KOBELCO WELDING TODAY

July 2000
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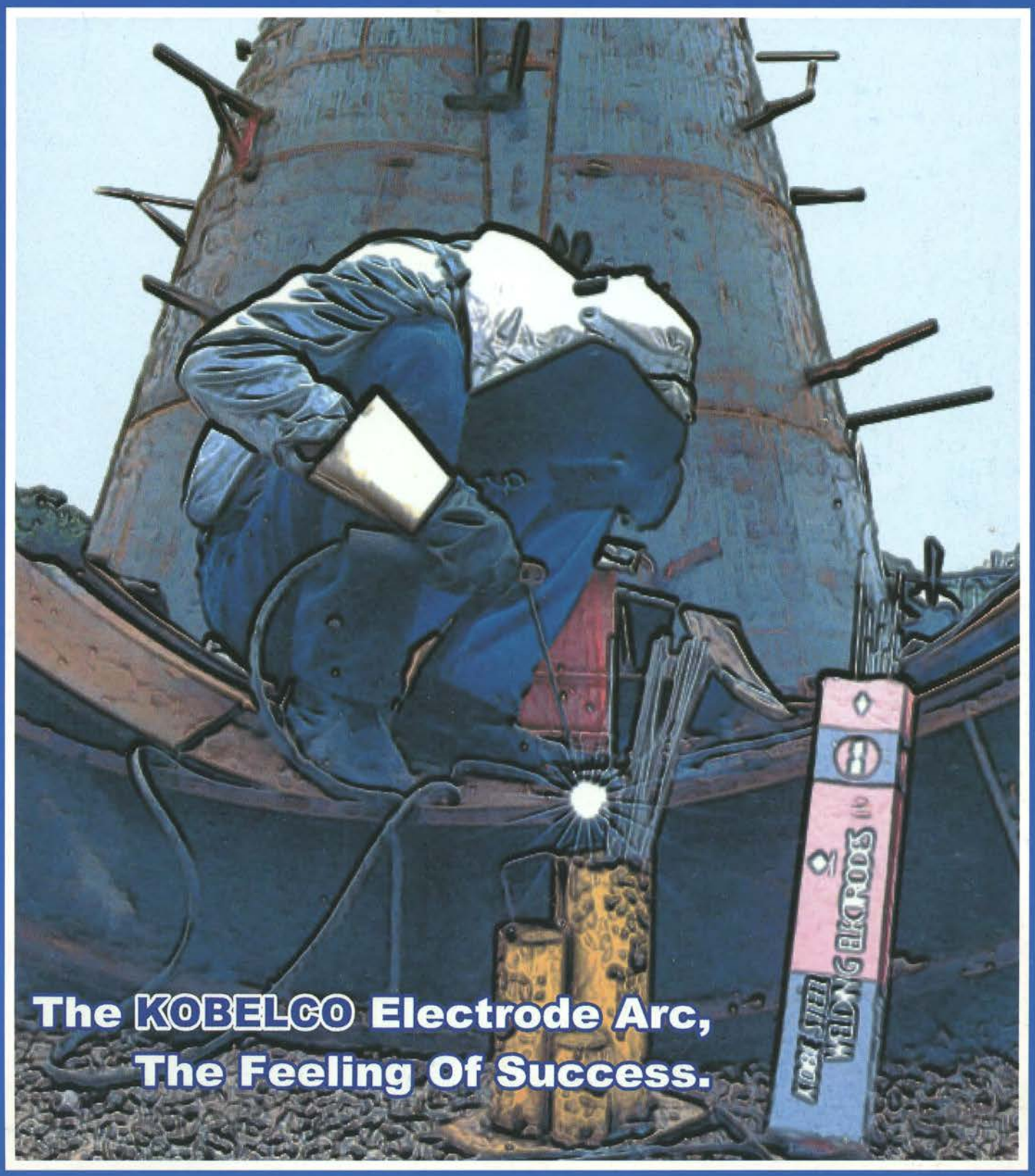
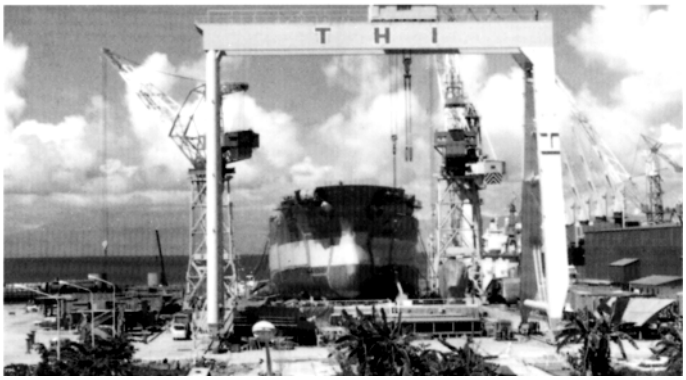


THI Cebu Shipyard Maintains High Japanese Quality with an International Quality System

Tsuneishi Heavy Industries (Cebu) Inc. (THI), the biggest shipyard in the Republic of the Philippines, was established in 1994 as a joint venture between Tsuneishi Shipbuilding Co., Ltd. of Japan and a Philippine conglomerate, Aboitiz. THI has adopted the similar fabrication processes as used in Tsuneishi Shipbuilding, Japan and the ships it builds are recognized as having the same quality as those built by the parent company. This high quality is consistently achieved by following the international quality assurance system ISO 9002, acquired in 1998.

