×65
PFS-1M	US-316	ER316	316 steel	■Good crack resistance	12×65
	US-316L	ER316L	316L steel	■Better corrosion resistance	
PFS-4M	US-410	—	403, 410, 410S, 410L, and 405 steel	■Good weldability	12×65

Note: (1) Bonded type flux. (2) Solid wire.
(3) Both AC and DC-EP currents are suitable; however, DC-EP is recommended for small dia. wires (≦2.4 mm).

Table 3. Kobelco flux/wire varieties for 9%Ni steel

Flux brand (1)	Wire brand (2)	Wire AWS class.	Intended usage and features		Flux size (Mesh)
			Base metal	Features	
PFN-3	US-709S	ERNiMo-8	9%Ni steel	■Ni-based alloy weld metal ■Excellent usability and crack resistance ■For flat position welding ■Both AC and DC-EP currents are suitable	12×65
PFN-4			9%Ni steel	■Ni-based alloy weld metal ■Excellent usability and X-ray soundness ■For horizontal groove and fillet welding ■For DC-EP current	12×65

Note: (1) Bonded flux. (2) Solid wire.

Table 4. Kobelco flux/wire varieties for hardfacing

Flux brand (1)	Wire brand (2)	Nominal hardness	Intended usage and applications		Flux size (Mesh)
			Type of wear	Applications (3)	
G-50	USH-250N	Hv 250	Metal-to-metal wear	Wheels, rollers, and tractor idlers	8×48
	USH-350N	Hv 350		Tractor idlers and links, shovels, steel mill rollers, tires	
	USH-400N	Hv 400	Metal-to-metal and abrasive wear	Tractor idlers and links, shovels, steel mill rollers, tires	
	USH-450N	Hv 450		Tractor rollers and idlers, shovels, steel mill rollers, blast furnace bells	
	USH-500N	Hv 500		Tractor rollers and idlers, shovels, steel mill rollers, blast furnace bells	
MF-30	USH-550N	Hv 550		Steel mill rollers, blast furnace bells	12×65
	USH-600N	Hv 600		Steel mill rollers (**Photo 1**), crusher cones	

Note: (1) Fused flux. (2) Flux-cored wire. (3) Both AC and DC-EP currents are suitable.

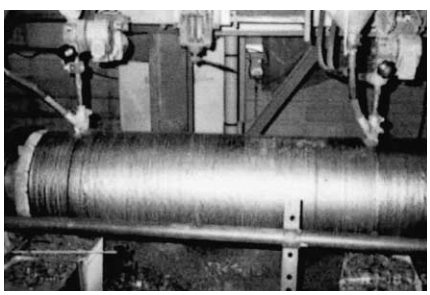


Photo 1. Hardfacing a steel mill roller by paralleled SAW with MF-30/USH-600N

Outstanding Characteristics of Kobelco Agglomerated Flux: AF-490

As shown in **Photo 2**, AF-490 (AWS A5.17 F7A4-EM12K, F6P6-EM12K) flux offers more regular bead appearance and superior slag removal over a wider range of welding speeds or heat input, when compared with conventional agglomerated fluxes that have typically been used in steel structures worldwide. In addition, in combination with US-12K (AWS A5.17 EM12K) solid wire, AF-490 provides unsurpassed absorbed energy in impact testing of the weld metal in the as-welded and postweld heat treated conditions as illustrated in **Fig. 1**.

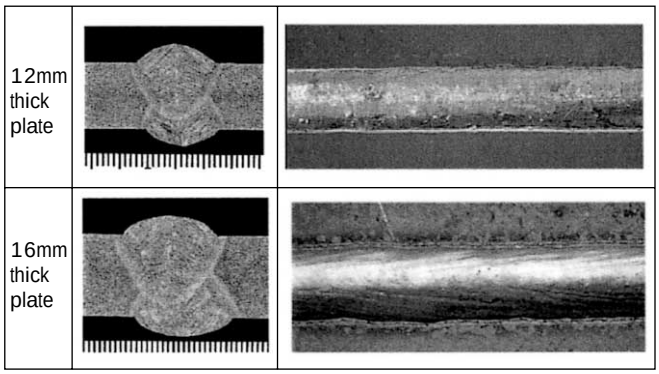


Photo 2. Joint penetration and bead appearance of AF-490/US-12K weld joints by single-pass-double-sided welding (700-750A/32-33V/40-80CPM)

