KOBELCO WELDING TODAY

April 2006 Vol.9 [No.2]

The KOBELCO Arc: Your Total Solution in Manual, Semi-Automatic and Automatic Welding

New DW-50 Offers Superior Impact Toughness for Flux Cored Arc Welding

DW-50 is a rutile-based flux-cored wire for out-of-position welding with CO_2 or Ar-CO_2 mixture shielding. It has a great reputation in many applications including steel structures, storage tanks, and piping. By taking customer needs seriously, Kobe Steel has improved the impact toughness of this wire in developing the new DW-50. This new version meets the requirements for AWS A5.20 E71T-9/-9M in addition to E71T-1/-1M.

The new DW-50 offers superior impact toughness plus the following outstanding characteristics:

- Fast-freezing slag makes for easier performance in vertical upward welding as well as in flat position welding, resulting in excellent bead appearance and shape.
- The capability of using high welding currents (e.g. up to 260A with a 1.2-mmØ wire) assures high efficiency with high deposition rates even in the vertical upward and overhead positions.
- Self-peeling slag results in glossy bead appearance in out-of-position welding.
- Sophisticated flux and sheath design provides low amounts of fume and spatter.
- Non-baked, shiny wire surface coated with special lubricant ensures consistent wire feedability and an extended life of the conduit liner.

The new DW-50 is suitable for single- and multiple-pass welding of mild and low-alloy steel. Table 1 shows typical chemical and mechanical properties of the multiple-pass weld metal tested in accordance with AWS A5.20.

Table 1: Typical chemical and mechanical properties of DW-50 (1.2 mmØ) weld metal tested per AWS A5.20.

Shielding gas	C	Si	Mn	P	S
CO_2	0.05	0.70	1.34	0.008	0.009
75Ar-25CO_2	0.05	0.83	1.53	0.008	0.009
Shielding gas	0.2%OS (MPa)	TS (MPa)	El. (%)	–29°C vE Av.(J)	–18°C vE Av.(J)
CO_2	540	607	30	68	76
75Ar-25CO_2	567	626	29	89	121

Figure 1 shows the impact toughness of DW-50 (1.2 mmØ) multiple-pass weld metal. The test results illustrate some variability because different welding positions, shielding gases, and specimen removal locations are included in the data; however, they also show impact toughness highly consistent with the AWS requirements (27J at –18°C for E71T-1/-1M; 27J at –29°C for E71T-9/-9M).

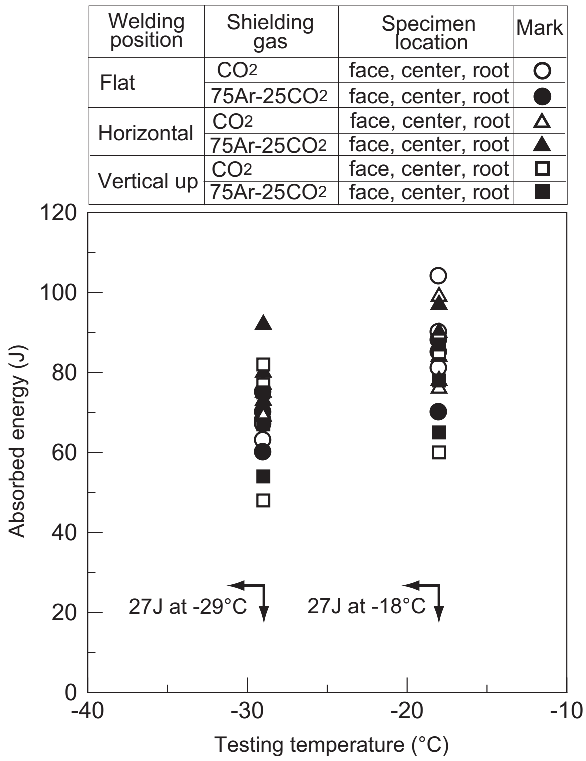

Figure 1: Impact test results of DW-50 (1.2 mmØ) multiple-pass weld metal. (Base metal: 25-mm thick SM490A, 490MPa HT steel; Welding current: 200-280A; Test specimen removal locations: face: 2 millimeters below the surface of the base metal; center: thickness-wise center; root: 2 millimeters above the backside surface of the base metal)

The new DW-50 is approved as Grade 3 by the ship classes such as AB, LR, NV, GL, and NK. This means that the new DW-50 satisfies the impact toughness requirements of 34J and 41J at minus 20°C specified respectively according to the type of steel and the type of joint to be welded.

Fruitful Spring;
Fruitful Welding Shows

Masakazu Tojo
General Manager
International Operations Dept.
Welding Company
Kobe Steel, Ltd.

The long-awaited season of cherry blossoms has come in Japan. With the arrival of Spring, April is the most cheerful month of the year in our country. I know that in your country, you may have some other time that is a favorite month or season. I wish all of you the best enjoyment during those pleasant times in your counties.

