KOBELCO WELDING TODAY

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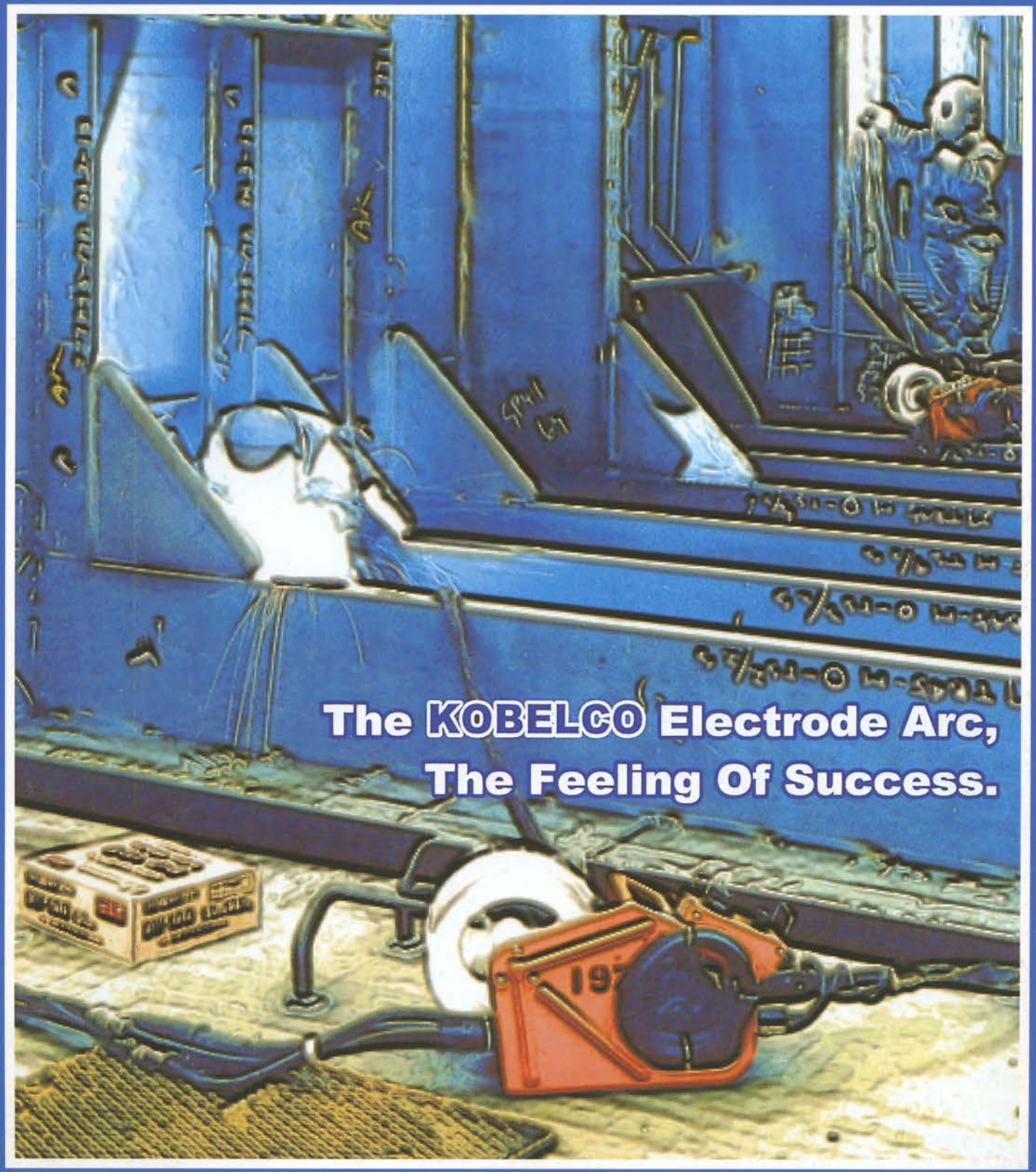


A Track Record of Innovation in Engineering Has Put SSE on the Map of International Prominence.

Sime Semcorp Engineering Sdn. Bhd. (SSE) is a preeminent fabricator in the Malaysian oil and gas industry. Their extensive capability integrates their size, worldwide networks and highly specialized know-how with a broad range of activities. "Efficiency" is the keystone of their activities including engineering, procurement, fabrication and construction of modules, jackets, heliport decks, pressure vessels and engineering plants.

SSE has built their organization with muscle and drive to uncompromising standards, placing emphasis on reliability, quality assurance and commitment. The spirit of excellence that has guided SSE since its inception in 1983 is based on dedication and is combined with expertise from their two corporate partners. SSE is a joint venture between Sime Darby Bhd, one of the largest multinational corporations in Southeast Asia, and Semcorp Engineering Pte Ltd., one of Singapore's premier engineering companies.

SSE's two yards in Pasir Gudang and Teluk Ramunia are fully equipped with the latest technologies.

