KOBELCO WELDING TODAY

January 1999
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Jurong Shipyard: Towards High Quality Welding and Productivity by Kobelco Welding Materials and Equipment

Jurong Shipyard Limited (JSL) was established in 1963 as a joint venture company between Ishikawajima-Harima Heavy Industries (IHI) of Japan and Temasek Holdings Pte. Ltd., a wholly owned investment company of the Singapore Government. On the eve of the laying of the foundation stone for Jurong Shipyard Limited on 20 February 1964, Dr. Goh Keng Swee, the Finance Minister, said that JSL venture rested on a sound economic basis. The many spheres of activities within the shipyard, encompassing shipbuilding, ship repairing and the manufacture of heavy industrial equipment had tremendous growth potential. Its growth would also stimulate many related and ancillary industries in Singapore and Malaysia. Although Singapore had been in the shipping industry for almost one and half centuries, hardly any shipbuilding industry of significance had been established until then. Singapore then ranked as the 5th busiest port in the world, and being strategically located at the crossroads of major sea-lanes between the Indian subcontinent and East Asia. Singapore, therefore, had a natural advantage as a ship repair center.

Jurong Shipyard: the integrity of marine services

Today, JSL is one of biggest shipyards listed on the Singapore Stock Exchange. It offers a "one-stop" total service in ship repair, ship conversion, shipbuilding, offshore repairs and conversions, and ancillary marine services. JSL has gained a reputation for high quality in the worldwide marine industry. With the additional capacity of a 500,000 dwt ULCC Dry-dock that started operations in July 1996. JSL has succeeded in attracting not only Floating Production Storage & Offloading (FPSO & FSO) conversion jobs, but has proven its credibility for undertaking complex upgrading of offshore projects such as semi-submersibles.

JSL successfully completed the prestigious "fast-track" development project on the "Ta'kuntah" ahead of schedule. The project involved the conversion of a ULCC tanker to that of a Floating Storage Offloading (FSO) unit for Modec (USA) Inc. and the fabrication of the Single Point Mooring (SPM) turret head under contract to Sofec Inc. this year. It also completed on schedule the upgrading of FPSO "Modec Venture I" for Modec (Japan) Inc.

JSL is presently busy upgrading the "Marine 500" for deep water drilling of up to 5.000 ft for Marine Drilling Company (USA). The Marine 500 is a self-propelled Offshore-drilling unit built according to the SONAT design in 1975. Currently JSL is also undertaking three conversion projects for Maritima Petroleo E Engenharia Ltda.

In hull construction, JSL has a long history of using KOBE B-14 and LB-52 stick electrodes for shop and erection welding. In order to improve work efficiency, JSL has employed the CO_2 semi-automotive welding process, the portable fillet welding equipment, "SUPER-ANIMO," in the shop panel welding, and the versatile gas shielded metal arc welding equipment, "PICOMAX-2," for the field erection of hull blocks in the shipbuilding yard since 1992.

To meet the high quality requirements for the extreme welding specifications for recent offshore projects, DW-55E flux cored wire has been used to meet the client's strict specifications, as well as to cut costs and enhance work productivity. The technical services that KWS has extended to JSL includes providing technical consulting for welding, as well as advising on the up-grading of welding processes and facilities in the yard. KWS is growing together with the performance of JSL.

(Reported by Thomas Teo / KWS)

Message from the Editor

To our dearest readers of KOBELCO WELDING TODAY: We are pleased to send KOBELCO WELDING TODAY, Vol. 2 (No. 1), to you. I suppose that when this issue arrives in your hands, you will have enjoyed the traditional New Year that is unique to your country. In Japan, most people enjoy New Year vacation for about one week, from the end of year to the beginning of New Year. We have a habit of eating, at midnight on the 31st of December, special buckwheat noodles — "Toshi Koshi Soba" in Japanese: this is a wav of giving thanks for the safe and healthy year. After that, we go to a nearby shrine or temple to pray for the best in the New Year. Some people pray — "Kami Danomi" in Japanese — for such individual desire as health, passing the university exam, recovery from the recession, and promotion in New Year.

In 1998, unfortunately, the Japanese welding market was sluggish. Every type of business was slow moving, and there have still been no clear signs of recovery from the slump. I, therefore, will go to a shrine to do "Kami Danomi" for an active moving of the welding market. A happy New Year to you!

Tetsuo Konohira

General Manager, IOD, Welding Div., Kobe Steel, Ltd.

