KOBELCO WELDING TODAY

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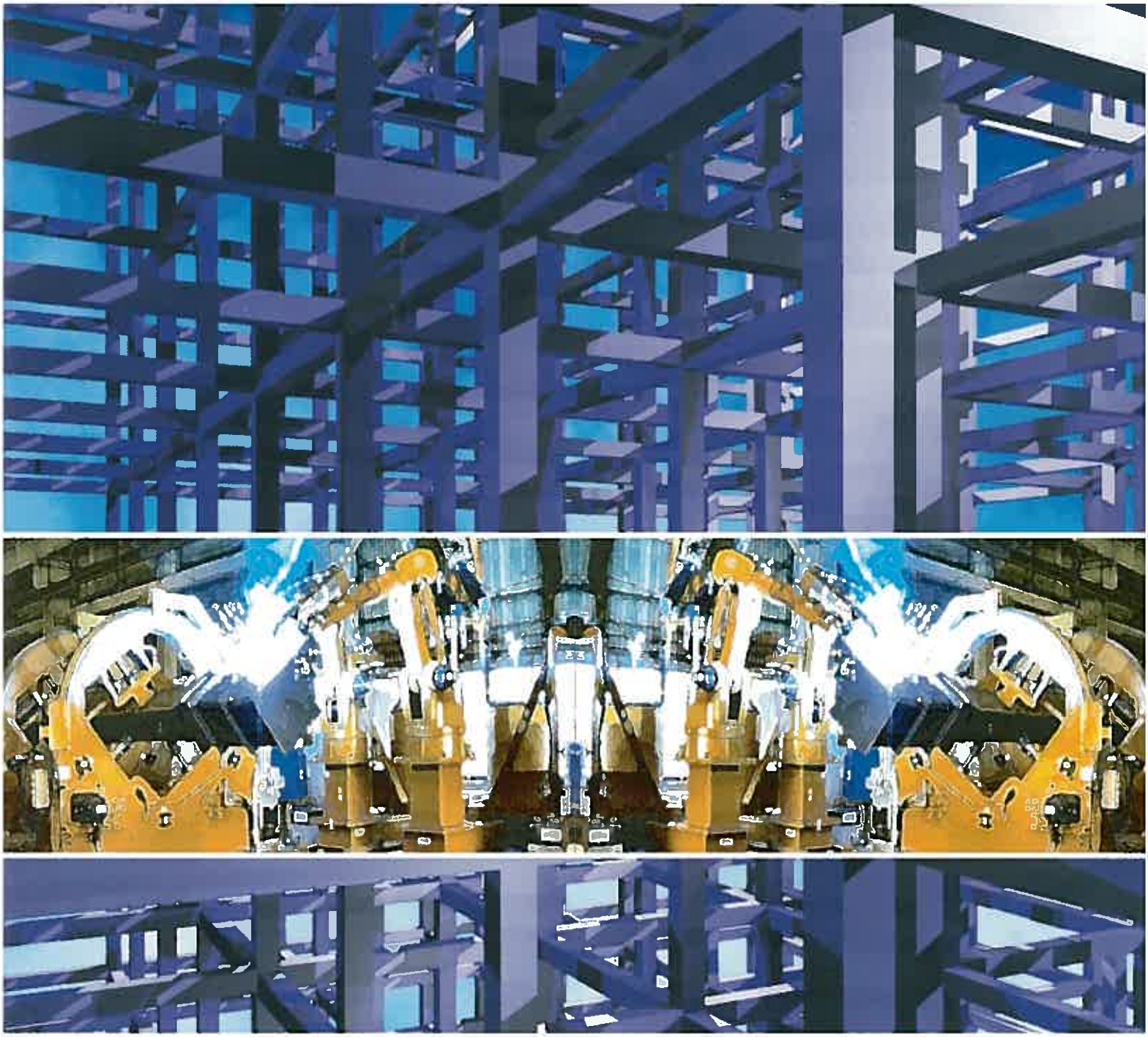
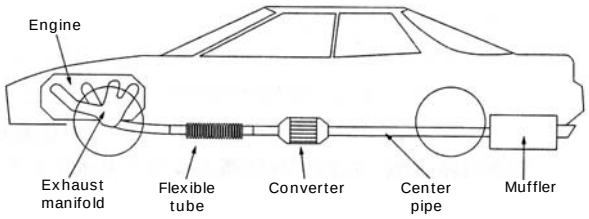