The Welding Company of Kobe Steel has served THI from the very start of its operation. B-14 and LB-52 for shielded metal arc welding, US-36 and PFH-55E for submerged arc welding and DW-100 for flux-cored arc welding are main welding consumables used in the shipyard. More than 50 tons of Kobelco welding consumables are used per month, making THI the biggest customer for Kobe Steel in the Philippines. It is noticeable that over 50% of the welding consumables used here consist of DW-100. This is because they have employed this wire for many applications as possible.

Above: THI Cebu is located on Cebu Island, and is the biggest shipyard in the Philippines



Above: A slipway for building new ships

Left: Floating docks for ship repair

The THI Cebu shipyard is located about two hours by car over the hill from Cebu City, the central city of Cebu Island in the southern part of the country. The ships built here are bulk carriers ranging from 23,000 to 45,000 DWT. Since the start of operation, 12 ships have been delivered by continuous shipbuilding. The shipyard also is equipped with two floating repair docks for engaging in ship repair business, taking advantage of the location as the center of the commercial sea routes in Eastern Asia.

The application of the wire includes welding hull shell plates by using the FBB one-side welding process. The wire's superb usability and mechanical properties are highly appraised.

We wish to continue to be a good and useful supplier to THI by maintaining excellent technical and commercial services so that they will be more satisfied.

(Reported by T. Tanaka, GM,
Manila Office, Shinsho Corp.)

Message from the Editor

To our dearest readers of Kobelco Welding Today: Hall a year has quickly passed since we hailed the Year 2000 with you as a turning point to a new era. The business environment surrounding our welding industry is undergoing a rapid transformation. In various parts of the world, big businesses are busing other companies or merging. Huge amounts of money are invested to create gigantic enterprises called "mega-companies."

However, we Kobelco Welding Group will follow our own management philosophy that places the interest of the customers and shareholders before every thing else. For this end, we are firmly determined to unwaveringly continue investment in the fields of manufacturing facility, research and development and human resources.

I am convinced that, in the 21st century, welding technology will achieve further development along with technical innovation in base metals as seen in the development of enhanced high strength steel. As a manufacturer, we will go on with research for new welding consumables and development of new welding procedures worthy of the new era. Thus, we will continue our efforts to keep on supplying welding consumables and related goods that will satisfy our customers.

I wish all the dearest readers, their family and friends every piece of luck and prosperity.

Tetsuo (Tom) Konohira
Editorial Chairman

General Manager

International Operations Department

Welding Company
Kobe Steel, Ltd.

Contents

KOBELCO PARTNERS

Sri Siam Mongkol (SSM) was established in 1976: we have been engaged in the welding electrodes business as a partner of Thai-Kobe Welding since 1985. SSM is among the first registered Authorized Distributors (AD) of the Thai Shinyokai Sales Network since it was introduced to the Thai market one decade ago. As the Network is continually growing and providing a competitive challenge, we have been able to build up good relationships with all the Shinyokai members by achieving the marketing targets of Thai-Kobe. With operative marketing and good team-based management, the Shinyokai's competencies will be achieved in the coming era of globalization.

SRI SIAM MONGKOL CO., LTD., Preecha Hemapanpairo, MD

Technical Report

MG-50

(AWS A5.18 ER70S-G)

MG-50 is one of the most popular solid wires for gas metal arc welding of mid- and heavy-thick mild steel and 490N/mm^2-class high strength steel with CO_2 shielding. Steel structures, construction machinery, and industrial machinery are typical applications of MG-50.

A Stable Arc at High Currents

A stable arc at high currents is the most important feature of MG-50. If a general solid wire is used at high currents with CO_2 shielding, it may generate much spatter, undercut and irregular bead appearance because of an unstable arc or irregular transfer of molten metal in large drops from the tip of the solid wire across the arc. In contrast, MG-50 generates less spatter and undercut with smoother bead appearance due to smoother molten metal transfer in smaller drops, even though the transfer mode is of globular transfer. This is owing to the specific chemical elements contained in MG-50 — a small amount of titanium in particular plays such an important role.

Wide Bands of Welding Currents and Arc Voltage

MG-50 performs over wide bands of welding currents and arc voltage, exhibiting the excellent arc stability. Figure 1 shows the proper current and voltage ranges for 1.2- and l.6-mmØ wire.