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"I have been in the welding supply industry for over 39 years. My history with KWAI has been a long and happy one. Before KOBELCO Flux Cored Wire was a known brand in the U.S.A., I and our welding engineer, Vemon DeMont, loaded up a machine and some wire on a trailer and went from state to state in the southern U.S. Doing onsite end-user demonstration. We now sell thousands of Stainless Flux Cored Wire on a monthly basis. We are proud to market KOBELCO wire in the U.S."

KOBALLOY, A DIVISION OF BMS INC.
Jim Baughmun, President

Technical Report

DWA-50

(AWS A5.20 E71T-1M)

DWA-50: the best choice for Ar+CO_2 gas mixture shielding in all-position welding of mild steel and 490N/mm^2 high strength steel.

European and American Practice Triggered the Birth of DWA-50

The traditional use of Ar+CO_2 gas mixture shielding in Europe and the United States triggered the development of DWA-50. Fabricators there have preferred the use of 75-85%Ar+25-15%CO_2 gas mixtures in gas metal arc welding in order to minimize the generation of spatter. These demands spurred Kobe Steel to develop a flux-cored wire, DWA-50, specifically suited for Ar+CO_2 gas mixture shielding.

What Makes DWA-50 a First-Class, Titania-Base, Flux-Cored wire?

The outstanding features of DWA-50 when used with Ar+CO_2 gas mixture shielding are:

(1) A wide range of proper welding currents, as shown in Fig. 1, which enables the selection of a versatile current suitable for all-position welding without position-by-position re-adjustment.

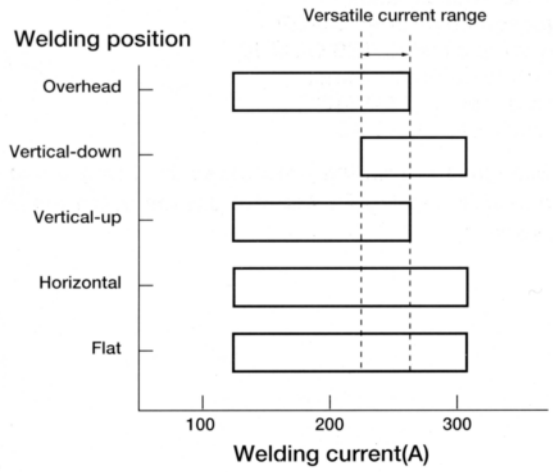


Fig. 1 — Proper welding current ranges and a versatile current range for all-position welding (DWA-50, 1.2 mmØ)

(2) Higher deposition efficiency (87-90%) and deposition rates due to a higher yield of deposited metal with less spatter-loss. Fig. 2 shows typical deposition rates of DWA-50.

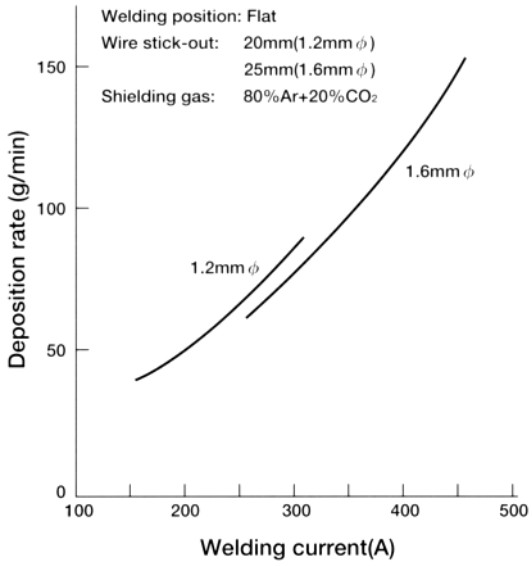


Fig. 2 — Typical deposition rates of DWA-50 as a function of welding currents

(3) Superb usability with gentle arcing, less spatter generation, uniform bead appearance, and easy-to-remove slag.

(4) Less welding fume generation than that of conventional titania-base flux-cored wire

(5) Deeper penetration — Fig. 3.