Pasir Gudang

The Pasir Gudang yard totals 45 acres in size, providing a covered fabrication area, auto-blast workshop and loaded-out wharves of up to l0,000 MT capacity. Key equipment include crawler and mobile cranes, automatic submerged arc welding machines, horizontal plate rolling machines and material handling equipment.

Teluk Ramunia

This 80-acre site is equipped with a fabrication shop, a yard powerhouse building, skid-ways and wharves of up to 11,000 MT capacity.

With a high level of skill and competence in carrying out their work, we are honored that Kobe Steel's welding product is one of their approved consumables. The main welding consumables they use are LB-52U (an E7016 electrode for one-side welding) and LB-52NS (an E7016-G electrode for low-temperature uses). These covered electrodes are used for their extensive work involving in integrated modules, jackets and production and facilities platforms.

A birds-eye view of the Pasir Gudang yard having a 45-acre site equipped with SSE's state-of-the-art technologies

A birds-eye view of the Teluk Ramunia yard with SSE's sophisticated equipment in a 80-acre site

In addition to these two types of electrodes, other types of KOBELCO welding consumables are also used in their operations.

We are proud of being associated with SSE and looking forward to maintaining an ever better and continuous business relationship.

Reported By **T. Hoashi**,
Sales Manager,
Shinsho (Malaysia) Sdn. Bhd.

Message from the Editor

To our dearest readers of Kobelco Welding Today: How did you spend your summer holidays this year? This summer's heat in Japan has been extreme, and is continuing now in September as if we were in a tropical zone. On the other hand, in Thailand and Singapore, where we have manufacturing and sales subsidiaries, there is no clear distinction between the dry and rainy seasons this year. Squalls peculiar to tropical climate have given way to drizzling rain that continues all day long. Though I am not a meteorologist, it seems to me that global warming has triggered these abnormal phenomena world over.

In our welding industry, too, such tasks as global environmental conservation and improvement of the welding operational environment are gaining in importance. We, The Welding Company of Kobe Steel, have been doing research and development in welding consumables with a view toward improving the environment. It is incumbent upon us to provide a pleasant working environment to our readers who are engaged in welding-related jobs and to protect this wonderful Earth. With this mission in mind, we will try to further develop ecologically oriented products toward the 21st century. These new products will be introduced in future issues of Kobelco Welding Today.

Let me wish all the dearest readers happiness and prosperity.

Tetsuo (Tom) Konohira
Editorial Chairman

General Manager

International Operations Department

Welding Company Kobe Steel, Ltd.

Contents

KOBELCO PARTNERS

C.V. Echo was founded in 1970. We have had an excellent relationship with Kobe Mig Wire Thailand (KMWT) since 1992. Thanks to the good quality of the products and continuous support extended by KMWT in both supply of products and technical development, we are pleased that KMWT now enjoys over 60% share of the wire market in Indonesia. We will continue to enhance aspects of management expertise towards more efficient marketing strategies in welcoming the era of globalization.

C.V. Echo, Arief Effendi, Executive Director

DW-55E

(AWS A5.20 E71T-9J)

Excellent low-temperature notch toughness at down to minus 40°C enables DW-55E flux-cored wire to be more versatile in application. Offshore structures and ships are typical applications for this all-position rutile cored wire.

Fig. 1 — Offshore structures require strict notch toughness in order to endure operations in harsh weather and roaring waves.

DW-55E Is More than Equal to Conventional Wires

DW-55E is classified as E71T-9J. The last digit, J, of the AWS classification designates this wire as meeting the optional requirements for improved toughness with 27J at minus 40°C. Conventional E71T-9 wires meet only the requirements of 27J at minus 20°C.

Beyond the matter of the AWS classification, the excellent notch toughness of DW-55E has been proven in production weld joints, too. Table 1 shows impact test results of the weld metal of this wire welded with butt joints in several welding positions. As shown in the table, the results are sufficiently high, although the impact energies are affected by welding position (or heat input) and specimen removal location (or microstructure) at both testing temperatures.

Table 1 — Charpy impact absorbed energies (J) of as-welded DW-55E weld metals in all-position welding of NK-grade (KL33) aluminum-killed steel

Welding position (1)	Specimen location (2)	Testing temperature (°C)	
		–20°C	–40°C
Flat, Heat Input: 18 kJ/cm	Face	143,160,100 (Av. 134)	103,116,95 (Av. 105)
	Root	70, 90, 79 (Av. 80)	32, 42, 54 (Av. 43)
Horizontal, Heat Input: 13 kJ/cm	Face	150,155,149 (Av. 151)	130,122,84 (Av. 112)
	Root	121,122,106 (Av. 116)	84,63,106 (Av. 84)
Vertical-up, Heat Input: 22 kJ/cm	Face	126,124,120 (Av. 123)	110,90,95 (Av. 98)
	Root	90, 76, 60 (Av. 75)	35, 67, 46 (Av. 49)

Note: (1) Heat input is the average.
(2) Specimen location: 2 mm-V side notch specimens were removed from the locations shown in Fig. 2