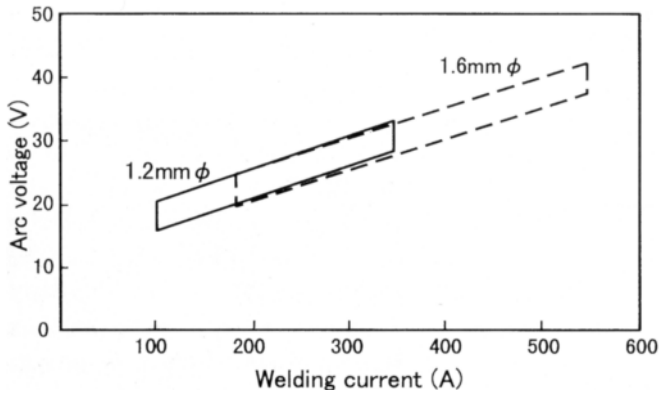


Fig. 1 — Proper ranges of welding currents and arc voltage for MG-50 (1.2 mmØ, 1.6 mmØ)

High Deposition Rates Contribute to High Welding Speeds

The use of a higher current produces a higher deposition rate, as in Fig. 2, thereby increasing welding speeds, which can decrease welding costs. This is the most important benefit of MG-50 derived from its outstanding usability at high currents in flat and horizontal fillet positions. However, to ensure the minimum tensile strength of 490N/mm^2, the procedure should be controlled with heat input of 30 kJ/cm max and pass-to-pass intervals causing a interpass temperature of 250°C max.

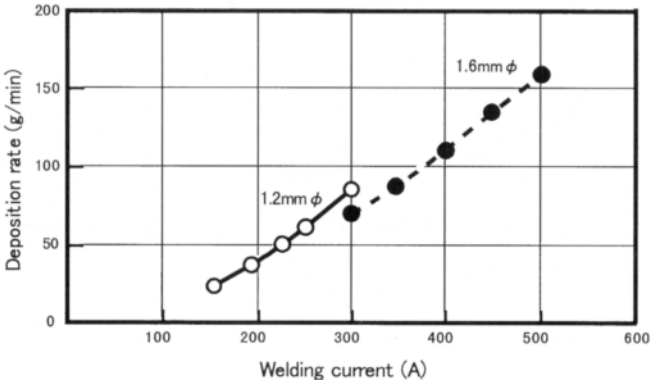


Fig. 2 — Deposition rates of MG-50 (wire extension: 15 mm for 1.2 mmØ; 20 mm for 1.6 mmØ)

Good Wire-Feeding and Seam-Tracking Minimize Downtime in Robotic Welding

The smooth surface and consistent cast and helix of MG-50 ensure smooth wire-feeding and seam-tracking along welding lines, thereby minimizing downtime in robotic welding and other automatic welding processes. Because of such invaluable characteristics, MG-50 has earned a consistent reputation from users as in the steel structure, construction machinery and industrial machinery industries.

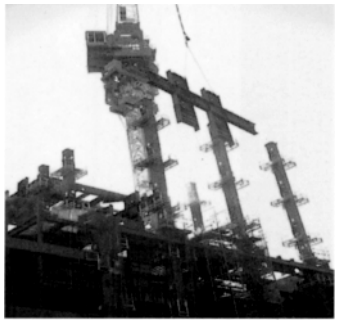


Fig. 3 — MG-50 maintains a persistently high reputation in the steel structure industry

MG-51T

(AWS A5.18 ER70S-6)

MG-51T: No. l solid wire for gas metal arc welding in autos, motorcycles, containers and other sheet metal products. MG-51T uses either CO_2 or Ar+CO_2 shielding in all position welding.

Steady Short-Circuiting at Low Currents

Steady short-circuiting at low currents is the most valuable feature of MG-51T. If a general solid wire is used at low currents it may generate much spatter, undercut and irregular bead appearance due to unsteady short-circuiting in the molten metal transfer. In contrast, MG-51T offers low spatter and undercut generation with uniform bead appearance because of consistent short-circuiting transfer of molten droplets between the tip of the wire and the molten pool. This outstanding feature is derived from the sophisticated design of chemical composition and consistent quality surface of MG-5 1T.

How to Create Steady Short-Circuiting

Selection of proper welding currents and arc voltage is essential for creating a steady short circuiting arc, thereby facilitating all-position welding with MG-51T — Fig. 1

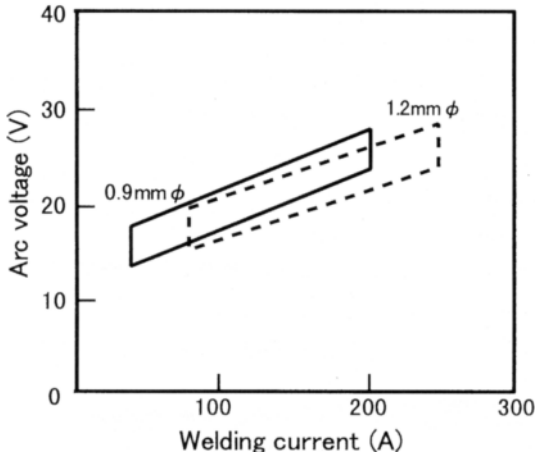


Fig. 1 — Proper ranges of welding currents and arc voltage for MG-51T (0.9 mmØ, 1.2 mmØ)

How to Adjust Weld Penetration

It is important to control weld penetration in welding sheet metals, because burn through (excessive melt-through) often results in damaged welds. Although an excessive root opening and joint misalignment can also cause burn through, an excessive welding current is more often the case. Figure 2 shows how to control weld penetration in relation to welding currents.