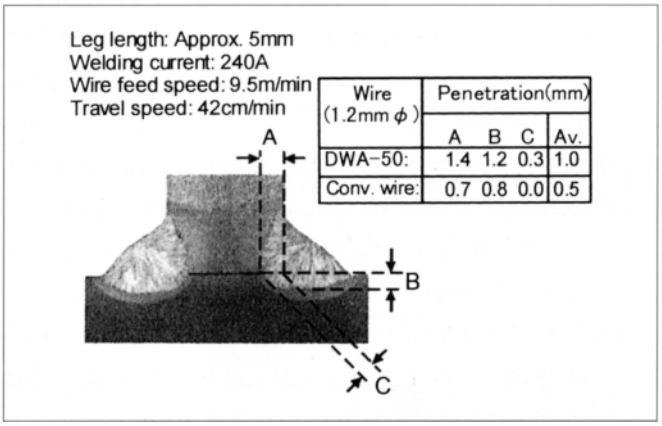


Fig. 3 — Penetration test results of DWA-50 in horizontal fillet welding with 80%Ar+20%CO_2 gas shielding

DWA-50 Shines in a Variety of Applications

The application of DWA-50 is almost limitless as long as the base metals are mild steel and 490N/mm^2 high strength steel, and the shielding gases are Ar+CO_2 gas mixtures. Nowadays DWA-50 is used in various applications in such industries as shipbuilding, construction, machinery fabrication, and civil engineering, particularly in Europe and the United States.

Fig. 4 — DWA-50 contributes to highly efficient welding in the shipbuilding industry

How to Use DWA-50

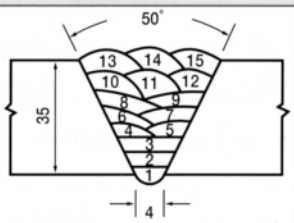
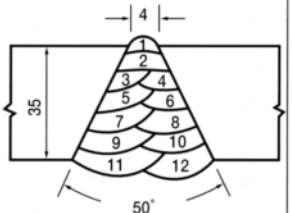
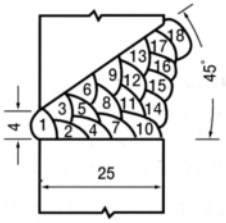
The integrity of welds depends greatly on how the welding consumables are used. In order to get the best welding results, care should be taken in the following ways.

(1) In flat butt welding the back-step technique should be used so as to get a deeper weld penetration. In horizontal and overhead position welding the straight-run technique should be used for better bead appearance.

(2) In vertical-down fillet welding the straight-run technique should be used at a faster welding speed in order to get a deeper weld penetration and to avoid slag inclusions.

(3) In horizontal fillet welding of primer-coated steel plates the welding speed should be lower than that for bare steel plates in order to prevent the porosity.

(4) In one-side welding of the root passes lower amperage and voltage should be used so as to avoid hot cracking. In case one-side welding is interrupted — the weld crater is remaining in the root of the-groove — the crater should be gouged off before being joined with a new bead. Gouging will remove the cracks and the shrinkage cavity that may have left in the bead's crater. Fig. 5 shows examples of welding procedures including those for one-side welding of the root passes.

Welding position	Plate thickness(mm), Joint preparation, and pass details	Welding parameters
Flat		Amp.and volt: 1st pass: 200A x 23V 2nd to cover pass: 280A x 29V Heat input: 1st pass: 15.2 kJ/cm 2nd to cover pass: Av. 22.6 kJ/cm
Vertical-up		Amp. and volt: 1st pass: 200A x 24V 2nd to cover pass: 230A x 26V Heat input: 1st pass: 29.6 kJ/cm 2nd to cover pass: Av. 27.7 kJ/cm
Horizontal		Amp. and volt: 1st pass: 200A x 23V 2nd to cover pass: 280A x 29V Heat input: 1st pass: 20.1 kJ/cm 2nd to cover pass: Av. 14.7kJ/cm

Note: (1) Wire size: 1.2 mmØ
(2) Shielding gas: 80%Ar+20%CO_2, 25 l/min
(3) Wire stick-out: 20-25 mm
(4) Power source polarity: DC-EP
(5) Type of base metal: ABS Gr. A32D
(6) Preheat temp: Room temp.
(7) Interpass temp: 100-150°C
(8) Backing material: FBB-3

Fig. 5 — Examples of welding procedures including those of one-side welding for the root passes using the FBB process

NC-36L

(AWS A5.4 E316L-16)

NC-36L is a matching electrode for welding 316L-type stainless steel. It can be used also for welding 316-type stainless steel, unless creep strength is a strict requirement at high temperature applications.

The Birth of NC-36L

NC-36L is the first stainless electrode developed by Kobe Steel. It was developed in 1952 when many fabricators in Japan were still using imported stainless electrodes. The brand name, NC-36L, was chosen as follows. N was for Nickel. C was for Chromium, 36 was coined from the applicable 316L-type stainless steel, and L was for low carbon.