Perpetual Innovation and Unrivaled Service: The KOBELCO Way

MXA-430M: Unsurpassed Flux-Cored Wire for Cr Stainless Steel Welding



15-Year Track Records for Welding Automotive Exhaust Systems

The automotive industry worldwide has been promoting weight reduction of car bodies by using thinner, lighter materials to improve the fuel consumption efficiency, and improving the fuel combustion efficiency to reduce exhaust gases. In this trend, automotive exhaust systems have seen innovations in steel materials, and the increasing use of 17Cr and 13Cr ferritic stainless steel sheets and pipes for exhaust manifolds, converters, and mufflers. To respond to this trend, Kobe Steel developed MXA-430M metal-type, flux-cored wire about 15 years ago. Since then this wire has earned a high reputation for the following advantages.

1. HIGHER BURN-THROUGH RESISTANCE: Automotive exhaust parts use sheet metals as thin as 0.8-2.0 mm. MXA-430M (1.2 mm Φ) offers higher resistance to burn-through (excessive melt-through) as shown in Figure 1. This results from proper penetration and a wider weld pool.

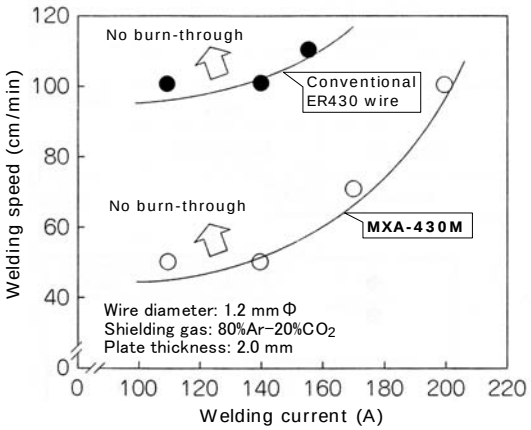
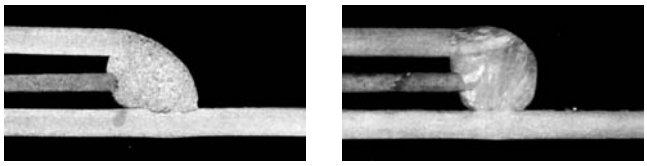


Figure 1: MXA-430M offers a wider current-speed range over conventional ER430 wire to prevent burn-through

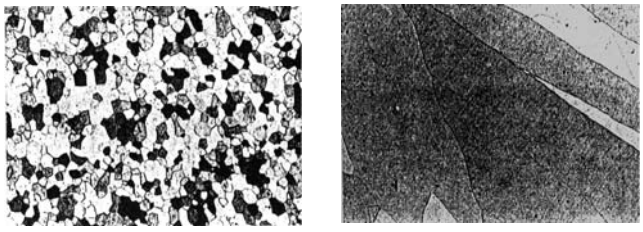
2. BETTER ROOT-GAP-BRIDGING ABILITY: Because the automotive exhaust parts are assemblages of thin pipes and press-formed shapes, the welding joints necessarily contain small or large gaps. If the weld pool cannot sufficiently bridges the gaps, incomplete fusion can occur. MXA-430M offers better root-gap-bridging ability over conventional ER430 wire to prevent incomplete fusion as shown in Figure 2.



MXA-430M Conventional ER430 wire

Figure 2: MXA-430M weld metal sufficiently bridges the gaps avoiding incomplete fusion in the 3-layer lapping joint that consists of a 1.5-mm stainless, 1.0-mm carbon, and 1.5-mm stainless steel assemblage with a root gap of 1.0 mm between sheet metals (130A, 17V, 45cm/min, 80%Ar-20%CO_2)

3. SUPERIOR CRACK RESISTANCE: The welding joints of auto parts are inevitably contaminated with machine oil caused by press-forming. Oil can be a source of carbon, sulfur and hydrogen, causing cracks in the weld. MXA-430M offers superior crack resistance, because of its finer microstructure over conventional ER430 wire (Figure 3).



MXA-430M Conventional ER430 wire

Figure 3: MXA-430M weld metal displays very fine microstructure to prevent cracks when compared with conventional ER430 wire

4. EXCELLENT CORROSION AND OXIDATION RESISTANCE: The automotive exhaust parts are required to be resistible against corrosive condensed liquids and high-temperature oxidation as well as snow-melting agent. The fine microstructure and unique chemical composition (17Cr-Nb) of MXA-430M weld metal offer higher resistance to intergranular and pitting corrosion and oxidation over conventional ER430 wire.