As you may know this year is the 250th anniversary of the birth of Wolfgang Amadeus Mozart. I guess his music might be some of the most popular in the world. Here in Japan his music is sometimes recognized as a kind of spiritual, healing music, because a lot of restaurants, shops and other places play it as background music. I of course love his music. It always makes me relaxed, quiet, and comfortable. It is surprising that he composed such attractive music that most people can enjoy it even after 250 years. He was really an artist of genius.

With respect to our business field, the Japan International Welding Show 2006 was held in Tokyo from the 12th to 15th of April. KOBELCO exhibited in our booth a lot of new and existing products and processes, and they attracted many international customers and visitors. It was really a fruitful event for our business. Following this welding show, the Beijing ESSEN Welding Fair 2006 will be open in Beijing from the 16th to 20th of May. I am expecting to see you at the Beijing ESSEN Fair, too.

Coming of the Season
of Welding Shows

Toshiyuki Okuzumi
General Manager
International Operations Dept.
Welding Company
Kobe Steel, Ltd.

The Japan International Welding Show (JIWS) was held in grand style in Tokyo from April 12 through 15. Reflecting the robust global economy, many overseas companies participated to exhibit their products and processes. This led me to realize the steady progress of globalization and the reliance of companies around the world on the welding technologies and materials of Japan. Following the JIWS, the Beijing Essen Welding Fair, one of the largest of its kind in Asia, is to be held in Beijing, China from May 16 through 19. China is now booming with much construction in both infrastructure and housing with an eye on the Beijing Olympic Games 2008 and the Shanghai Expo 2010. In addition, there are many big projects for expansion in the energy and shipbuilding industries.

As the coming Beijing Essen Welding Fair is expected to draw much more attention than before, the scale of our participation will be second to that of the JIWS. We will demonstrate the performance of our welding robots for steel frames, exhibit welding materials and photo panels in the fields of energy-related equipment and automobiles, and hold several technical seminars. We intend to offer you solutions with our established high quality and high efficiency welding fabrication technologies, trying hard to remain the only one and number one manufacturer for you. We look forward to seeing as many of you as possible at our booth at the Fair.

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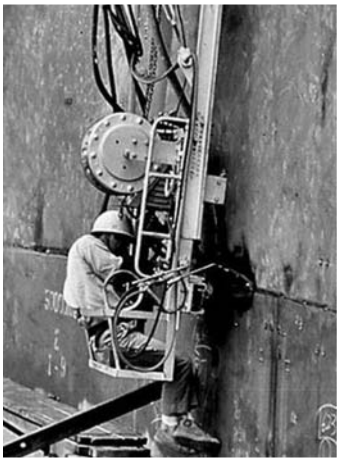
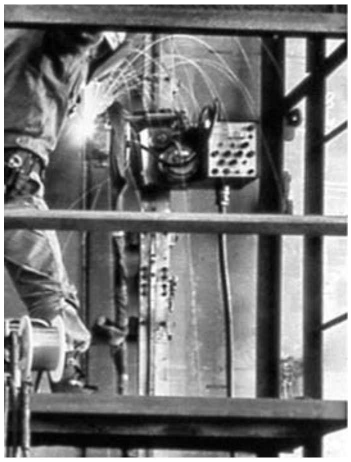


WELDING OF CRUDE OIL STORAGE TANKS

PART 2

WELDING PROCEDURE CONTROLS



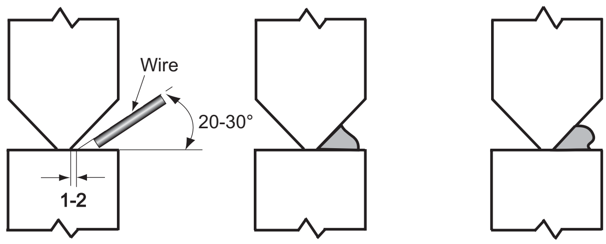
Large-capacity storage tanks for crude oil are commonly constructed from mild steel and 550-610 MPa high tensile strength steel. Depending on requirements for weld quality and efficiency, a variety of welding types are used, including submerged arc welding (SAW), electrogas arc welding (EGW), gas metal arc welding (GMAW), and shielded metal arc welding (SMAW). Each welding process requires special consideration and handling to obtain successful results. Following Part 1, How to Select Filler Metals, which appeared in the last issue, Part 2 of this two part series on welding crude oil storage tanks of the floating-roof type discusses welding procedure controls at the construction site.

Shell plate horizontal butt joints

In order to weld the horizontal butt joints of storage tank shell plates, the horizontal SAW process is most efficient. However, horizontal SAW requires more stringent procedure controls compared with flat and horizontal fillet SAW. This section discusses the weld imperfections that are likely to occur in horizontal SAW, preventive measures, and tips for better procedure controls.