Basic Characteristics of NC-36L

NC-36L is a lime-titania type, all-position electrode and is classified as AWS E316L-16. The suffix 16 designates that NC-36L is suitable for welding by both AC and DC-EP (electrode positive) polarity. The deposited metal is of a low-carbon (0.04% max.), 18%Cr-12%Ni-Mo type.

What NC-36L Offers

NC-36L offers:

(1) Lower susceptibility to hot cracking due to the properly controlled ferrite, lower phosphorus, and lower sulfur content in the deposited metal. Fig. 1 shows the typical amount of ferrite in the NC-36L deposited metal plotted in a DeLong diagram.

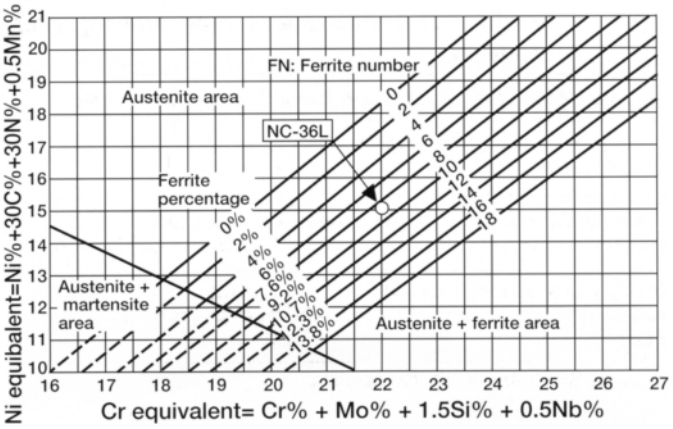


Fig. 1 — A DeLong diagram and a typical ferrite number of NC-36L deposited metal.

The ferrite precipitates while the molten weld metal solidifies. Fig. 2 shows the microstructure of a weld consisting of 316L-type base metal and NC-36L weld metal. It clearly shows the ferrite network structure precipitated in the austenite matrix of the weld metal. 316L-type base metal, however, does not contain ferrite to become a fully austenite structure. This ferrite network structure is effective at preventing the hot cracking that may take place in weld metal. However, excessive ferrite content has adverse effects, so it must be properly controlled.

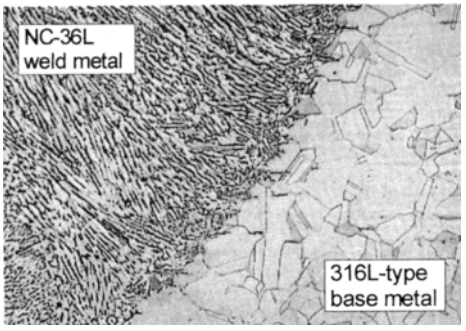


Fig. 2 — A microstructure of the weld consisting of 316L base metal and NC-36L weld metal (120x)

(2) Because of the sophisticated design of its chemical composition NC-36L weld metal features excellent resistibility against general-, intergranular-, and pitting corrosion. Table 1 shows corrosion test results of NC-36L deposited metal.

Table 1 — Corrosion test results of NC-36L deposited metal in as-welded (AW) and sensitizing treatment (SE) condition.

Type of corrosion and test method	Typical test results
General-corrosion by 5% diluted sulfuric acid test (JIS G0591), AW	Corrosion loss: 5g/m^2/h
Intergranular-corrosion by 65% nitric acid test (ASTM A262-C), AW	Corrosion rate: 0.00138 ipm (inch per month)
Intergranular-corrosion by copper sulfate, sulfuric acid test (ASTM A262-E), SE(1)	Bending test after corrosion test: No cracking

Note (1) SE: 650°C x 2h, Air cooling

(3) Stable tensile and impact strength of the deposited metal due to the properly controlled chemical composition.
(4) Suitability in the flat, horizontal, vertical, and overhead welding positions.

Fig. 3 — Cooling piping of the energy plants is one of the applications of NC-36L because of superior pitting corrosion resistibility against chloride ions.

Why NC-36L Has Lived So Long

Since it was launched in the markets, NC-36L has seen its features refined and its markets expanded. Kobe Steel pursues continual quality control so as to maintain the outstanding features of NC-36L produced in Japan and Thailand. This quality control is a key factor in the product's persistently high reputation, particularly in such specialty fields as the chemical, oil refinery, paper, and nuclear-power industries. In construction of the equipment for these industries the quality control is one of the most important keys to the success.

How to Use NC-36L

The choice of NC-36L can be the way to fulfill stricter requirements for ferrite content, corrosion resistibility, and mechanical properties. When you use NC-36L, however, the following instructions should be noted in order to get the best results.