Chinese Yuan: Where is it going?

On business trips these days, I sometimes find it difficult to change my flight schedules because the airlines are fully booked with so many travelers. A lot of people take vacations in this season. On the other hand, I don't think most Japanese people are accustomed to taking long vacations; they tend to travel a week or so at most. I do not mean that we, Japanese, would not like to take a long vacation. Rather we may not be familiar with spending a long time in just enjoying a long vacation, and getting away from business. Anyway, we are so lucky that we are able to think about our vacations. By contrast, there are so many adults and children around the world who can only think how to survive in such crises as conflicts and food shortages.

Meanwhile, in many countries, especially the USA, the revaluation of the Chinese Yuan against the major currencies is an issue. As you know, KOBELCO established Kobe Welding of Tangshan (KWT) in China in 2003, and KWT is exporting some of their products. If the currency revaluation comes into effect, KWT will also not be able to avoid economic adversity. The currency revaluation is such a big issue, not only for KWT but also for the global economy, that we have to watch how China will handle it.

Masakazu Tojo
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International Operations Dept.
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Canteen in KWK

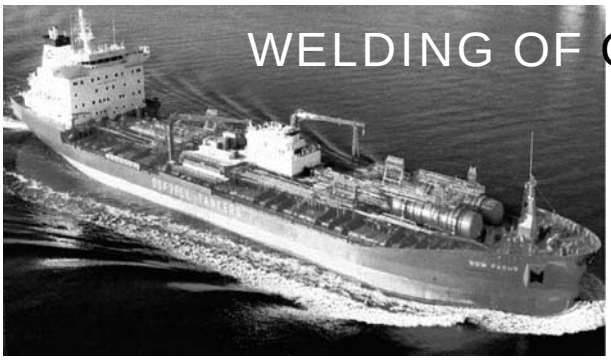
Workers enjoying Sam Gyeob Sal

Set meal with rice and soup and choice of four dishes

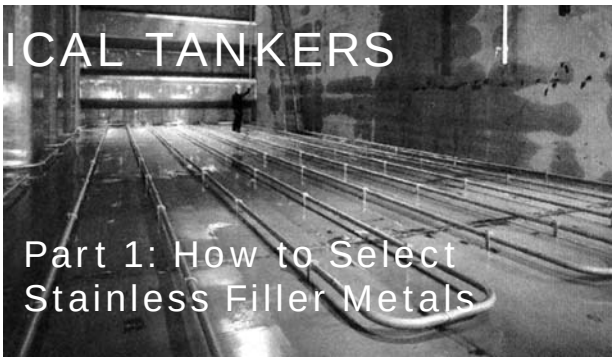
Kobe Welding of Korea (KWK) is in Changwon, an industrial city in the south of South Korea. With four beautiful and clearly distinct seasons, South Korea is famous for its variety of food. At KWK, the canteen offers meals using local seasonal foods for all the employees. The workers can choose from four kinds of dishes including Kimchi (pickled cabbage or other vegetables) in addition to rice, their staple food, and soup. Sam Gyeob Sal, served every two weeks, is an ethnic Korean dish consisting of roasted pork and rice wrapped together in lettuce. It is a special favorite of the workers.

Reported by Ki Hyun, Sung
Section Chief, Administration Dept.

CONTENTS



WELDING OF CHEMICAL TANKERS



Part 1: How to Select Stainless Filler Metals

Chemical tankers carry many corrosive liquids such as petroleum and chemical products, acids, alkalis, even molasses, animal oils, and vegetable oils. Therefore, while chemical tanker hulls may be made of low-cost carbon steel, their cargo tanks and piping systems require corrosion-resistant stainless and stainless-clad steels. Because of the use of special steel materials, the welding procedures used during the manufacturing of chemical tankers also need special considerations. This two-part series of articles on welding chemical tankers will begin with Part 1: How to Select Stainless Filler Metals. In the next issue the series will continue with Part 2: Essential Factors in Welding Control Procedures.

Several types of stainless steel are used

The stainless steel grades used in cargo tanks and piping systems are mainly austenitic 316L, 316LN, and 317L which provide excellent pitting corrosion resistance in chloride-rich environments. Nitrogen-bearing 316LN offers higher tensile strength and stronger resistance to pitting corrosion. In recent years, the use of duplex stainless steel has also increased due to its superior resistance against stress corrosion cracking and its higher tensile strength. Common grades of duplex stainless steel are UNS S31803 and JIS SUS329J3L. Table 1 shows the typical chemical and mechanical requirements for these grades of stainless steel.