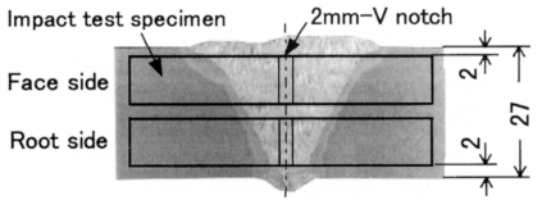


Fig. 2 — Location of impact test specimens removed from DW-55E welds (One-side welding with a ceramic backing material of FBB-3T)

Ship-Class Approvals Certify the Quality of DW-55E for High Grade Steels in Shipbuilding

DW-55E is approved as a Grade-3 flux-cored wire by the following ship-class societies in the world.

NK: Nippon Kaiji Kyokai (Japan)
AB: American Bureau of Shipping (USA)
LR: Lloyd's Register of Shipping (UK)
NV: Det Norske Veritas (Norway)
BV: Bureau Veritas (France)
GL: Germanischer Lloyd (Germany)
CR: Central Research of Ships S. A. (Taiwan)

Grade-3 approval is given to the welding consumables that satisfy the strict notch toughness specified by

ship-class rules to ensure the suitability of the welding consumables for the extra-high notch toughness steels classified as E-grade of mild steel and EH-grade of high strength steel (EH32, EH36). E- and EH-grade steels are used for the more important parts of a ship's hull, such as stress-concentrating corners, to ensure the resistance of the hull against brittle fracture during a voyage.

The Use of Proper Amperage and Voltage is Essential

With CO_2 gas shielding, DW-55E offers glossy bead appearance with fine ripples, negligible spatter losses and self-peeling slag removal in uses over a broad range of welding currents as shown in Fig. 3 in all-position welding with single pass and multiple passes.

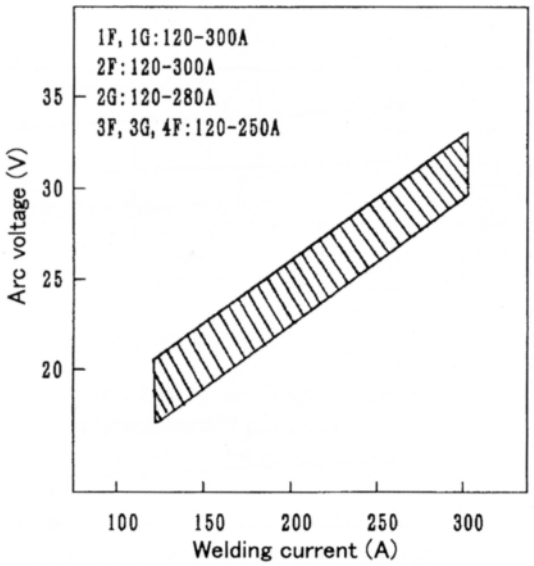


Fig. 3 — Proper ranges of welding currents and arc voltage (DW-55E, 1.2 mmØ); the welding positions of 2G, 3F, 3G and 4F restrict the use of high currents as shown in the figure respectively.

Heat Input Is a Key Factor in Quality Control of Welds

Heat input (HI = A x V x 60/S where A is for welding current; V is for arc voltage; and S is for travel speed) is a predominant factor particularly in control of impact toughness of welds. Table 2 shows recommended heat input for DW-55E in all-position welding. The minimum heat input is to control hardness (Hv: 280 max) of the weld metal, while the maximum heat input is to ensure impact notch toughness of the weld metal.

Table 2 — Recommended heat input ranges for DW-55E

Welding position (1)	Heat input (kJ/cm)
1F, 1G	10-30
2F	10-20
2G	10-15
3F, 3G, 4F	15-30

Note (1) 1F: flat fillet; 1G: flat groove; 2F: horizontal fillet; 2G: horizontal groove; 3F: vertical fillet; 3G: vertical groove; 4F: overhead fillet

Travel Speeds Determine Fillet Leg Lengths

In quality control of fillet welds, control of leg length is essential, provided the fillet weld has no excessive concavity. Figure 4 shows how travel speed determines leg length of fillet welds in use of DW-55E.

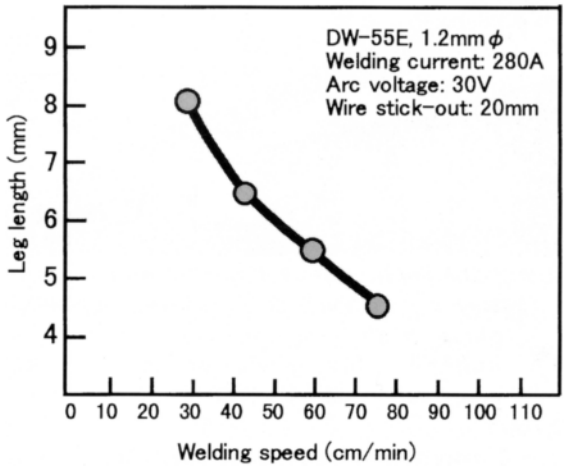


Fig. 4 — Fillet leg length vs. travel speed in use of DW-55E in single pass horizontal fillet welding