(1) SLAG INCLUSIONS
In horizontal SAW, small slag inclusions can occur at the upper part of the welding groove, adjacent to the fusion line. Slag inclusions are likely caused by low heat input — thus small amounts of deposited metal — that results faster cooling speeds then prevent the slag from being removed from the weld pool during the solidification process. Selecting the proper flux-wire combination can prevent this slag inclusion, along with the following preventive measures:

- Clean the welding groove before welding and remove slag completely on each weld pass after welding.
- Minimize the supply of flux to the welding point where the arc is not visible.
- Maintain the specified wire tracking position and work angle especially during the first pass to get the preferable weld bead contour as shown in Figure 1.



(a) Aiming of wire (b) Good bead contour (c) Poor bead contour

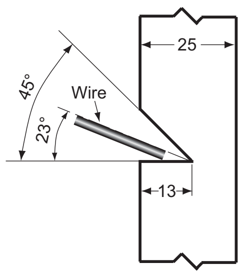
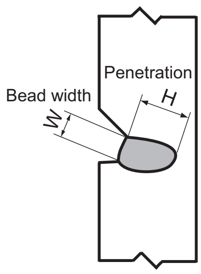
Figure 1: The tracking position and work angle of wire.

- Use adequate welding amperage (460A min. for a 3.2-mmØ wire) to agitate the weld pool and thereby help the molten slag move to the weld pool surface.

(2) HOT CRACKS
The root pass of horizontal SAW welds can take on a form that in cross-section appears to be pear-shaped. A pear-shaped bead has a large height/width (H/W) ratio, and it is likely to contain hot cracks at the center line of the weld metal. These are likely to be caused by the segregation of impu-

rities such as phosphorous and sulfur and by the concentration of contraction stresses during the solidification process of the molten metal. This type of hot crack is also known as a “pear-shaped bead crack.” Pear-shaped bead crack susceptibility of the root pass in horizontal SAW was tested according to the testing conditions shown in Table 1 and the results are shown in Figure 2.

Table 1: Pear-shaped bead crack testing conditions.

Testing materials	
Steel plate: SM490A (490MPa HT, 25 mm thick.) Welding wire: US-36 (AWS EH14, 3.2 mmØ,) Welding flux: MF-33H (AWS F7A6-EH14, 12 × 65 mesh)	
Welding conditions	
Power source: DC-EP, Drooping output Welding current: 400-550A Arc voltage: 27-30V Carriage speed: 25-50 cpm Preheat temperature: 50°C Wire extension: approx. 25 mm	
Groove preparation and work angle of wire	Definition of H and W of weld metal
	

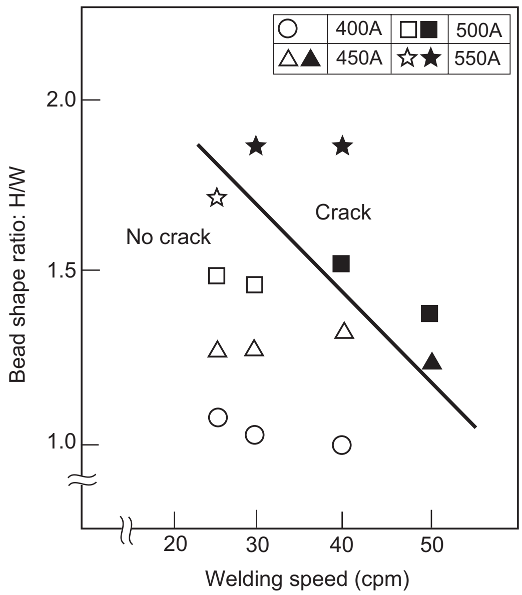


Figure 2: Effects of welding amperage, welding speed, and bead shape ratio on the pear-shaped bead crack susceptibility of the root pass weld metal in horizontal SAW.

Figure 2 clearly demonstrates that with increases in welding current and welding speed, pear-shaped bead cracks are more likely to occur. The critical H/W ratio associated with cracking decreases as the welding speed increases. Therefore, in root pass welding, excessively high currents and speeds should be avoided.

(3) POROSITY
Dew, rainwater, rust, oil, dirt, and rust-protecting paint on the surfaces of a welding groove can cause porosity in the weld metal. Therefore, these contaminants should be removed by heating the groove with a gas burner and by brushing with a wire brush before welding. Because the contaminant on the root face affects porosity more seriously it should be removed carefully.

(4) BACK GOUGING
Because SAW offers deeper penetration, back gouging is not usually applied in standard oil storage tanks. In these cases, it is better to adjust the joint penetration in both the back-side root pass and final-side root pass to prevent pear-shaped bead cracks. However, back gouging should be employed for 25-mm or thicker plates in order to ensure sufficient joint penetration.

(5) TACK WELDING
For tack welding shell plates, SMAW with 3.2 or 4.0-mmØ low hydrogen electrodes is commonly used. In general, the bead length of tack welds should range from 50 to 100 mm, and the pitch should range from 300 to 500 mm, depending on plate thickness and the length of the welding line, in order to fix the welding joint firmly. The tack weld bead is laid mostly on the back side — not on the final side. This is because smooth contact is required between the final side groove face and the backing copper that is set on the final side to prevent excessive melt-through of the backing weld.