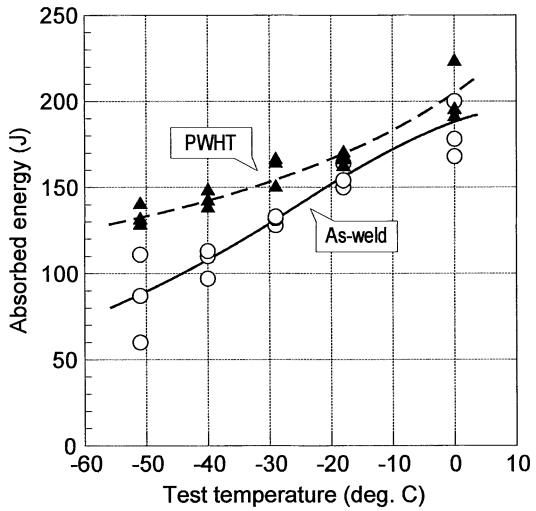


Figure 1. Impact test results of AF-490/US-12K multi-pass weld metal in the as-welded and PWHT (620℃ ×1hr) conditions

With such excellent usability and mechanical properties, AF-490/US-12K should be used in a wide range of applications for mild steel and 490-MPa high strength steel including single-pass-double-sided welding in hulls and fillet welding in architectural structures and bridges.

A Revolutionary SAW Process: High-Speed FCB One-Run Welding

The Flux Copper Backing (FCB) one-run process developed by Kobe Steel has been a standard SAW process for single-sided welding of hull plates at high travel speeds in shipbuilding worldwide since its inception in 1965. However, users have desired that the FCB process enhance productivity more efficiently to cope with increased fabrication costs caused by the requirements for double hulled oil tankers.

The development of Ti-B micro-alloyed PFI-55E flux has increased FCB process efficiency over the conventional flux, as shown in **Fig. 2**. This advantage is derived from 20% higher deposition rates, applicability of a four-wire process and consistent bead appearance over a wide range of welding parameters, which in turn has made applicable plate thickness range as wide as 10-40 mm in one-run SAW. In addition, higher travel speeds decrease heat input by 10%, thereby improving the mechanical properties of the weld metal and heat affected zone and decreasing welding distortion. The mechanical properties of PFI-55E/US-36 meet the ship class grade-3 requirements.

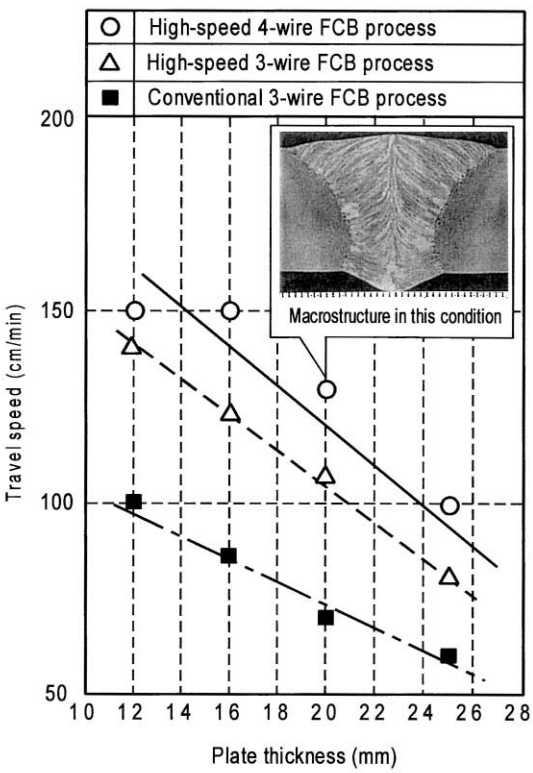


Figure 2. Proper travel speed as a function of plate thickness for high-speed FCB process in comparison with conventional FCB process

Unmatched Performance with DC-EP Currents in Low Temperature Applications

A flux/wire combination of PFH-55AS/US-36J has been developed so as to possess mechanical properties similar to those of traditional PFH-55LT/US-36 but its welding performance has been modified to suit DC-EP current that is most often used overseas though not in Japan. Ti-B micro-alloyed PFH-55AS/US-36J offer, in both as-welded and postweld heat treated conditions, consistent room temperature tensile properties and low temperature notch toughness at −60℃ as shown in **Fig. 3** and CTOD values at−20℃ (**Table 5**), due to fine grained acicular ferrite microstructure of the weld metal−**Photo 3**.