Low Ambient Temperatures and Thick Base Metals Require Preheating

Mild steel and 490N/mm^2-class high strength steel have quite good weldability and DW-55E weld metals contain diffusible hydrogen as low as Grade H10 of the ship-class requirement (0.10 ml/g max). However, cold cracking can occur in the welds when the ambient temperature is low and the base metal is thick. Therefore, preheating the base metal by 30-150°C (an exact temperature depends on the metal temperature and plate thickness) is recommended in order to prevent cold cracking in the welds. Where the surrounding temperature exceeds 5°C and plate thickness is 25 mm or less, no preheating is needed.

Technical Report

MG-60

(AWS A5.28 ER80S-G)

In the construction of steel structures, bridges, machinery and pressure vessels, MG-60 can be a dependable CO_2 solid wire for welding 590N/mm^2-class high strength steel. MG-60 offers persistent mechanical properties and usability with a stable arc in uses over a wide range of welding currents.

Fig. 1 — Consumption of 590N/mm^2-class high strength steel is less than that of mild steel and 490N/mm^2-class high strength steel, but it is an indispensable grade of steel in bridge construction, hence MG-60 is, too.

Basic Characteristics of MG-60

The unique chemical composition and production process of MG-60 assure excellent mechanical properties and usability. Tables 1 and 2 show chemical composition and mechanical properties of the all-deposited metal, respectively.

Table 1 — Typical chemical composition of MG-60 all-deposited metal in CO_2 welding (%)

C	Si	Mn	P	S	Ti	Mo
0.08	0.77	1.52	0.009	0.012	0.07	0.32

Table 2 — Typical mechanical properties of MG-60 all-deposited metal in CO_2 welding

0.2% PS (N/mm^2)	TS (N/mm^2)	El (%)	RA (%)	IE at –5°C (J)	PWHT (°C x hr)
599	689	29	66	109	As-weld
591	672	26	62	98	625 x 1
585	665	26	61	87	625 x 5
576	654	26	59	76	625 x10

Note: Each impact energy value is the average of 6 specimens.

It is clear, in Fig. 2, that both 0.2% proof strength and tensile strength decrease as the soaking time in postweld heat treatment increases. The two strengths, however, are maintained adequately even when the soaking time is extended to 10 hours. Postweld heat treatment causes a decrease of impact absorbed energy of low-alloy high strength steels and weld metals due to SR embrittlement in general. MG-60 weld metal, however, maintains its impact notch toughness at a sufficient level even after an extended postweld heat treatment as shown in Fig 2.

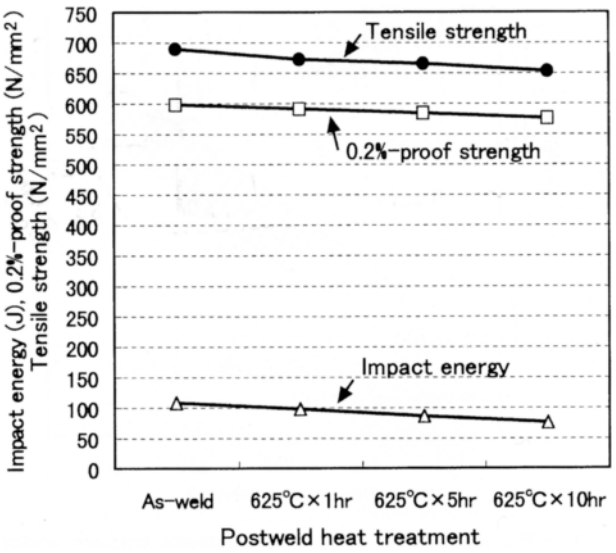


Fig. 2 — The effects of postweld heat treatment on 0.2%-proof strength, tensile strength and impact energy of MG-60 all-deposited metal

Important Welding Parameters in Quality Control of High Strength Welds

How to control strength and toughness of welds is essential in welding, particularly, high strength steel. Both strength and toughness are affected by the cooling speed of the weld during welding. The cooling speed varies according to heat input and interpass temperatures. Therefore, heat input and interpass temperatures are very important parameters to control

strength and toughness of welds. Figures 3, 4 and 5 show how heat input and interpass temperatures affect 0.2%-proof strength, tensile strength and notch toughness of MG-60 all-deposited metals. In these figures, it is obvious that the higher the heat input and interpass temperature, the lower the strength and toughness of the welds. These test results suggest that the heat input and interpass temperature should be controlled up to 30 kJ/cm and 250°C respectively in the use of MG-60 in order to maintain sufficient strength and toughness.