(6) GROOVE PREPARATION
Groove design affects the penetration, fusion, and appearance of weld beads. Figure 3 shows typical horizontal groove preparations for some variations in plate thickness used commonly in storage tanks. 12- and 19-mm plates use symmetrical grooves on the back and final sides. By contrast, 25 mm or thicker plates use asymmetrical grooves on the back and final sides taking into account the back gouging area on the final side.

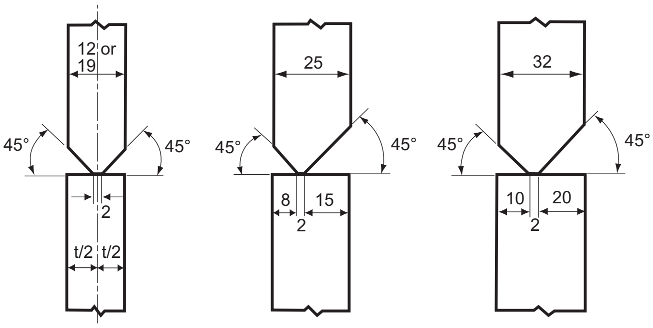


Figure 3: Typical groove preparations for horizontal SAW of the shell plates of oil storage tanks.

(7) WELDING CONDITIONS

Typical welding amperage, arc voltage, carriage speed, heat input, and pass sequence for horizontal SAW of 25-mm thick plates are shown in Table 2. In order to ensure sufficient mechanical properties of the weld metal, heat input should be controlled up to 3.0 kJ/mm. Figure 4 shows the typical macrostructure of an MF-33H/US-49 (AWS F8A6-EG-A4) weld.

Table 2: Typical welding conditions for horizontal SAW with MF-33H/US-49 for 588MPa high tensile strength steel (25t).

Pass No.	Welding amperage (A)	Arc voltage (V)	Carriage speed (cm/min.)	Heat input (kJ/mm)
1	470-490	27-30	30	2.7
2	470-490	27-30	30	2.7
3	470-490	27-30	35	2.4
4	470-490	27-30	55	1.5
5	470-490	27-30	30	2.7
6	470-490	27-30	40	2.1
7	470-490	27-30	45	1.8
8	470-490	27-30	60	1.4

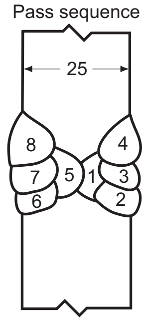
Current polarity	DC-EP	Pass sequence 
Preheat temp. (°C)	50-100	
Interpass temp. (°C)	149-177	
Work angle of wire	23° inclined	
Back gouging	Applied	

Figure 4: Macrostructure of an MF-33H/US-49 weld made in accordance with the welding conditions shown in Table 2.

Shell plate vertical butt joints

The vertical butt joint of large-capacity storage tank shells is commonly welded by using the EGW process. Kobe Steel recommends the SEGARC process, a portable, easy-to-handle EGW process suitable for such short length welding lines as the shell plate vertical butt joint. The following section discusses tips for better welding results by means of the SEGARC process.

(1) GAS SHIELDING

With the SEGARC process the weld pool is shielded with CO_2 gas to prevent nitrogen and oxygen in the air from entering into the weld metal. Therefore, control over the gas flow rate and wire extension, and protection against high winds are essential procedure controls that ensure proper gas shielding. Where the wind velocity is 2 m/sec or higher, the welding area should be shielded. When storage tank construction sites are located near the sea, the wind velocity may be so high that wind screens are indispensable. Figure 5 shows how protection against wind may typically be employed at a construction site. In this case, EGW is carried out in a booth that provides a shield against air currents that would disperse the shielding gas.

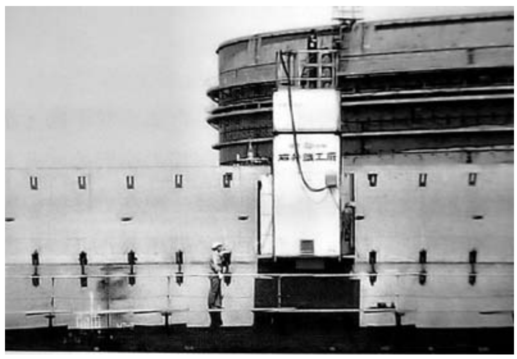


Figure 5: A self-contained EGW unit for the vertical butt joint of shell plates in a windy area at the construction site.