(1) No preheating should be used when you weld 316L and 316-type stainless steel. Rather the interpass temperature should be kept at 150°C or lower. This is to minimize the heat-affected zone, and thereby to minimize weld decay or localized corrosion at the areas adjacent to the grain boundaries.
(2) Use proper welding currents. This is to minimize the electrode-burn caused by Joule's heat. The electrode-burn adversely affects usability and mechanical properties of the weld metal.
(3) Re-dry NC-36L at 150-200°C for 30-60 minutes before use when it picks up moisture. If an electrode picks up moisture the arc blow becomes stronger, which causes much spatter, irregular bead appearance, and undercut.

What the Ar/CO_2-Mixture Shielding Offers

In gas metal arc welding of mild steel and 490N/mm^2 high strength steel Ar/CO_2 mixtures are often used for gas shielding besides CO_2. The choice of shielding gas varies country by country and user by user. In Europe Ar/CO_2 mixtures are more popular, whereas in Japan CO_2 is the favorite. Machinery fabricators often use Ar/CO_2 mixtures, whereas steel structure fabricators prefer CO_2. The rest of this article discusses the characteristics of Ar/CO_2-mixture shielding in comparison with CO_2 shielding.

The most important useful characteristic of Ar/CO_2-mixtures, typically 80%Ar+20%CO_2, is their unique molten metal transfer mechanism. The Ar/CO_2-mixture shielding allows the molten metal transfer to occur through "spray transfer" at high welding currents. With CO_2 shielding, on the other hand, molten metal transfer at high welding currents occurs through "globular transfer" in the case of solid wires. Fig. 1 shows the difference between the two.

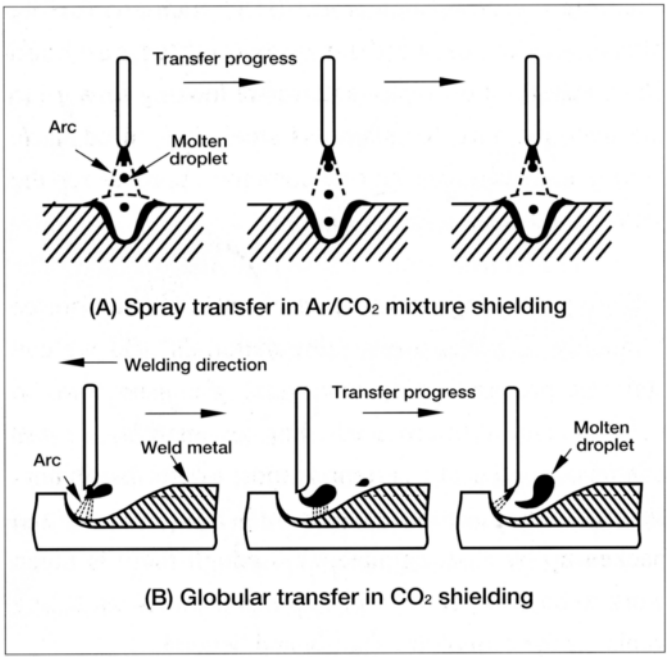
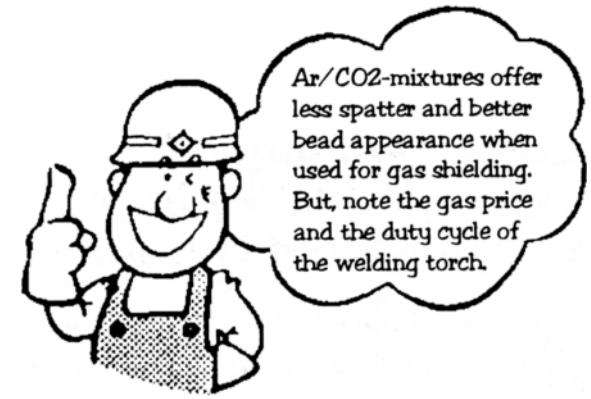
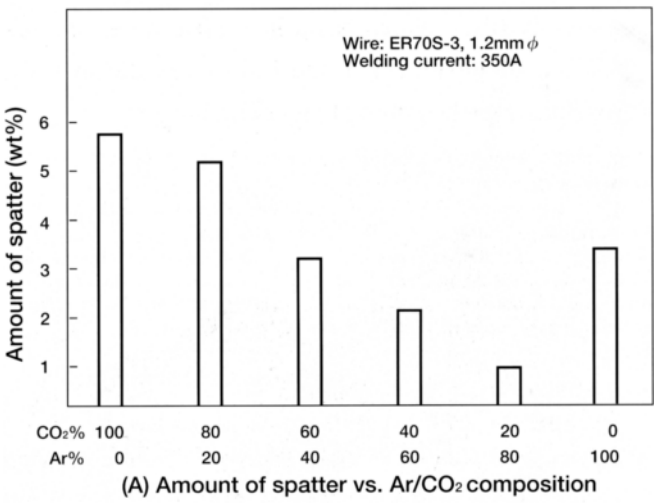