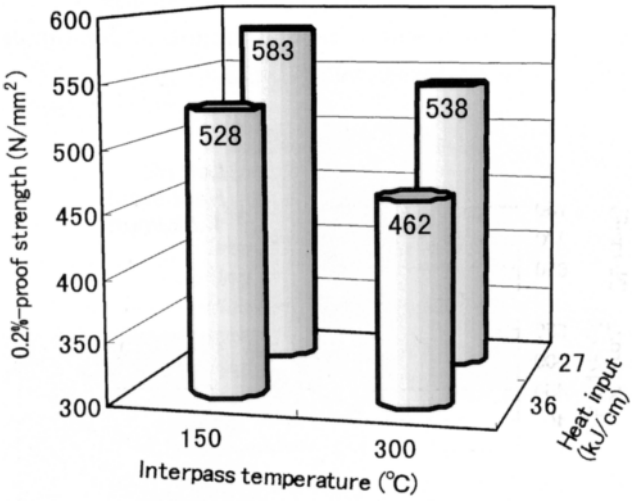


Fig. 3 — The effects of heat input and interpass temperature on 0.2%-proof strength of MG-60 all-deposited metal

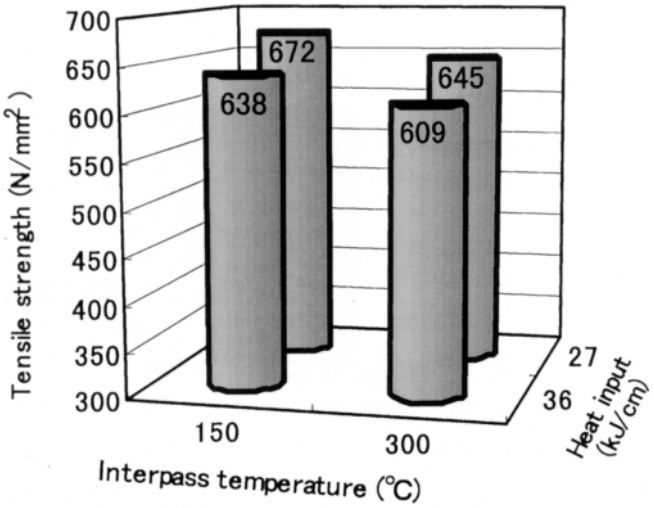


Fig. 4 — The effects of heat input and interpass temperature on tensile strength of MG-60 all-deposited metal

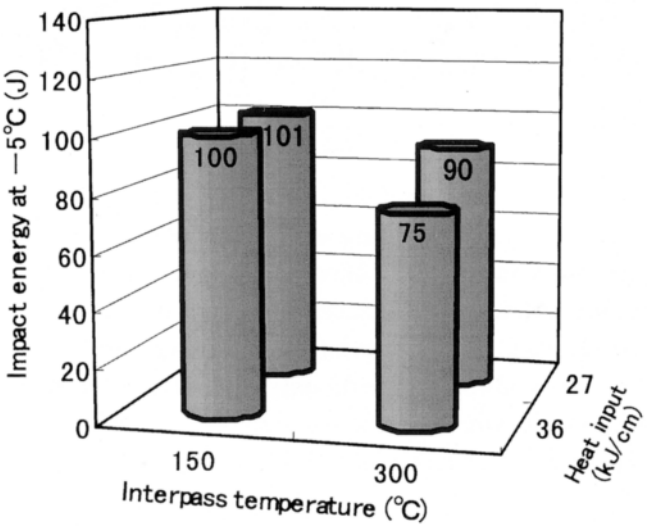


Fig. 5 — The effects of heat input and interpass temperature on Charpy impact energy (the average of 6 specimens) of MG-60 all- deposited metal

The Use of Proper Currents and Voltage Provides a Stable, Gentle Arc with Low Spatter

MG-60 offers a stable, gentle arc with low spatter of fine particles when compared with conventional solid wires when proper currents and arc voltage are used. As shown in Fig. 6, the use of MG-60 can decrease the amount of spatter by approximately 15% when compared with a conventional wire.

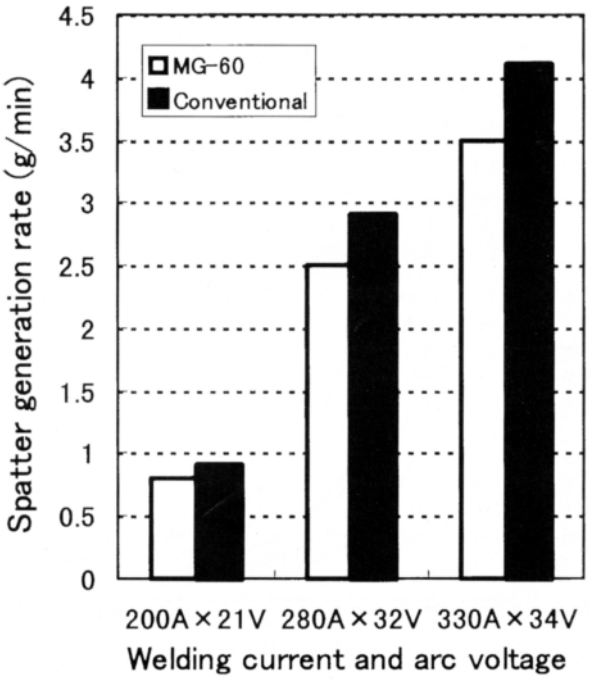


Fig. 6 — A comparison between MG-60 and a conventional wire on spatter generation rates

What Is Heat Input, and How Does It Affect the Quality of Welds?