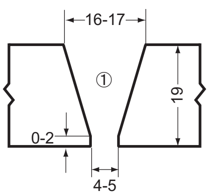
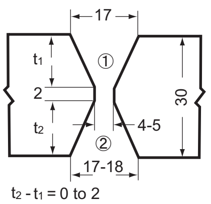
(2) HEAT INPUT

The SEGARC process uses high currents to achieve high deposition rates and efficiency. However, it travels at slower speeds than conventional arc welding to fill the joint groove in one pass. Consequently, the heat input can reach as high as 5-8 kJ/mm. High heat input leads to slow cooling rates that in turn may cause softening and embrittlement at the heat-affected zone of the base metal due to grain-coarsening. Therefore, any scheduled welding procedure should be tested before employing it for the actual work. To prevent excessive heat input in the base metals, steel plates with thicknesses of 25 mm or less can be completed by single-pass EGW; however, steel plates that are over 25 mm in thickness require two passes, i.e. one pass on the front side of the groove and another pass on the back side.

(3) WELDING CONDITIONS

The SEGARC process uses single-V grooves for 25 mm or thinner plates or double-V grooves for thicker plates over 25 mm. Table 3 shows typical joint configurations and welding parameters suitable for shell plate vertical butt joints. Figure 6 shows the typical macrostructure of a DWS-60G weld made in accordance with the welding procedure shown in Table 3.

Table 3: Typical groove configurations and welding parameters for shell plate vertical butt joints.

Plate thickness	19 mm	30 mm
Groove configuration		
Steel plate	SPV490 (610MPa HT)	SPV490 (610MPa HT)
Welding wire	DWS-60G (1.6Ø)	DWS-60G (1.6Ø)
Pass No.	①	① ②
Wire extension	35-40 mm	35-40 mm
DC-EP amperage	380-400A	380-400A
Arc voltage	40-42V	39-41V
Travel speed	12-15 cpm	13-16 cpm
Heat input	6.1-7.6 kJ/mm	5.9-7.2 kJ/mm
Shielding gas	CO_2: 30 liter/min.	CO_2: 30 liter/min.
Backing material	Water-cooled copper shoe	Glass tape plus water-cooled copper shoe
Front side copper shoe's groove width	24 mm	28 mm

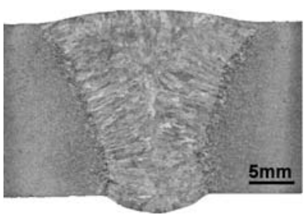


Figure 6: Macrostructure of a DWS-60G weld made in accordance with the welding procedure shown in Table 3 (Plate thickness: 19 mm).

Shell to annular plate tee joints

Shell to annular plate tee joints have to carry, over the lifetime of the storage tank, severe bending stresses caused by frequent loading and unloading of the liquid and uneven settling of the foundation under the tank. Therefore, this joint must be welded appropriately in order to prevent the porosity, root cracks, overlap, and undercut that are liable to occur and hinder effectiveness and performance.

(1) POROSITY

Porosity in a shell to annular plate tee joint weld typically occurs as worm track holes that start at the root of the root pass weld and elongate towards the surface of the weld. Clustered and scattered pits are another type of porosity often observed in the tee joint weld. Such porosity can be caused by rust, dirt, oil, rainwater, and dew on the base metal. Therefore, these contaminants should be removed, particularly from the root face of the joint, with a wire brush, solvent, or burner. Once a tack weld has been laid at the root of the joint, the root face cannot be sufficiently cleaned, and porosity cannot be easily prevented. For this reason, SMAW, which has better resistance against contaminants, is recommended for the root pass on the base metal, and SAW for the filling and capping passes.

(2) ROOT CRACK

Root cracks, which tend to initiate at the root of the root pass weld, can be caused by the combined effects of hydrogen, low-ductility microstructure, and restriction stresses in the weld. Contaminants such as rust, dirt, oil, rainwater, and dew on the base metal can be sources of hydrogen. Therefore, such contaminants should be removed and, for high strength steel, preheating should be applied to reduce cooling speeds, thereby preventing root cracks.

(3) OVERLAP AND UNDERCUT

Multiple-pass fillet welding of the shell to annular plate tee joint requires careful selection of welding parameters and wire-tracking for each pass to build up weld beads with the absence of overlap and undercut. Overlap is particularly serious because it may cause stress concentration and thus initiate fractures of welds affected by applied loads. Table 4 shows a typical pass sequence, suitable welding parameters for each pass, and proper wire-tracking location. Figure 5 shows the typical macrostructure of the weld.

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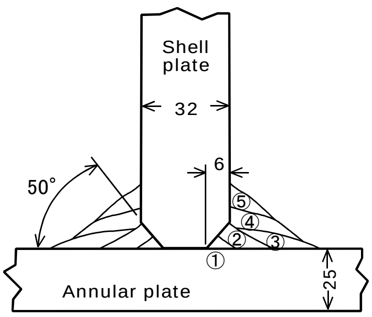
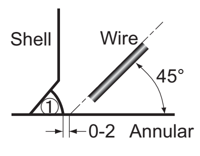
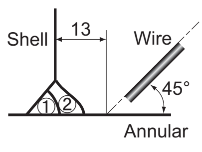
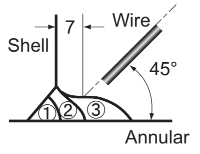
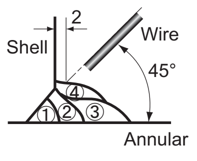
Table 4: A typical pass sequence, suitable welding parameters, and proper wire-tracking location for multiple-pass fillet weld in the shell to annular plate tee joint.