These stainless steel materials are used for monometallic components and stainless-clad steel components for the cargo tanks and piping systems. During welding, several combinations of materials have to be joined in all positions as shown in Figures 1 and 2. When welding these monometallic and dissimilar metal joints careful consideration is required in selecting filler metals in order to obtain sound welds.

Table 1: Chemical and mechanical requirements for austenitic and duplex stainless steel wrought products (1)

Properties	Type of stainless steel			
	316L	316LN	317L	S31803
C%	0.03 max	0.030 max	0.03 max	0.030 max
Mn%	2.00 max	2.00 max	2.00 max	2.00 max
Si%	1.00 max	1.00 max	1.00 max	1.00 max
Cr%	16.00-18.00	16.00-18.00	18.00-20.00	21.0-23.0
Ni%	10.00-14.00	10.00-14.00	11.00-15.00	4.50-6.50
Mo%	2.00-3.00	2.00-3.00	3.00-4.00	2.50-3.50
N%	-	0.10-0.16	-	0.08-0.20
YS (MPa)	170 min	205 min	205 min	450 min
TS (MPa)	485 min	515 min	515 min	620 min
El (%)	40.0 min	40.0 min	40.0 min	25.0 min

(1) In accordance with ASTM A204

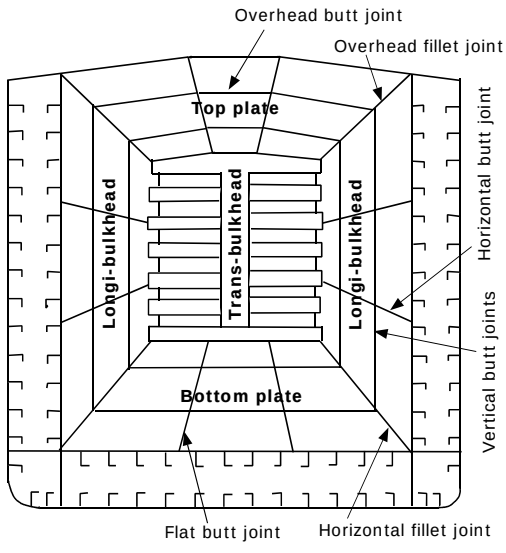


Figure 1: A cross sectional view of a cargo tank with welding joints in all positions