Heat input can be referred to as "the electrical energy supplied by the welding arc to the workpiece." In practice, however, heat input can approximately — if the arc efficiency is not taken into consideration — be characterized as the ratio of the arc power supplied to the electrode to the arc travel speed, as shown in the following equation:

$$HI = \frac{A \times V \times 60}{S}$$

where "A" is welding current (ampere: the quantity of electricity conveyed in one second); "V" is welding arc-voltage (volt); "S" is the arc travel speed or welding speed (mm/min or cm/min); "60" standardizes the units for "A" and "S," since 1 minute is 60 seconds). In this way, the unit of heat input can be J/mm, kJ/mm, J/cm, or kJ/cm where "J" and "kJ" stand for Joule and kilo-Joule respectively.

The most important characteristic of heat input is that it governs the cooling rates in welds and thereby affects the microstructure of the weld metal and the heat-affected zone. A change in microstructure directly affects the mechanical properties of welds. Therefore, the control of heat input is very important in arc welding in terms of quality control.

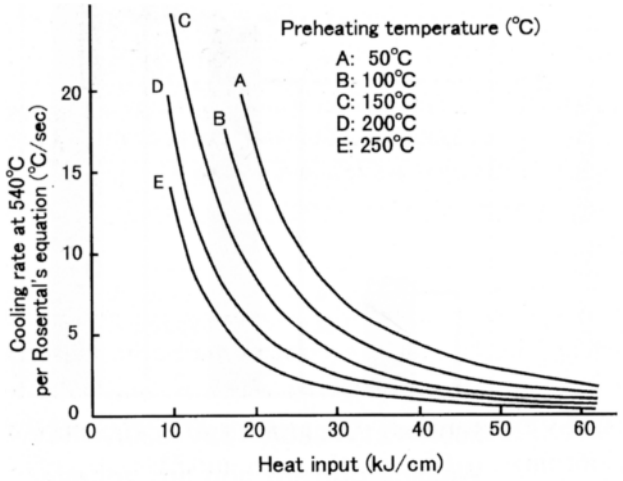


Fig. 1 — The effect of heat input on cooling rates in welds as a function of preheating temperatures (Plate thickness: 19 mm)

Figure 1 shows how heat input affects the cooling rates in welds. This figure suggests that the effect of heat input on the cooling rate is more significant in lower heat input ranges at every preheating temperature when the plate thickness is kept constant. Figure 2 shows the use of higher heat input (A: 2.5 kJ/mm) causes more coarse microstructure when compared with lower heat input (B: l.0 kJ/mm). This marked difference in microstructure results in significant effect on the strength of welds as shown in Fig. 3.

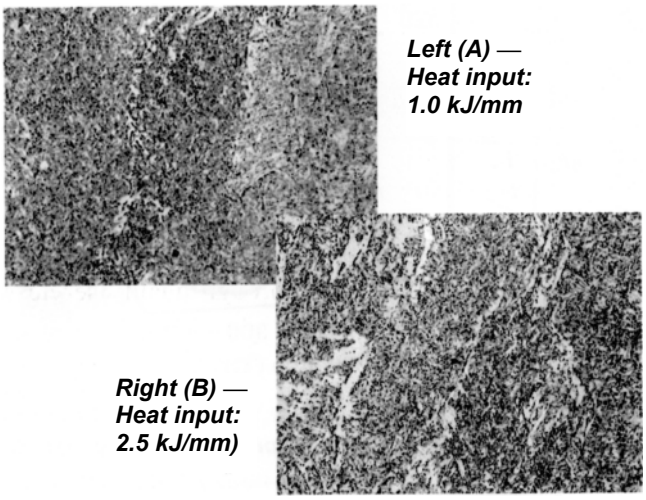


Fig. 2 — A comparison of microstructures of gas metal arc welded all-deposited metals of an ER80S-G trial wire, using two different amounts of heat input (X400) (Source: IIW Doc. XII-1647-00, 2000)

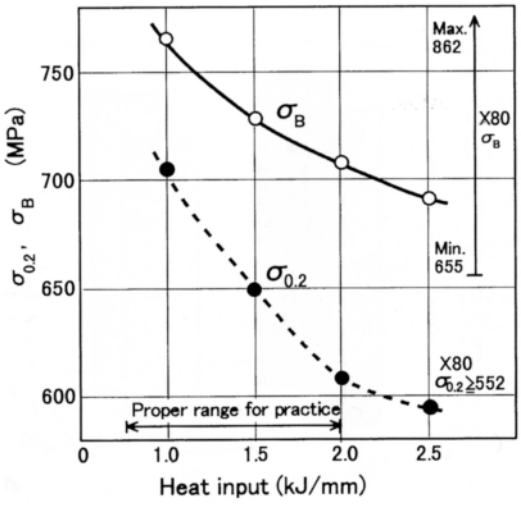


Fig. 3 — The effect of heat input on strength of all-deposited metals of an ER80S-G trial wire in gas metal arc welding (Source: IIW Doc. XII-1647-00, 2000)

A Short Story of KWAI's 10-Year History of Rapid Growing in Business

Kobelco Welding of America, Inc. (KWAI) was established in Houston, Texas in 1990, as a wholesale company owned by Kobe Steel USA Holdings for marketing Kobelco welding consumables in North America and Latin America.