Base metal	SPV490 (610MPa HT)				
Welding flux and wire	MF-300 / US-40 (AWS F9A4-EA3-A3)				
Preheat temperature	50-100°C				
Interpass temperature	149-177°C				
Pass sequence					
Pass No.	DC-EP amp. (A)	Arc voltage (V)	Travel speed (cpm)	Heat input (kJ/mm)	Wire-tracking position
①	SMAW with LB-62UL (AWS E9016G, 5.0 mmØ), 220-230A				
②	400-420	28-30	30	2.4	
③	400-420	28-30	30	2.4	
④	400-420	26-28	30	2.2	
⑤	360-380	26-28	45	1.3	

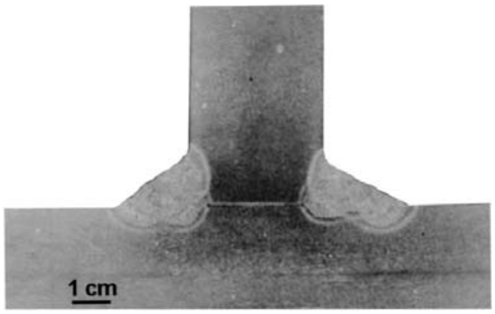


Figure 5: Macrostructure of a MF-300/US-40 weld made in accordance with the welding conditions shown in Table 4.

Bottom plate joints

Lap joints and butt joints with steel backing are used according to the capacity of the storage tank. Because the bottom plate rests directly on the foundation, the prevention of porosity caused by rust, dirt, rainwater, and dew is the key. In order to prevent porosity, SMAW is often used for the root pass, followed by SAW for the filling and capping passes. Table 5 shows a typical pass sequence, suitable welding parameters, and proper wire-tracking location for lap joint. Figure 6 shows the typical macrostructure of the weld.

Table 5: A typical pass sequence, suitable welding parameters, and proper wire-tracking location for multiple-pass lap weld in the bottom plate joint.

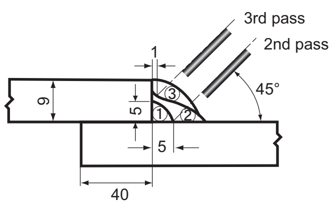
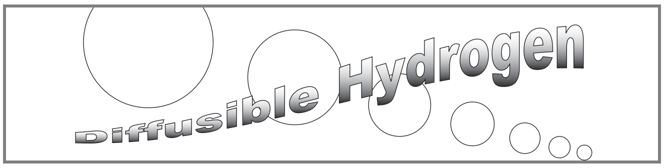
Base metal	SS 400 (Mild steel)			
Welding flux and wire	MF-300 / US-36 (AWS F7A6-EH-14)			
Pass sequence and wire-tracking location				
Pass No.	DC-EP amp. (A)	Arc voltage (V)	Travel speed (cpm)	Heat input (kJ/mm)
①	SMAW with LB-47 (AWS E7016, 4.0 mmØ), 170-175A			
②	400-420	28-30	40	1.8
③	350-370	26-28	60	1.0

Figure 6: Macrostructure of a MF-300/US-36 weld made in accordance with the welding conditions shown in Table 5.



What is diffusible hydrogen?

In welding, hydrogen is generated from the dissociation of water vapor or hydrocarbons in the welding arc. Metals such as steel and aluminum at or near their melting temperatures diffuse hydrogen at a very high rate. Therefore, the molten weld metal can rapidly pick up hydrogen from the hot gas in the arc. Once in the weld metal, hydrogen atoms can diffuse swiftly into the heat-affected zone (HAZ) of the base metal, as diffusible hydrogen ($[H]_D$), because their diameter is much smaller than the lattice size of the metals.

Metals reject $[H]_D$ during cooling and phase transformation, whereupon it concentrates at microstructural dislocations and voids in the matrix. The driving force to form diatomic or molecular hydrogen in the voids is so great that pressure may increase. This induces localized tensile stresses that add to residual tensile stresses.

How to measure $[H]_D$

The $[H]_D$ content of weld metal has been measured by several methods: glycerol displacement as per JIS Z 3118, mercury displacement as per ISO 3690 and AWS A4.3, and gas chromatography as per JIS Z 3118, ISO 3690, and AWS A4.3. However, the glycerol displacement method has the problem of low accuracy in measuring a low amount of $[H]_D$ (2 ml/100g or less), and the mercury displacement method has the problem of environmental pollution. By contrast, the gas chromatography has no such problems. This is why, today, the gas chromatography is commonly used for measuring the $[H]_D$ content of the weld metals produced by the SMAW, GMAW, FCAW and SAW processes.