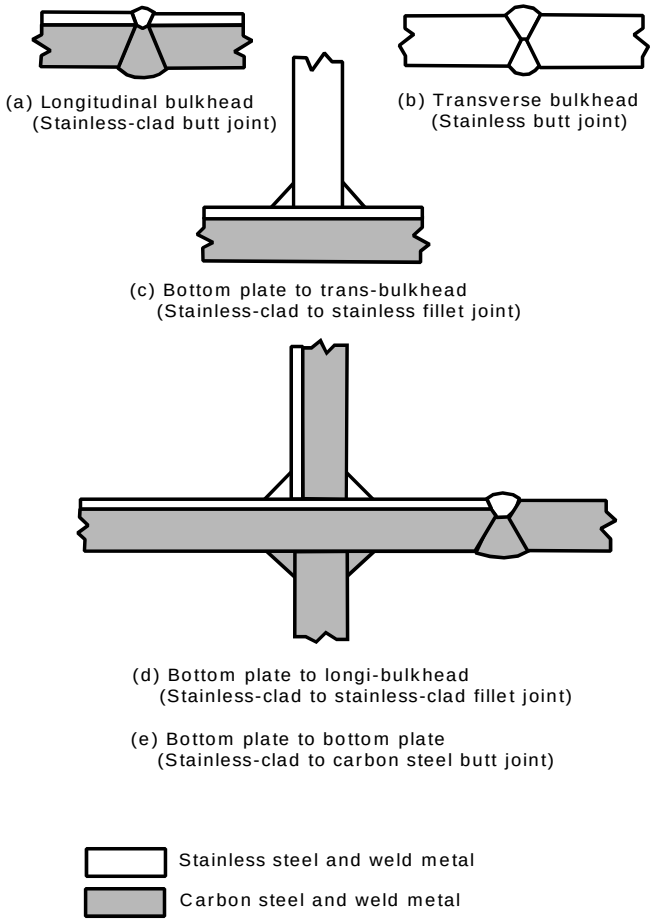


Figure 2: Varieties of weld joints in cargo tanks

FCAW is widely used due to excellent performance

In welding stainless steel and stainless-clad steel assemblies, shielded metal arc welding (SMAW), flux cored arc welding (FCAW), gas tungsten arc welding (GTAW), and submerged arc welding (SAW) are commonly used. SMAW is so versatile that it is used for such assemblies as plate-to-plate joints and pipe-to-pipe joints in all positions. FCAW with CO_2 or Ar-CO_2 mixture shielding offers higher efficiency, smoother bead appearance, better slag removal, and lower spatter, thereby cutting welding costs. For cargo tanks that consist of out-of-position joints as shown in Figure 1, all-position type flux-cored wires are particularly versatile. In addition, when compared with GMAW using solid wires, FCAW provides the weld metal with lower carbon and, thus, superior resistance to intergranular corrosion. Because of these advantages, FCAW is widely used in fillet and butt joints. Figure 3 shows an example of FCAW of stainless-clad steel butt joints in the inner bottom plate of a cargo tank.

Figure 3: FCAW of stainless-clad steel butt joints in the inner bottom plates of a cargo tank

GTAW's applications include out-of-position welding of pipes and repair welding for dressing the weld bead surfaces made by other welding processes. SAW is indispensable for stainless steel plate-to-plate joints as in transverse bulkheads.

Filler metal selection is the key to successful welding

As shown in Table 2, 316L and 317L stainless steels commonly use matching filler metals, but 316LN stainless steel uses the higher Cr-Ni filler metals (317L-type filler metals) to provide the weld metal with the pitting corrosion resistance equivalent or superior to the base metal. For UNS S31803 and SUS329J3L duplex stainless steel, the specific filler metals shown in the table are recommended.

Table 2: Suitable filler metals for austenitic and duplex stainless steel joints

Type of stainless steel	Welding process			
	SMAW	FCAW (1)	GTAW (2)	SAW
316L	NC-36L	DW-316LP	TGS-316L TGX-316L	PFS-1M / US-316L
316LN	NC-317L	DW-317L	TGS-317L	PFS-1 / US-317L
317L	NC-317L	DW-317L	TGS-317L	PFS-1 / US-317L
S31803	NC-329M	DW-329AP	TGS-329M	-
329J3L	NC-329M	DW-329AP	TGS-329M	-

(1) Shielding gas: 100% CO_2 or Ar-CO_2 mixture

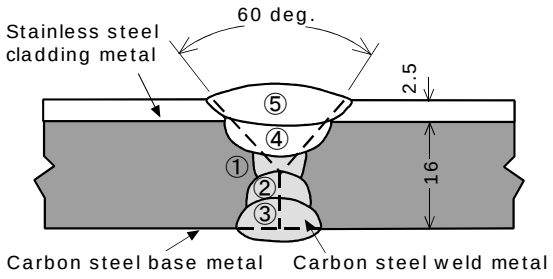
(2) TGX-316L is a flux-cored rod recommended only for root-pass welding.

Austenitic stainless steel is often used for the cladding metal bonded with the carbon steel base metal to produce stainless-clad steel. For welding stainless-clad steel joints, a filler metal with higher Ni-Cr is needed in addition to those discussed above to prevent hot cracks in the buffer layer of the weld metal. Table 3 shows common combinations of filler metals for SMAW and FCAW of stainless-clad steel butt joints.

Table 3: Suitable filler metals for stainless-clad steel joints (1)

Type of cladded stainless steel	SMAW		FCAW	
	Buffer layer (Pass No. 4)	Final layer (Pass No. 5)	Buffer layer (Pass No. 4)	Final layer (Pass No. 5)
316L	NC-39MoL	NC-36L	DW-309MoLP	DW-316LP
316LN	NC-39MoL	NC-317L	DW-309MoLP	DW-317L
317L	NC-39MoL	NC-317L	DW-309MoLP	DW-317L

(1) Typical weld pass sequence in a stainless-clad butt joint:



NC-39MoL and DW-309MoLP are also used for stainless-clad steel fillet joints and stainless-clad steel to carbon steel butt joints shown in Figure 2. Figure 4 shows a typical selection of filler metals for stainless-clad steel fillet joints.