Left:
KWAI's Houston Office

Right:
KWAI's executives and staff at the opening of the office

Since KWAI launched its business, it has worked closely with all its customers through quality services both in sales activities and technical support. Because of its outstanding business attitude, KWAI has earned rapid business growth led by its good reputation and the distributors sales network expanded nationwide. Nowadays, more than 300 distributors are distributing the welding wires, mostly flux-cored wires, supplied from KWAI. In particular, KWAI's stainless steel flux-cored wires have earned the largest market share, 40%, in the North American market.

Left:
The first KWA party in Houston in 1993

Right:
The first president of KWAI, Mac Tojo, left, received the baton of management from Ogata, GM, right

Left:
KWAI's first time at the AWS show in Anaheim in 1990

Right:
KWAI's booth at the AWS show in Philadelphia in 1994;
Ted Nariai, left (the former president) and Jim Baughman

Inviting nearly 100 distributors of the Kobelco Welding Association (KWA) and customers, KWAI hosted a reception in Chicago to celebrate KWAI's 10th anniversary at the time as the AWS welding show in April this year. At this ceremony, all the people of the KWA commemorated KWAI's favorable business growth for the last 10 years and pledged a big stride in business in the new era. KWAI and KWA will pursue further customer satisfaction, through the activities based on the business slogan QTQ (Quality products, Technical support and Quick delivery), targeting a higher market share.

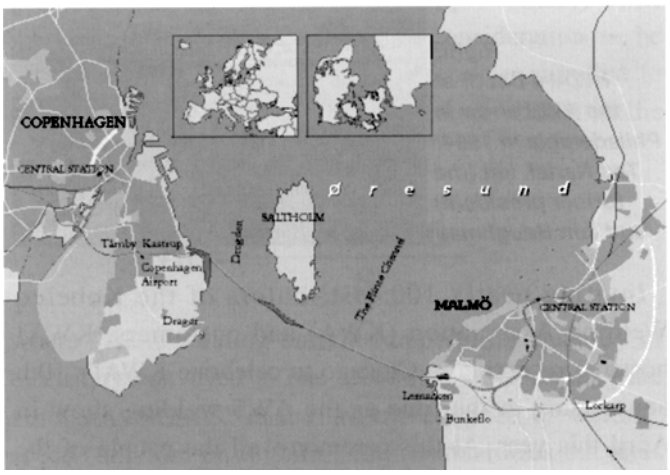
The men of merits, front row, are proud of the 10th anniversary memorials presented by KWAI, commemorated by the executives and staff

Since Kobelco welding consumables were first launched in the North American market in the early 1960's, the opening of KWAI was a turning point for business expansion. KWAI expanded its sales network by opening the Cincinnati Distribution Center (1993), the Salt Lake Sales Office and Distribution Center (1996), the Chicago Sales Office (1999) and the Chicago Distribution Center (2000).

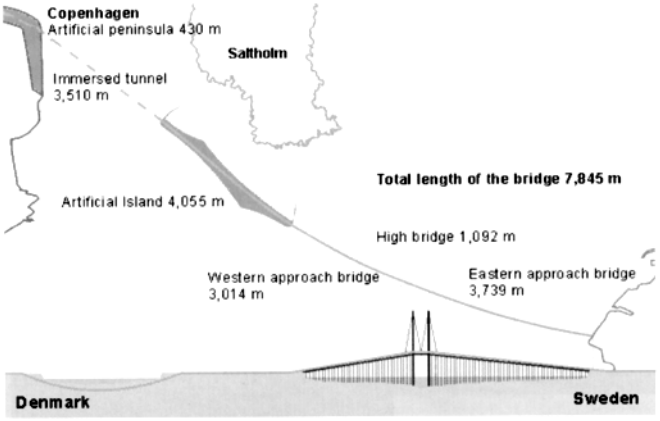
Feature Article

Kobe Steel and Elga Play a Key Role in a Century-Old Dream

With the opening of the Aalesund Bridge on July 1st came the dawn of a new era in Scandinavian road and rail traffic when the century-old dream of a permanent traffic connection between Denmark and Sweden became a reality. The coast-to-coast link comprises a four-lane motorway and a double track electrified railway between Lernacken on the Swedish side and Kastrup on the Danish side. The new trains can travel at top speed of 180 kilometers per hour (ca. 110 mph) making it possible to complete the almost 16 km (ca. 10 mile) long link in only about 6 minutes.