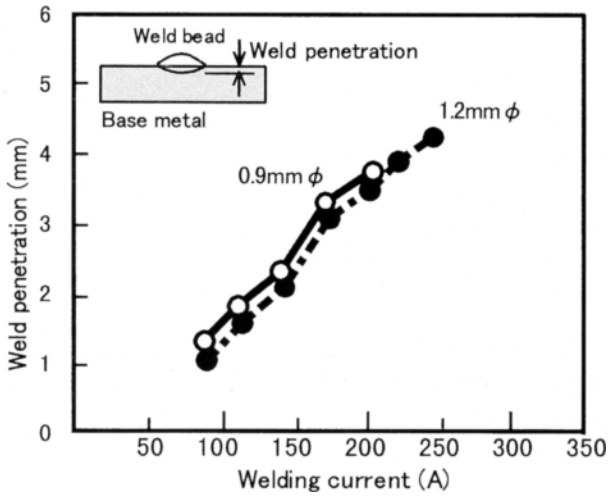


Fig. 2 — Weld penetration of MG-51T as a function of welding currents with a short circuiting arc

Outstanding Wire-Feeding and Seam-Tracking Contribute to an Increase of Welding Efficiency

The smooth surface and consistent cast and helix of" MG-51T provides steady wire-feeding through liners and tips and exact seam-tracking along welding lines, which can decrease downtime for higher welding efficiency in semi-automatic and automatic welding. Due to such benefits, MG-51T has seen the market expand in the auto, motorcycle, container and other sheet metal industries.

Fig. 3 — MG-51T is one of the most popular solid wires in the motorcycle industry

LB-62L

(AWS A5.5 E8016-C1)

LB-62L: the best choice for welding ASTM A537 Cl-2 or other equivalent type of steel for low-temperature service. LPG spherical tanks are typical applications of LB-62L.

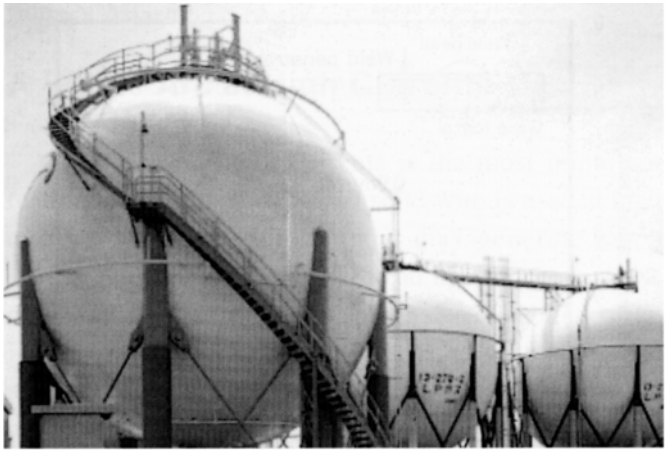


Fig. 1 — Some types of LPG storage tanks use ASTM A537 Cl-2 steel having a minimum tensile strength of 550N/mm^2, and LB-62L is one of the most suitable covered electrodes for this steel.

Steady Notch Toughness and Tensile Strength Are Dependable Characteristics of LB-62L

Notch toughness is one of the most important qualities of materials used in low-temperature equipment because it offers resistance against brittle fractures under severe service conditions. Weld notch toughness, however, is commonly affected by variables encountered in welding: heat input, plate thickness, cooling speed, welding position and postweld heat treatment.

LB-62L ensures sufficient notch toughness at low temperatures down to minus 60°C over a wide range of such variables. Figure 2 shows Charpy impact absorbed energies of the weld metal as a function of heat input. The test results show a slight decrease with an increase of heat input. However, the weld metal maintains an adequate level of absorbed energy over the range of heat input.

Figure 3 shows how the strength of the weld metal depends on the cooling speed in welding. Both the tensile strength and 0.2% proof strength are prone to decrease little by little as the cooling speed decreases.

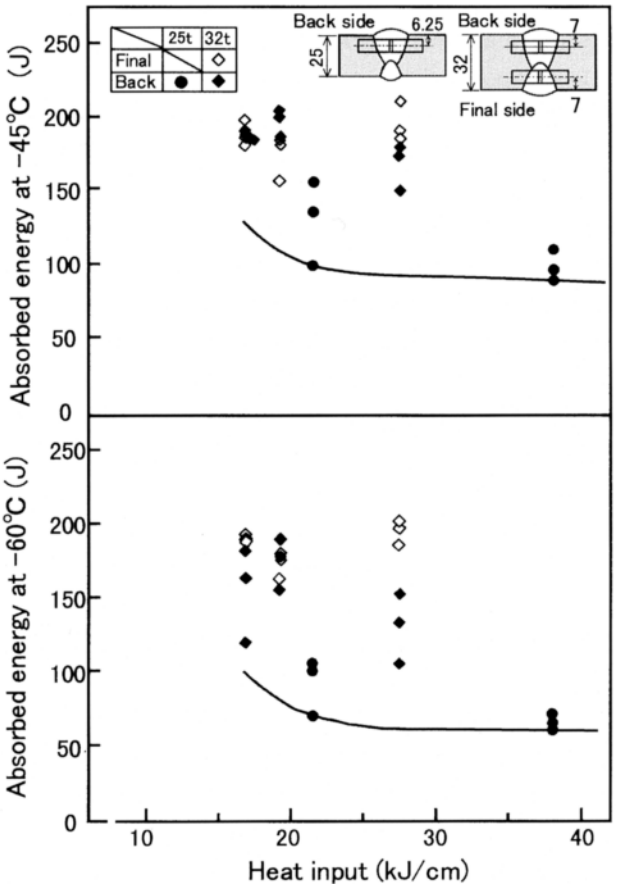


Fig. 2 — Impact absorbed energies of LB-62L (4.0Ø) weld metal as a function of heat input in welding double-V groove joints in flat, horizontal and vertical-up positions. (As-weld; Power source: AC)