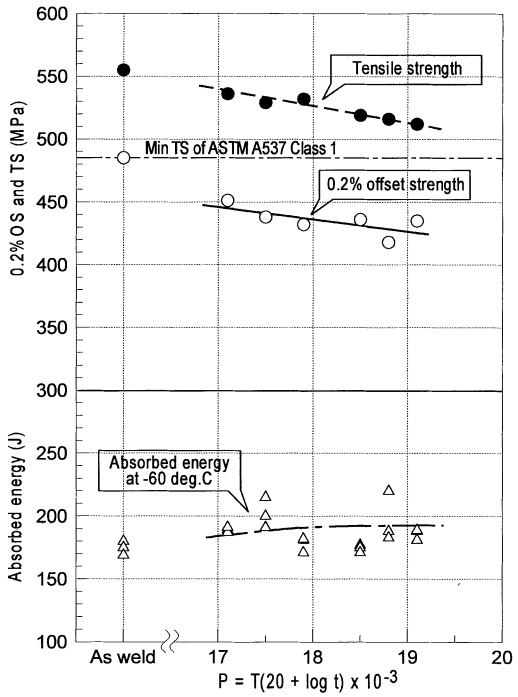


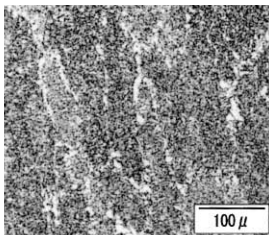
Figure 3. Mechanical properties of PFH-55AS/US36J weld metal as a function of PWHT parameter
17.1: 580℃ ×1hr, 17.5: 600℃ ×1hr, 17.9: 620℃ ×1hr
18.5: 620℃ ×5hr, 18.8: 620℃ ×10hr, 19.1: 650℃ ×5hr

Table 5. CTOD values of PFH-55AS/US-36J weld metal

Base metal	PWHT	Test temp.	CTOD (mm)
BS4360 Gr. 50D T: 70 mm	As-welded	−20℃	1.10, 1.10, 1.00
	620℃×3hr	−20℃	1.06, 1.59, 1.31

Note: Testing method: BS standard

Photo 3.
Fine grained acicular ferrite microstructure of Ti-B micro-alloyed PFH-55AS/US-36J weld metal (as-welded)



Tips for Successful SAW

1. Power source polarity

The particular combination of flux and wire generally determines the choice of AC or DC in SAW. With DC-EP, the flux consumption ratio is roughly 10-30% higher than with AC depending on the type of flux. Consequently, the chemistry−and thus the mechanical properties−of the weld metal can be affected by the polarity to a high or low degree depending on the type of flux. This is why, where the quality requirement is stringent, a careful combination of flux and wire is necessary in consideration of the polarity of the power source to be used.

2. Recycling flux

The unfused part of the flux distributed around the arc is commonly recovered for reuse; however, recovered flux can be contaminated with ferric oxides and changed in grain size, which may affect the usability of the flux and quality of the weld metal when the use of recycled flux is excessive. To maintain good performance of a flux, an appropriate amount of virgin flux should be added to the retrieved flux. It is recommended that the recycling of flux be limited to a total number of three times as a rule of thumb.

3. Redrying flux

Regardless of the type of flux−fused, bonded and agglomerated−fluxes can absorb moisture at a high or low rate, even though some particular brands of flux offer moisture resistance. Therefore, it is recommended that any flux be redried before use to recover the desired usability of the flux and to decrease diffusible hydrogen in the weld metal, in accordance with the manufacturer's specification as shown in **Table 6** for example.

Table 6. Proper redrying conditions for Kobelco fluxes

Type of flux	Brand	Drying temp.	Drying time
Fused	All brands	150-350℃	1 hr
Bonded	PFH-80AK PFH-80AS	250-350℃	1 hr
	Other brands	200-300℃	1 hr
Agglomerated	AF-490	200-300℃	1 hr

4. Depth of flux layer

The depth of the flux layer affects the appearance and soundness of the weld. If the flux layer is excessively deep, the bead appearance becomes irregular and slag inclusions will degrade the soundness. Conversely, if the flux depth is excessively shallow, flashing and spattering will occur, resulting in poor bead appearance and X-ray soundness.