With the gas chromatography method specified by the JIS standard, a small steel piece, e.g. 10T×15W×30L for SMAW, is welded with a single bead using the covered electrode to be tested. Soon after the welding, the weld specimen is cooled in ice water and is cleaned with a wire brush. Then, the weld specimen is put in the hydrogen-collecting container, followed by the argon purging to remove the air in the container. The hydrogen-collecting container is kept for 72 hours in the constant-temperature (45°C) container to collect $[H]_D$. To measure the amount of $[H]_D$, the hydrogen-collecting container is connected to the measuring apparatus as shown in Figure 1.

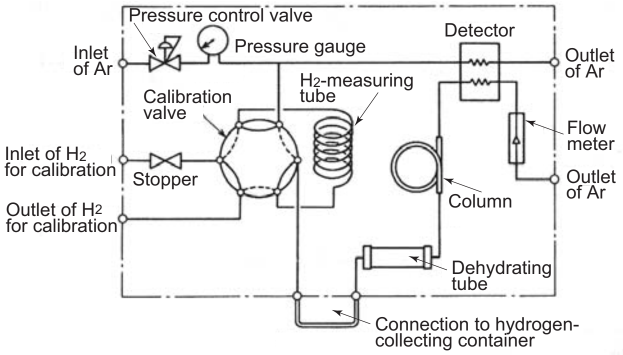


Figure 1: Instrumental components of the gas chromatography method for determining the $[H]_D$ content of weld specimens.

Effects on weldability

$[H]_D$ can be a cause of hydrogen cracking (also known as underbead, cold, or delayed cracking). Hydrogen cracking can occur when welding carbon and low-alloy steels. The potential for hydrogen cracking in the weld metal and HAZ depends on their composition, $[H]_D$ content, and stress level. It generally occur at a temperature below 150°C immediately upon cooling or after a period of several hours with the combined presence of susceptible microstructure, high amounts of $[H]_D$, and high tensile stress.

How to reduce $[H]_D$

Moisture and other hydrogenous compounds can dissociate in the welding arc and introduce $[H]_D$ in the weld metal. Possible sources include moisture in the electrode covering, welding flux, shielding gas, or contaminants in the filler or base metal. The filler wire or rod itself may be a source of contamination stemming from the lubricants used during the wire-drawing operation.

In order to reduce the content of $[H]_D$ and minimize its adverse effects when welding, the following points are recommended:

(1) Use low hydrogen welding consumables and, more preferably, extra-low and ultra-low hydrogen welding consumables. Also recommended are low-moisture-absorbing welding consumables which can resist moisture pickup for extended time periods under conditions of high atmospheric humidity.

(2) Store and re-dry the welding consumables according to the manufacturers' recommendations.

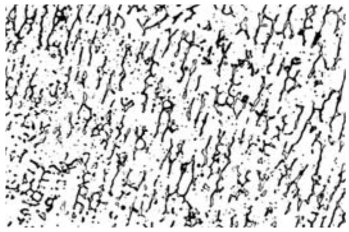
(3) Clean the welding groove and the area around it carefully and properly to remove such hydrogen sources as rust, oil, paint, rainwater, and dew.

» References «

[1] JIS Z 3118-1992 and Z 3212-2000
[2] Welding Handbook, Vol 4, 8th Edition, P4-5, 1998, AWS.

The H-series DW stainless steel flux-cored wires shine in high-temperature applications

DW-308H / DW-308LH / DW-316H / DW-316LH / DW-347H / DW309LH



Conventional stainless steel flux-cored wires (FCW) generally contain a minute amount of bismuth oxide (Bi_2O_3) in the flux to improve slag removal in welding. The resulting weld metal contains a very small amount of Bi. When this weld metal is exposed to high temperatures over 600°C, the ductility (elongation) of the weld metal is reduced because of the segregation of Bi at the grain boundaries, and cracks can occur.

In contrast to this, the H-series DW stainless steel FCWs shown in Table 1 contain no bismuth oxide in the flux and, thus, no Bi in the weld metal. Consequently, the elongation of the weld metal at high temperatures is higher than that of conventional FCWs as shown in Figures 1 and 2. This is why the Bi-free FCWs are suitable for high temperature applications including high temperature equipment and postweld stabilization heat treatment. The H-series FCWs contain advanced flux compositions (without B_2O_3) that make slag removal comparable to conventional FCWs.

Table 1: Typical chemical and mechanical properties of H-series DW stainless steel flux-cored wires

Brand name		DW-308H	DW-308LH	DW-316H	DW-316LH	DW-347H	DW-309LH
AWS class.		E308H T1-1/-4	E308L T1-1/-4	E316 T1-1/-4	E316L T1-1/-4	E347 T1-1/-4	E309L T1-1/-4
Chemical composition of weld meal (mass%)	C	0.060	0.026	0.050	0.023	0.027	0.028
	Si	0.42	0.41	0.38	0.45	0.38	0.47
	Mn	1.50	1.35	1.10	1.08	1.18	1.24
	Ni	9.62	10.20	11.60	11.94	10.20	12.58
	Cr	18.68	18.70	18.75	18.47	18.87	24.17
	Mo	-	-	2.40	2.45	-	-
	Nb	-	-	-	-	0.57	-
	Bi	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
FN (1)		6	8	8	9	7	20
TS (MPa)		575	540	570	540	602	578
El. (%)		48	52	42	45	43	39

(1) Ferrite No. per a DeLong diagram.