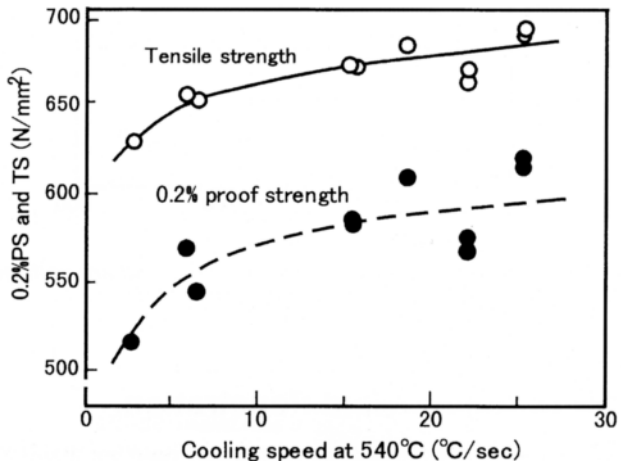


Fig. 3 — Strength of LB-62L (4.0Ø) weld metal vs. cooling speed (As-weld; Power source: AC)

Table 1 shows the plate thickness and heat input corresponding to the cooling speeds shown in Fig. 3.

Table 1 — Welding conditions

Cooling speed at 540°C (°C/sec)	Plate thickness (mm)	Average heat input (kJ/cm)	Welding position
2.8	12	26.6	Vertical up
5.9	25	38.0	Vertical up
6.4	12	17.4	Flat
15.3	32	27.4	Vertical up
18.4	25	21.5	Flat
22.0	32	19.2	Flat
25.2	32	16.8	Horizontal

Note: No preheating.

In general, cooling speed decreases in use of a thinner base metal or a higher interpass temperature when the heat input is kept constant. Therefore, in order to attain targeted weld quality, heat input and interpass temperature should properly be controlled according to the thickness of base metal in use and required qualities for the weld.

LB-62L Maintains Adequate Tensile Strength Over Extended PWHT

Some weld joints where residual stresses are prone to concentrate (e.g. a crown plate to nozzle weld joint of a spherical tank) require postweld heat treatment (PWHT). As usual with ferritic weld metal, the strength of LB-62L weld metal decreases as PWHT temperature and soaking time increase. However, LB-62L weld metal maintains adequate tensile strength over the minimum tensile strength (550N/mm^2) of A537 Cl-2 steel even after extended PWHT as shown in Fig. 4. In addition, some types of weld metal lose notch toughness due to embrittlement caused by PWHT. LB-62L weld metal, however, maintains adequate notch toughness even after PWHT as shown in Fig. 5.

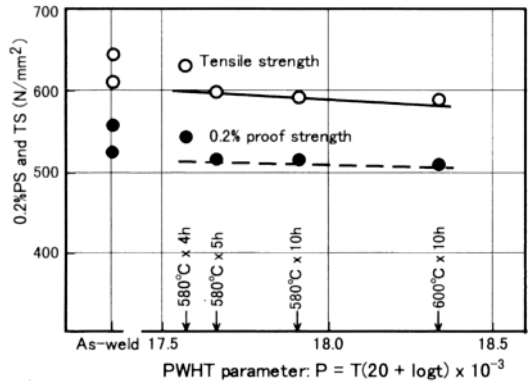


Fig. 4 — Strength of LB-62L (5.0Ø) all-deposited metal vs. PWHT parameter (Power source: DC-EP, Heat input: av. 19 kJ/cm, Welding position: flat)

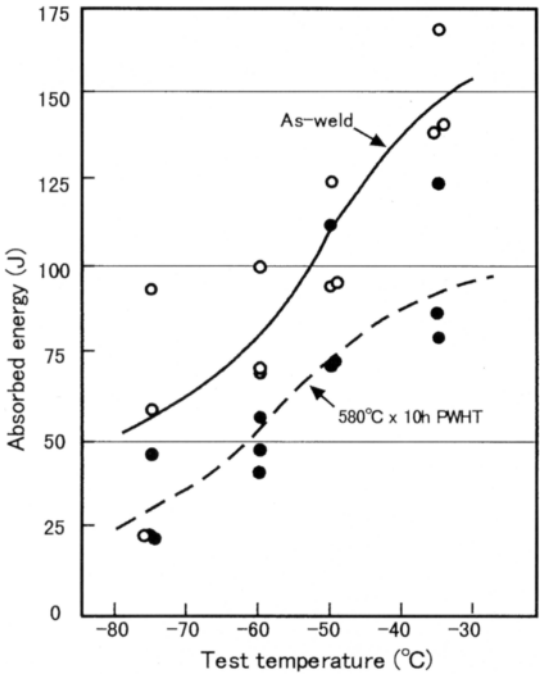


Fig. 5 — The effect of postweld heat treatment on impact absorbed energy of LB-62L (4.0Ø) weld metal (Power source: DC-EP, Heat input: av. 38.7 kJ/cm, Welding position: Vertical up, Base metal: A537 Cl-2, Groove preparation: double V)

LB-62L Offers Extra-Low Hydrogen and Moisture Resistant Characteristics

LB-62L offers extra-low hydrogen weld metal, which decreases the preheating temperature needed for preventing cold cracking. In addition, LB-62L picks up less moisture due to its moisture resistant coating compared with conventional low-hydrogen electrodes — Fig. 6. Such outstanding features can make quality control easier and more economical by reducing the costs for preheating the work and redrying the electrode.