DWA-81Ni1 AWS A5.29 E81T1-Ni1MJ

A Brand New Flux-Cored Wire for Low Temperature Applications

DWA-81Ni1 resembles DWA-55L, sharing a similar rutile-based flux core, suitable shielding gas (80%Ar-20%CO_2), tensile strength and notch toughness of as-welded weld metal. However, their chemical compositions—and thus their AWS classifications—are different, and only DWA-81Ni1 is suited to postweld heat treatment (PWHT). The nickel content of DWA-81Ni1 weld metal is nominally 1% and notch toughness can be kept sufficient even after PWHT.

The low Ni content and PWHT applicability can be advantages in specific fabrications—such as those that adhere to the NACE standard which requires the weldment to be low in Ni content and hardness for minimizing the susceptibility to sulfide stress corrosion cracking (SSCC) that tends to occur in corrosive, aqueous H_2S environments. Such specific fabrications can be involved in offshore structures and floating production, storage and offloading vessels (**Photo 1**). Many low-alloy steels used in such applications may require PWHT to temper or relieve stresses in the weld to achieve increased ductility.

Table 1 shows typical chemical composition and tensile properties of DWA-81Ni1 welded on high strength FH36 grade steel of LR ship class. The tensile properties of the weld metal meet the requirements (0.2%OS≧355MPa, TS: 490-620, El≧21%) of this steel grade. Ti-B micro-alloying is one of the features of the chemical composition of the weld metal, which contributes to fine grain acicular ferrite microstructure (**Photo 2**) and in turn excellent notch toughness with minimized SR embrittlement as shown in **Figure 1** and CTOD values—**Table 2**.

Table 1. Typical properties of DWA-81Ni1 weld metal (1)

Chemical composition of weld metal (%)							
C	Si	Mn	P	S	Ni	Ti	B
0.049	0.31	1.25	0.008	0.007	0.96	0.046	0.0057

Tensile properties of weld metal					
Welding position	PWHT	0.2% OS (MPa)	TS (MPa)	El (%)	RA (%)
Horizontal	As weld	581	604	25	68
	580℃×2h	533	596	26	63
Vertical	As weld	544	604	27	71
	580℃×2h	509	591	30	71

Note: (1) Specimen location: final side

Photo 1. A Floating production, storage and offloading vessel (FPSO) (Source: Fene Shipyard, Italy)

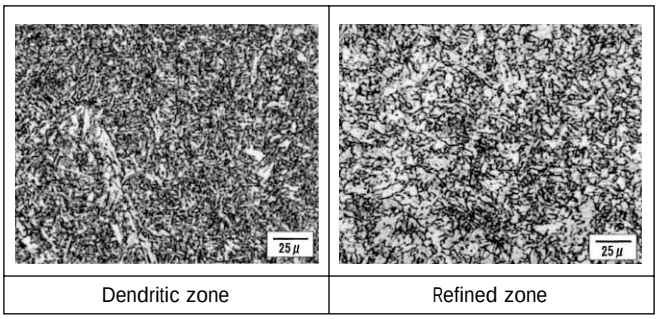


Photo 2. Fine microstructures of DWA-81Ni1 as-welded weld metal on the final side in vertical position

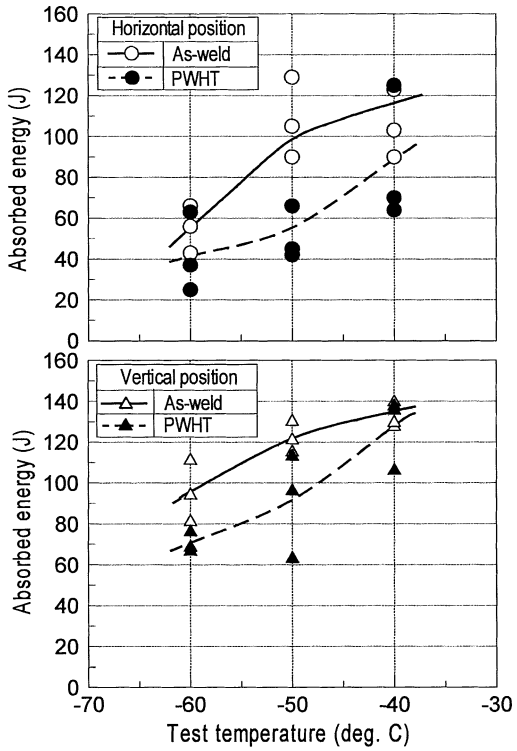


Figure 1. Absorbed energies in Charpy impact testing of DWA-81Ni1 weld metal in the as-welded and PWHT (580℃ × 2h) conditions