Fig. 1 — A comparison between Ar/CO_2 mixtures and CO_2 on the molten metal transfer mode in gas metal arc welding with solid wires.

Generally speaking, spray transfer reduces spatter, as a result, increases deposition efficiency (Fig. 2), and improves bead appearance and notch toughness of the weld metal.

In the case of flux-cored wires the type of molten metal transfer also depends, on any scale, on the characteristics of cored fluxes, though Ar/CO_2-mixture shielding provides smoother molten metal transfer through "spray transfer."





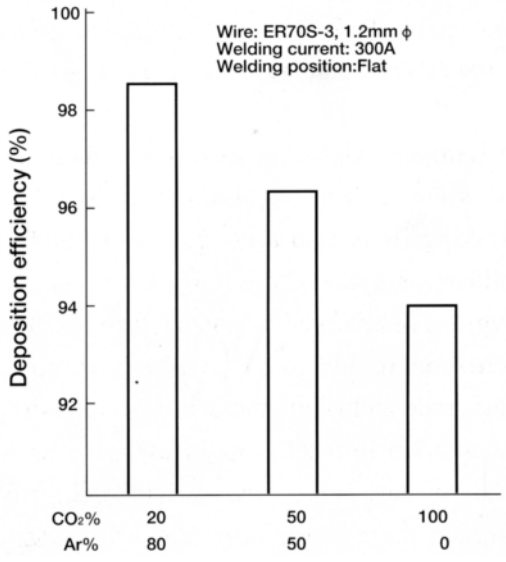
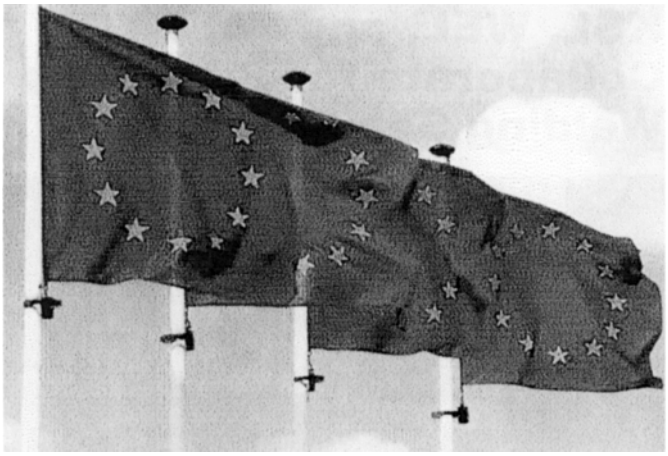


Fig. 2 — Effects of Ar/CO_2 composition on amount of spatter and deposition efficiency of solid wires.

Ar/CO_2-mixture shielding, however, causes a lower duty cycle of the welding torch because of more arc radiation heat than CO_2 shielding. And Ar/CO_2-mixtures may be more expensive.

Kobelco Welding of Europe b.v. (KWE) in an ever expanding Europe

When we refer to doing business in Europe we are mainly referring to those countries in Western and Northern Europe or at least those within the European Community (EC), which has a land area more than 8.7 times that of Japan. Since the fall of the Berlin wall. Europe has been becoming bigger and bigger.

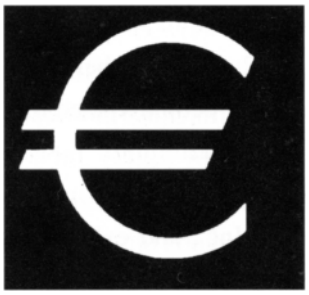


The EU flag fluttering in the wind of a New Year

The European Union's expansion to include Central and Eastern Europe and Cyprus is a historical undertaking. It is also an opportunity for Europe to consolidate its security, economy, culture and place in the world. An enlarged Union with over 100 million new citizens, to add to the present 370 million, will promote trade and economic activity and foster growth and integration in the European economy as a whole. Cultural diversity is a source of Europe's creativity and wealth, and the new Member States will augment the Union's role and influence on the international scene.