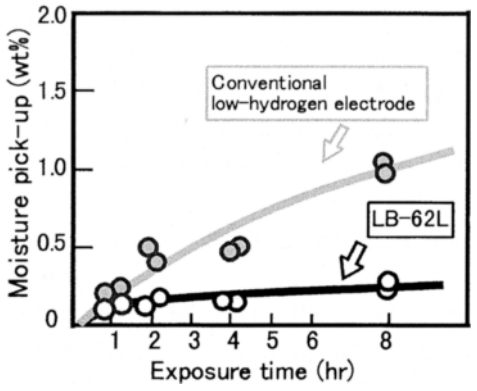


Fig. 6 — Test results of LB-62L and a conventional low-hydrogen electrode on moisture pick-up under the controlled atmosphere: 30°C x 80%RH.

Spray Transfer Arc: Advantages and limitations

In gas metal arc welding (GMAW), the many varieties of shielding gases, welding wires, and power sources result in three different modes of metal transfer across the arc. These modes are known as spray, globular, and short-circuiting. Figure 1 shows differences between the three metal transfer modes. Each mode of metal transfer has specific advantages and limitations.

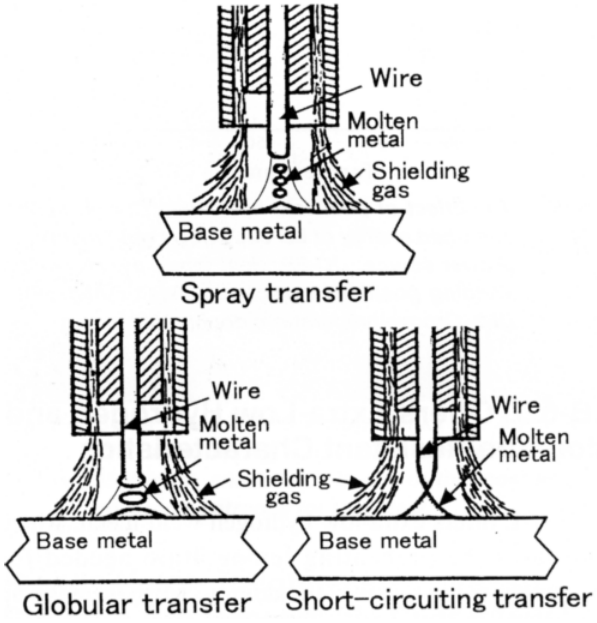
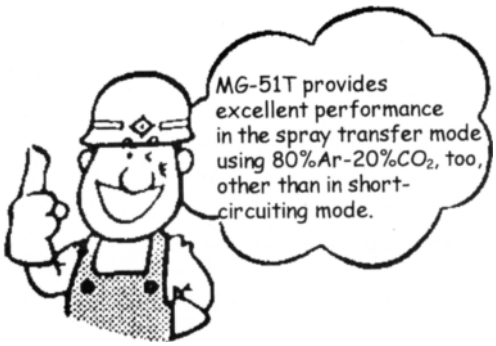


Fig. 1 — Three major molten metal transfer modes in gas metal arc welding with solid wires



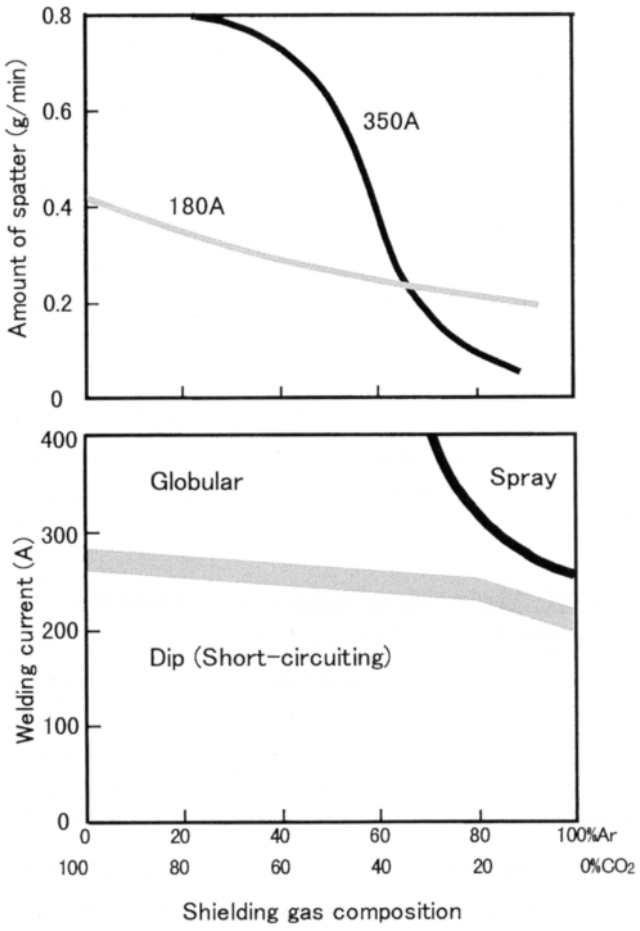


Fig. 2 — Molten metal transfer modes and amount of spatter in conventional GMAW with a solid wire. (Source: Welding Journal)