- Base metal: 50-mm thick FH36
- Groove: double-bevel
- Specimen location: final side

Table 2. CTOD values of DWA-81Ni1 weld metal in the as-welded condition

Base metal	PWHT	Test temp.	CTOD (mm)
FH36 T: 50 mm	Horizontal	−10℃	0.38, 0.38, 0.38
	Vertical	−10℃	0.65, 0.76, 0.77

Note: Testing method: BS standard (W = 2B)

Thomas Medal is Awarded to the Best Contributor to International Standardization for Welding Consumables

The International Institute of Welding (IIW) awarded the“ Thomas Medal ”to Mr. Shinsuke Tsutsumi, a senior researcher of the Technical Development Dept. of Kobe Steel Welding Company, in the Opening Ceremony of the 56th IIW Annual Assembly held in Bucharest of Rumania on July 6, 2003.

The Thomas Medal was presented by Mr. Thomas Mustaleski (right), President of the American Welding Society, to Mr. Shinsuke Tsutsumi (left)

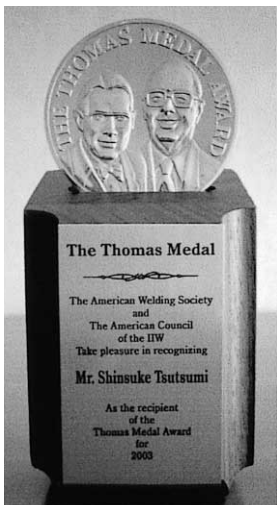
Mr. Tsutsumi, as a member of the IIW Commissions II and XII, has contributed toward international standardization of welding consumables since 1991, when a draft of the ISO standard for flux-cored wires was first prepared by the IIW Commission XII. Since then the work of international standardization has had to encounter many turns and twists, involving hot arguments between a number of representatives from European countries, USA, Canada and Japan. In January 1998, however, at the ISO/TC44/SC3 (welding consumables) meeting, Mr. Tsutsumi proposed the “ cohabitation idea ”, as a way for two systems to“ live together. ”After the idea was accepted by ISO in 1999, progress on the international project of standardization has been boosted.

The following cohabitation standards were published in 2002, which were prepared by the Japanese members in accordance with the consensus among the members from Canada, Japan and USA.

(1) **ISO 14171**: SAW wires and wire-flux combinations for non alloy and fine grain steels
(2) **ISO 14341**: GMAW wires for non alloy and fine grain steels

In addition, the final draft standards (ISO/FDIS 636, 17632, 17633, 17634, and 18276, for various welding consumables for carbon steel, low-alloy steel, and stainless steel) have been submitted to ISO/TC44/SC3 from Japan, which were prepared by the Subcommittee on ISO Standardization of the Technical Committee of the Welding Consumables Division of The Japan Welding Engineering Society. Mr. Tsutsumi has been engaged in such international activities as the Chair of the Subcommittee in Japan since 1998.

The Thomas Medal is awarded to an individual who has been involved in IIW/ISO international standards activities for more than ten years, and requires the presentation of a lecture that illustrates the incorporation of global studies in the standardization of welding technology. Thomas Medal Award has been given annually since 1998, and Mr. Tsutsumi received the 6th honor this year.



Thomas Medal:
A prestigious honor that was denominated with the commemoration of the achievement of AWS standardization by Mr. Thomas and Dr. Thomas Jr. (USA)

Reported by **KWT editorial staff**

KOBELCO WELDING TODAY
October 2003, Vol.6 (No.4)

Publisher : The International Operations Dept., Welding Company, Kobe Steel, Ltd.
Printer : Fukuda Printing Co., Ltd.
Editor : KOBELCO WELDING TODAY Editorial Staff
URL : http : // www.kobelco.co.jp
E-MAIL : iod@melts.kobelco.co.jp