Geographical location of the Fixed Link

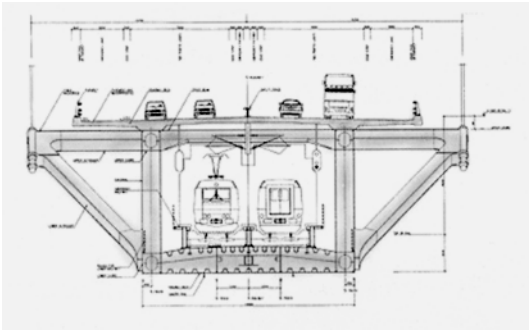


Distance covered by the Fixed Link

The construction work took 5 years to complete which included the building of a new motorway and railway in both Sweden and Denmark, together with the tunnel, the artificial island and the bridge that connects Copenhagen and Malmoe.

For the construction of the critical 1092m (3582.68 ft) 'High Bridge' part, in the face of stiff competition, Elga was chosen as the main supplier of flux cored wire (FCW) made by Kobe Steel, Ltd. Japan. This 'High Bridge' is the longest spanning cable-stayed bridge in the world for combined road and rail traffic. Its construction demanded the very best welding consumables and technical support. Since Elga, as the sole supplier of Kobe Steel's FCW in Scandinavia, has built up a vast experience for more than 12 years in the offshore and shipbuilding industries, they were in a strong position to supply technical support and welding consumables.

The steel used for construction was Weldox 420E (EN S 420 ML) from SSAB, which gives excellent impact values down to –40°C. The main contractors were Kockums, Karlskronavarvet and Knislinge Mekainska Verkstad. The wires they selected were DWA-55L (diameter: 1.2 mm) for semi-automatic welding and MXA-55T (diameters: 1.2 and 1.4 mm) for mainly robotic welding and shop welding.



Both Kobe Steel, Ltd. and Kobelco Welding of Europe B.V. would like to thank Elga for making it possible for KOBELCO to be a part of this truly amazing Scandinavian project.

Report compiled and written in corporation with ELGA AB by Robert Anthony Melvin at Kobelco Welding of Europe B.V.

Visiting Salt Lake City during the 2002 Olympic Winter Games will provide you with a beautiful memory

When I was living in Houston, Texas while working for Kobelco Welding of America (KWAI), I visited a beautiful city, Salt Lake City, Utah, where KWAI has a distribution center and sales office.

Salt Lake City is situated in a large valley surrounded by high mountains to the east and to the west. To the northwest, lies the famous Great Salt Lake, the world's second-largest saltwater lake. A few rivers and numerous streams empty into the lake, continuously running sources of clean water with lots of green along their banks. Even in summer, you can see snow on the tops of the mountains and in the shade of the valley. This City is also known for copper mining and a Mormon capitol, a dry city that regulates the sale of alcohol.

Attending a sales meeting, right to left, Salt Lake KWAI Regional Sales Mgr. R. Rust, KWAI President D. Kawaue, and Y. Nakai from IOD, KSL (Top); Posing in a beautiful prospect, R. Rust, left, and Y. Nakai (Bottom)

Today, the latest and biggest issue should be the 2002 Olympic Winter Games that will be hosted by Salt Lake City. The City is getting ready to be a good host. Various close games are happening in the 2000 Olympic Summer Games in Sydney. Australia now as I write this column in September. The next Winter Games in 2002 will be even more exciting, I hope.

Like other cities that hosted the Olympic Games in the past. Salt Lake City has been working on constructing speedways, main streets, ski fields, new lifts, skating rinks, hotels, gyms and so on. I do not know whether it is good for this City to invest so much money for these new facilities or the many things to entertain visitors. Overbuilding and growth sometimes have negative consequences. Nevertheless, such anxiety may have nothing to do with this beautiful city because the people of the City seem to be disciplined and courteous. I hope, anyhow, everything goes fine to Salt Lake City.

The nature is still there and it is definitely beautiful and comfortable to be in. You can enjoy hiking, fishing, skiing, climbing, and playing golf and almost any other sport that exist. I recommend you to visit Salt Lake City once, at least. If you have a chance to be in the City at the occasion of the 2002 Olympic Winter Games, it must be one of the greatest memories you would ever have. I hope I will be one of the visitors there for that occasion in 2002.

Reported by Y. Nakai, IOD, KSL

Editorial Postscript

FABTECH International, the North America's largest annual metal forming and fabrication exposition and conference, is going to open at The International Exposition Center, Cleveland. Ohio on Nov. 14-16, 2000.

Beijing Essen-Welding 2000, an international welding fair, is being held at The Shanghai Everbright Convention Center in China from the 14th to 17th of November this year.

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WELDING CONSUMABLE

KOBELCO

THE WORLDWIDE MANUFACTURER

Landmark Tower In Japan

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