As shown in Fig. 2, a spray transfer arc requires relatively high welding currents (higher than the "transition current" or "critical current" related to the wire diameter). Argon or argon-rich gas mixtures (e.g. 80%Ar+20%CO_2) are necessary for shielding the spray arc. The spray transfer mode results in a highly directed, stable stream of discrete drops and is essentially spatter free.

The high arc energy associated with the spray transfer arc is not suitable for joining sheet metal due to burn through or for welding steels in the vertical or overhead positions because of molten metal extrusion. It is, therefore, used extensively for flat position welding of various metals and alloys.

The work thickness and welding position limitations of the spray transfer arc have been largely overcome with specially designed power sources. These power sources produce controlled waveforms and frequencies that pulse the welding current. During this pulse, one or more drops are formed and transferred. By reducing the average arc energy and the wire-melting rate, the pulsing makes the desirable features of spray transfer available for joining sheet metals and welding thick metals in all positions.

A New Edition/Addenda of ASME Code Affects the AWS Classification for Kobelco Welding Consumables

Construction of boilers, pressure vessels and piping systems is often carried out under strict regulations (Boiler and Pressure Vessel Code) set forth by the American Society for Mechanical Engineers (ASME). The ASME Code consists of a set of sections including Sec. II Part C (Material Specifications — Welding Consumables), which is a group of specifications for various acceptable welding consumables and brazing filler metals. Many of these specifications are identical to and have the same numerical designation as AWS specifications.

A new edition/addenda of ASME Sec. II Part C (1998 Edition and 1999 Addenda) was published as of July 1, 1999, adopting the AWS standards shown in Table 1. In order to keep the conformity with the new edition and addenda of the ASME Code, Kobe Steel has changed the AWS designations of the brands of welding consumables categorized in A5.11, A5.14, A5.17, A5.23, A5.25, and A5.29 as shown in Table 2.

Table 1. AWS standards adopted by ASME Sec. II Part C 1998 edition and 1999 addenda

ANSI/AWS A 5.11/A5.11M-1997	Specification for Nickel and Nickel-Alloy Welding Electrodes for Shielded Metal Arc Welding
ANSI/AWS A5.14/A5.14M-1997	Specification for Nickel and Nickel-Alloy Bare Welding Electrodes and Rods
ANSI/AWS A5.17/A5.17M-1997	Specification for Carbon Steel Electrodes and Fluxes for Submerged Arc Welding
ANSI/AWS A5.23/A5.23M-1997	Specification for Low-Alloy Steel Electrodes and Fluxes for Submerged Arc Welding
ANSI/AWS A5.25/A5.25M-1997	Specification for Carbon and Low-Alloy Steel Electrodes and Fluxes for Electroslag Welding
ANSI/AWS A5.26/A5.26M-1997	Specification for Carbon and Low-Alloy Steel Electrodes for Electrogas Welding
ANSI/AWS A5.29-1998	Specification for Low-Alloy Steel Electrodes for Flux-Cored Arc Welding

(Note: A5.xx: US customary unit; A5.xxM: SI unit)

Table 2. New AWS classification for the brands affected by the new edition/addenda of ASME

Brand	Old classification	New classification
Covered electrode		
NIC-70E	—	AWS A5.11 ENiCrFe-9
NIC-70S	—	AWS A5.11 ENiCrFe-9
NIC-1S	—	AWS A5.11 ENiMo-8
TIG wire		
TGS-709S	—	AWS A5.14 ERNiMo-8
SAW consumable		
US-709S	—	AWS A5.14 ERNiMo-8
G-80/US-511	AWS A5.23 F9PZ-EG-B2	AWS A5.23 F7PZ-EG-B2
MF-29A/US-511	AWS A5.23 F9PZ-EG-B2	AWS A5.23 F7PZ-EG-B2
MF-200N/US-511N	AWS A5.23 F9PZ-EG-B2	AWS A5.23 F7P0-EG-B2
MF-29N/US-511N	AWS A5.23 F10PZ-EG-B2	AWS A5.23 F8P2-EG-B2
PF-200/US-511N	AWS A5.23 F9PZ-EG-B2	AWS A5.23 F8P2-EG-B2
PF-200S/US-505	—	AWS A5.23 F8PZ-EG-B8
PF-200S/US-9Cb	—	AWS A5.23 F10PZ-EG-G
Flux-cored wire		
DWA-55L	AWS A5.29 E80T1-K2	AWS A5.29 E81T1-K2M
DW-55LSR	AWS A5.29 E80T1-K2	AWS A5.29 E81T1-K2
DW-55L	AWS A5.29 E80T1-K2	AWS A5.29 E81T1-K2
DWA-55LSR	AWS A5.29 E81T1-Ni1	AWS A5.29 E81T1-Ni1M
MXA-55T	AWS A5.29 E80T1-K2	AWS A5.29 E81T1-K2M
DW-60W	AWS A5.29 E80T1-W	AWS A5.29 E81T1-W2
MX-60W	AWS A5.29 E80T1 -W	AWS A5.29 E80T1-W2
DW-588	AWS A5.29 E80T1 -W	AWS A5.29 E81T1-W2