The signing of the Europe Agreements, which has the objective to establish a free-trade area by the year 2002, has been a great boost to trade. These agreements form the legal framework for association between the applicant countries and the European Union and cover their political and economic relations. Their objective is to provide an appropriate framework for the applicant countries' gradual integration into the community. The Europe Agreements have been concluded with Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, and Slovakia.

The agreement concluded with Slovenia in 19% has not yet been ratified. When these countries are included, the land area will be more than 11.6 times Japan's, which is over a 33% increase in size.



The EURO: a power of Europe

The introduction of the single currency, the EURO, in January 1999 as a legal currency for conducting business transactions, and, in January 2002, the banknotes and coins for use by everybody all over Europe will be a huge step forward for Europe.

Not only is Europe moving towards a common currency, it is also trying to standardize other things, which has its an effect on the welding world. For example the new Euro Norm (EN) standard for the classification of welding consumables has been completed for most types, and we are looking forward to the new standard for stainless steel flux cored wire, hoping that there can be one common approval for the welding industries.

KWE's on-going market research enables us to foresee trends towards the use of new materials, and we can start the preparation of new welding consumables to meet customers' future needs. For new markets we will continue to offer our current support to our distributors such as technical sales support by KWE personnel and backed up by KSL engineers. Although there is much work to be done, KWE will strive to meet its marketing goals for the turn of the century and beyond.

(Reporter: Robert Melvin, Technical Manager/ KWE)

Several Thousand Visitors Enjoy "Weld Expo Canada"

An international welding fair, "Weld Expo Canada," was held at the National Trade Center in Toronto from the 20th through 22nd of October 1998, during which time several thousand people visited the exhibition. 312 corporate exhibitors attended. Kobelco Welding of America Inc. (KWAI) attended in collaboration with Kanematsu Canada Inc., and exhibited such flux-cored wires as DW stainless series, FRONTIARC-711, and DWA-50, displayed weld bead samples and put on welding demonstrations. On the other hand, KWAI had CGP and TriNex, Kobelco's sales agents, and advertisement of Kobelco's welding consumables at their booths too. This fair was a good occasion to have high quality Kobelco welding consumables studied by many people in Canada, and we could increase our reputation among the users in Toronto.

Portuguese Kobelco Welding Brochures Work Well at CSMAQ 98" in Brazil

DW stainless series and FRONTIARC-711 attract the visitor's attention at the KSL-KWAI booth

An international machinery exhibition, CSMAQ '98, was held at the International Trade Mart in Sao Paulo from November 17th through the 20th in 1998. 138 corporate exhibitors attended, and the number of visitors reached to 3,500. Kobe Steel and KWAI collaborated in the exhibition. We decided to prepare Portuguese-language Kobelco welding brochures, expecting that a larger number of people would learn about our products. As a result, the brochures worked wonderfully, allowing the attendees to study carefully the high quality brands such as the DW stainless series and FRONTIARC-711, even in a machinery exhibition. Through this exhibition Kobelco welding consumables may become well reputed, not only in Brazil and also in South American countries.

Business Competitors, KSL, WEL, and TASETO, Collaborate for Singapore Welding Seminar

Kobelco booth attracts the visitor's attention

Weldtech Asia '98 (Singapore), an international welding exhibition, was held at Suntec Center in Singapore from the 2nd through the 4th of December 1998. 8,300 visitors enjoyed the fair. Kobe Steel (KSL) and Kobe Welding Singapore (KWS) are corporate exhibitors. DW stainless flux-cored wires, Cr-Mo electrodes, LB-52, and RB-26 were exhibited.

On December 3rd. the Singapore Welding Society (SWS) hosted a seminar focusing on stainless flux-cored wires. For this seminar, three competitors in the stainless welding consumable business, KSL, WEL, and TASETO joined together in making technical presentations. Mr. Watanabe, a researcher in KSL Technical Department, gave a technical presentation that was so interesting that the seminar room overflowed with audience members with no space to sit. The presentation was highly reputed, as was Kobelco's exhibition at the fair.

3000 Welders Attempt the 2nd Iwatani-Cup Welding Skill Contest Held in DaLian City in China

The Iwatani-Cup Welding Skill Contest, a Japan-China welding technology exchange meeting, was held in DaLian-city in China on October 20th 1998. This was the second time the contest was held since being commenced by Mr. Koji Saito, the chairman of Iwatani International Corporation, who is very eager to promote technical exchange between Japan and China.