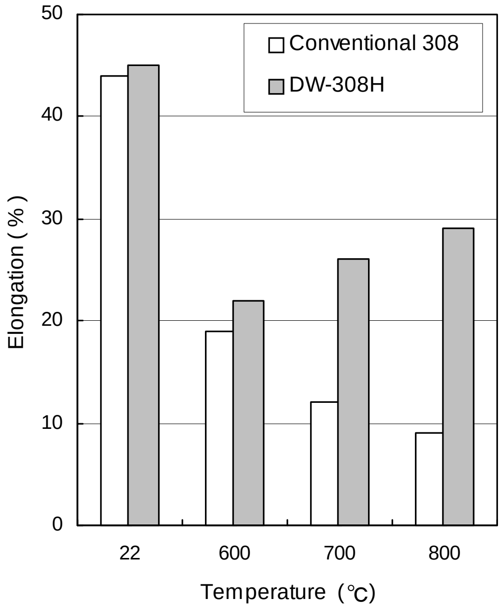


Figure 1: A comparison of high temperature elongation between DW-308H and conventional 308 FCW.

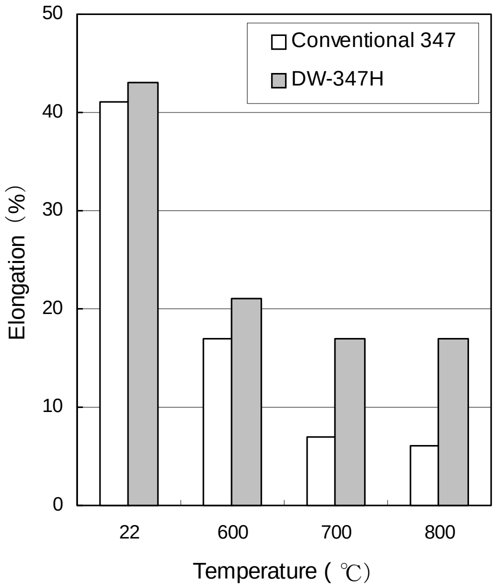


Figure 2: A comparison of high temperature elongation between DW-347H and conventional 347 FCW.

Where welds are subject to solid solution heat treatment and hot rolling, too, the H-series DW stainless steel FCWs should also be used to prevent reduced ductility.

My new challenge for the international markets

Yoshihiro Tokimoto
International operations Dept.
Kobe Steel, Ltd.

My name is Yoshihiro Tokimoto. I transferred to the International Operations Dept. from NI-Kobe Welding, which is a subsidiary of the Welding Company of Kobe Steel in Nagasaki City, in February. Because I was working only in domestic sales for 15 years since entering Kobe Steel, I think I have to broaden my horizons by learning many things about the overseas markets and the manufacturing processes of our products. I have just taken charge of Kobe Welding of Tangshan (KWT) in this department. Convinced as I am of the company's potential, I will dedicate myself to supporting KWT in China so that it can be a profitable and administratively independent company as soon as possible.

Let me mention a little more about myself and my family. I was born in 1968 and have a wife and two children, a five-year-old daughter and a two-year-old son. My present pastimes are raising children and drinking single malt whiskies. I'm worrying whether or not I can enjoy the Chinese distilled spirits when I visit China in the near future.

Greetings from KWE

I am pleased to make my sincere greetings to the readers of Kobelco Welding Today. My name is Fumitake Morimoto. I was transferred from the International Operations Dept. to Kobelco Welding of Europe (KWE) in the Netherlands last December. KWE is located in Heerlen, in the southern part of the Netherlands. It was established in 1994 as a manufacturing plant for stainless steel flux-cored wires. We have a new project of producing flux-cored wires for mild steel that is scheduled to start up in 2007. It's my pleasure to work for this project in my capacity as the Marketing Manager, because it is a big challenge for us.

By the way, as you may know, the 2006 FIFA World Cup will be played in Germany this year. I hope to go and see it, if I can get a ticket! Of course that's the problem. I do not have any ticket at this moment. I went to Dortmund in Germany on Feb. 28 to watch the Japan vs. Bosnia-Herzegovina friendly match. It was not a good weather for football; however, I enjoyed it very much because I could see the players so close up. I hope your country and Japan will have a good result in the World Cup.

Hello! I'm Fumitake Morimoto at the Japan vs. Bosnia-Herzegovina friendly match.

The business slogan of KWE for this year is "Full Customer Satisfaction." We will provide our best service to our customers. I'm sure this slogan should not be only for KWE, but also for all the Kobelco Group companies.

See you at the World Cup!

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