Feature Article

Kobelco in the AWS Welding Show Attracts over 20,000 Visitors

The 47th Annual International Welding and Fabricating Exposition and the 81st AWS Annual Convention was held at McCormick Place in downtown Chicago, Illinois. This annual exposition is also known as the AWS Welding Show and is one of the largest welding events in the world. Kobelco Welding of America (KWAI) was one of 617 exhibitors there, attending from April 26 to the 28th.

KWAI's booth seemed to attract a lot of visitors who came looking for innovative Kobelco welding wires as well as technical assistance on welding consumables and welding procedures. KWAI emphasized Kobelco flux cored wires, which offer high welding efficiency and superior weldability, by demonstrating the wires in the demo booth. KWAI exhibited new products, including DW-50, classified as AWS A5.20 E71T-1, which offers better weldability in vertical up positions. DW-329AP is another highlight, as a special flux-cored wire for duplex stainless steel, offering excellent weldability in all-position welding. This welding show was a valuable occasion for the KWAI Chicago Sales Office to promote its business in the Midwest.

At this occasion, KWAI also held a reception for the Kobelco Welding Association (KWA), inviting almost 100 members and customers to celebrate its 10th anniversary.

With hearty welcome and skillful demos, the KWAI booth attracted many visitors during the welding fair.

At the ceremony, Tom Konohira (Chairman, KWAI), Duke Kawaue (President, KWAI), Bryan Willingham (President, BMS) and Jack Barton (General Manager, Koike Aronson) lined up on stage to kick off the party. The party began with "Kagami-Wari," a traditional ceremony, in which a few executives break open a barrel of Sake (a Japanese traditional wine) with wooden mallets. After the lid is cracked, the Sake is shared by everyone at the party. Following some executives' witty remarks, everyone toasted a KWA's prosperous future. With satisfaction or disappointment of attendees, door prizes (including Poke-mon cards) were passed out. A live band provided music and a good time was had by the entire group at the party.

It has been over 40 years since a Kobelco welding consumable was first launched on the North American market. KSL's steady business expansion in the market led to the establishment of KWAI in Houston 10 years ago in order to provide better service for increasing customers. KWAI is forging ahead, targeting increased business progress in the new decade. Looking forward to meeting you at the next AWS Welding Show in Cleveland, Ohio in 2001.

Reported by
Y. Nakai, KSL

With a Fresh Exhibition, Kobelco Attracts Numerous Visitors in the Welding Show 2000

The Japan International Welding Show 2000 opened at INTEX OSAKA on April 12 and ran through April 15. Perhaps reflecting the economic recession still dragging on in Asia, the Show did not attract a high turnout: 115 exhibitors in and out of Japan and 52,000 visitors during the tour days. Both figures are lower than those attained at the last Show held in Tokyo in 1998.

The main theme of the Show this time was "The Advanced Welding and Joining Technology Opens the Door to the 21st Century — Let's Think of the Fundamentals of Production." Kobe Steel, in the role of a welding industry leader, took part in the Show with the slogan of "KOBELCO'S TECHNOLOGY SPARKLES IN THE 21ST CENTURY." Highlights from the field of welding consumables included advanced flux-cored wires and solid wires for gas metal arc welding. These include the DW-BF Series (a group of flux-cored wires that facilitate 10mm-leg-length horizontal fillet welds in one pass welding), MG-55 and MX-55 (a solid wire and flux-cored wire offering good mechanical properties in welding with high heat input and interpass temperatures). These wires contribute to the improvement of welding efficiency and reduction of the total fabrication cost.

As indicated in the Kobelco-Group's business slogan of QTQ (Quality Products, Technical Support, Quick Delivery), we are determined to pursue CS (Customer Satisfaction) in order to make constant contributions to our clients in the new century. The next Japan International Welding Show will be held in Tokyo in April 2002, when World Cup Football will be hosted by Japan. We give you a hearty welcome in advance.

Top: Attractive technical presentation using visual aids and a welding robot on the main stage
Bottom: Business talk and technical service corners

Reported by **D. Hino**, KSL

Editorial Postscript

The DW-BF Series consists of four different brands (DW-50BF, DW-60BF, DW-50WBF, and DW-60WBF) suitable for one-pass large-leg fillet welding of high strength steel and atmospheric corrosion resisting steel respectively, particularly in bridge construction.

MG-55 and MX-55 ensure the minimum tensile strength of 490N/mm^2 in high efficient welding using high heat input of 40 kJ/cm max and less pass-to-pass intervals with a maximum interpass temperature of 350°C.

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