For the first contest held in 1997, 8,000 welders attended the shielded metal arc welding and CO_2 arc welding competitions. As for the 1998 contest, a total of 3,000 pre-screened, higher-skill welders competed for the championship.

In DaLian-city, they have two DaLian shipyards (the new and old) which are leading heavy industries locally. Welders from the new shipyard shared many of the top spots in the 1997 contest. As for the '98 contest, however, the old shipyard's challengers placed in most of the higher ranks: nine of their welders won the prizes, being selected from among 100 welders who were ranked highest in the shielded metal arc welding and CO: arc welding competitions respectively.

For the CO_2 arc welding competition, in particular, the old shipyard's welders made a clean sweep of the first, second, and third prizes. The champion was Mr. Wang DeQing (posing at the center the photo) who is a fundamental-level welder with one-year job experience since his joining the old shipyard. "We could gain the winning of all of the prizes for the CO_2 arc welding competition due to excellent DW-100 flux-cored wire....We will also compete in the contest next year." said Mr. Qin, the deputy general manager of the old shipyard, who worked as the coach for the contest.

The winners for the CO_2 arc welding competition: the champion, Mr. Wang, is at the center

Editorial Postscript

It has been one year since the first issue of KOBELCO WELDING TODAY was published. What do you think of our journal? We will do our best, creating a useful, interesting magazine for you. In this issue, we have put a new column, called "KOBELCO PARTNERS," and totally changed the motif of the cover picture of this issue, hoping 1999 will be a happy, fruitful year.

From the 12th through 17th of February 1999 Weld India International 1999 Exhibition is schedule to be held in New Delhi. Kobe Steel, Ltd. will be a corporate exhibitor in collaboration with Nikko Boeki Kaisha Ltd. and Weldwell Speciality Pve. Ltd. We are looking forward to seeing you at the Kobelco booth there.

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JAPAN :
KOBE STEEL, LTD.Welding Division
International Operations Dept.
KOBELCO Bldg., 3-2Toyo 2-chome, Koto-ku, Tokyo 135-8381 JAPAN
Tel. (81)3 5634-5031 Fax. (81)3 5634-5047

EUROPE :
KOBELCO WELDING OF EUROPE B.V.
Eisterweg 8, 6422 PN, Heerlen, The Netherlands
Tel. (31)45-547-1111 Fax. (31)45-547-1100

USA :
KOBELCO WELDING OF AMERICA INC.
7478 Harwin Drive, Houston, Texas 77036, USA
Tel. (1)713 974-5774 Fax. (1)713 974-6543

KOREA :
KOBE WELDING OF KOREA CO., LTD.
21-14, Palryong-Dong, Changwon, Kyongnam, Republic of Korea
Tel.(82)551 292-6886 Fax.(82)551 292-7786

SINGAPORE :
KOBE WELDING (SINGAPORE) PTE. LTD.
20, Pandan Avenue, Jurong, Singapore 609387, Republic of Singapore
Tel.(65)2 68 27 11 Fax.(65)2 64 17 51

THAILAND :
THAI-KOBE WELDING CO., LTD.
500, Soi1, Bangpoo Industrial Estate, Sukhumvit Road, Praeksa, Samutprakarn 10280, Thailand
Tel.(66)2 324-05 88~91 Fax.(66)2 324-07 97

KOBE MIG WIRE (THAILAND) CO., LTD.
491, Soi 1, Bangpoo Industrial Estate, Sukhumvit Road, Praeksa Samutprakarn 10280, Thailand
Tel.(66)2 324-05 88~91 Fax.(66)2 324-07 97

MALAYSIA :
ST KOBE WELDING (MALAYSIA) SDN. BHD.
Plot 502, Jalan Perusahaan Baru, Kawasan Perusahaan Prai, 13600 Prai, Malaysia
Tel.(60)4-3905792 Fax.(60)4-3905827

INDONESIA :
P.T. INTAN PERTIWI INDUSTRI
(Technically-Collaborated Company)
Jalan P Jayakarta 45, Block A/27,
Jakarta 11110, Indonesia
Tel.(62)21-639-2608 Fax.(62)21-649-6081

PHILIPPINES :
WELDING RESOURCES INTERNATIONAL INC.
(INDUSTRIAL WELDING CORPORATION)
(Technically-Collaborated Company)
No. 10, R. Jacinto Street, Canumay, Valenzuela, Metro Manila, 1440, Philippines
Tel.(63)2-292-6968 Fax.(63)2-292-6974

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