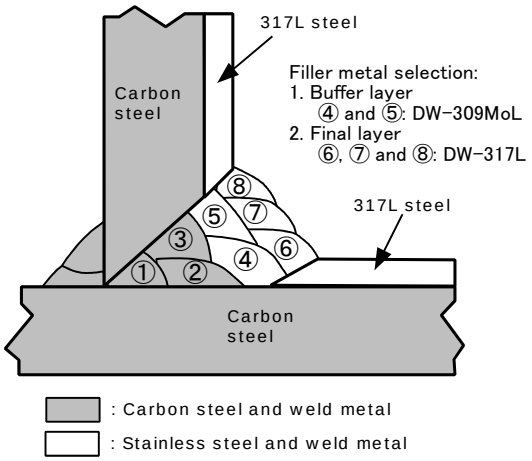


Figure 4: A typical selection of filler metals for stainless-clad steel fillet joints

SAW is not suitable for welding in the groove of the cladded side because its penetration is deeper, which increases dilution of the base metal and may cause hot cracking. GTAW is better at minimizing base metal dilution due to shallower penetration, but its welding efficiency is lower.

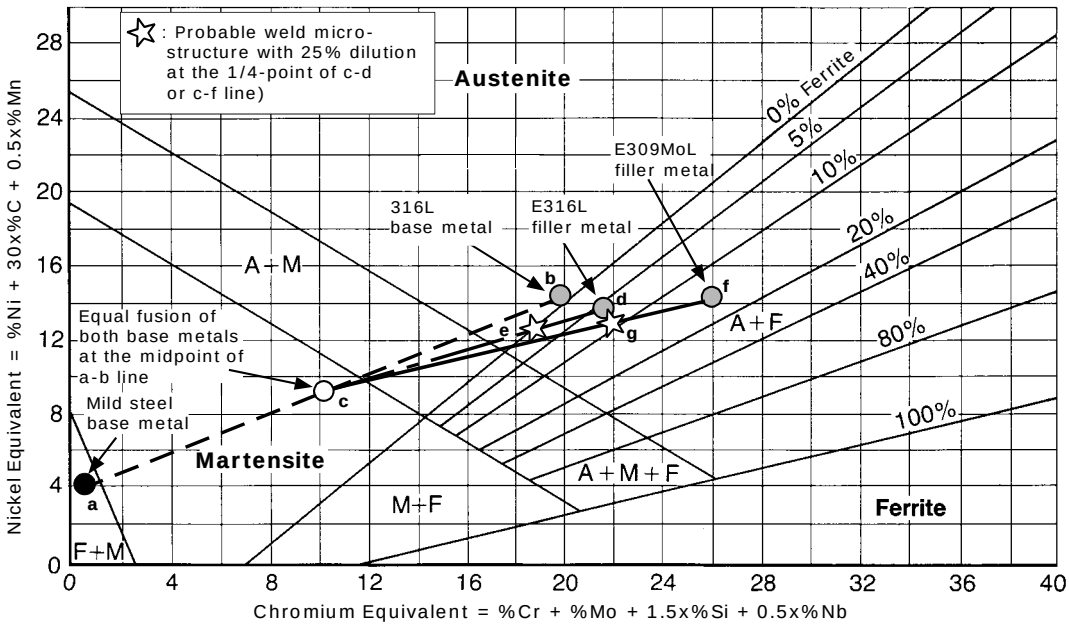


Figure 5: A Schaeffler diagram and the estimated microstructures (e and g) of the weld metals in the dissimilar-metal welding of mild steel (a) and 316L steel (b) base metals, using E316L (d) and E309MoL (f) filler metals, respectively

This is why SMAW and FCAW are commonly used for welding stainless-clad steel joints. Of the two, FCAW is more widespread because its deposition rate is 3-4 times higher and it is about 2 times higher in deposition efficiency in addition to having superior usability.

Figure 5 shows that the use of an E309MoL filler metal for the buffer layer will accommodate the dilution from the mild steel and 316L base metals, and the diluted weld metal will contain a sufficient amount of ferrite (around 5-10%) to prevent hot cracks. In contrast, with an E316L filler metal, the diluted weld metal of the buffer layer will contain no ferrite, thus causing hot cracks.

Characteristics of filler metals

Table 4 shows the chemical composition and tensile properties of SMAW filler metals listed in Tables 2 and 3. All of these filler metals (covered electrodes) can be used with either AC or DCEP polarity in all positions. They offer consistent and sound weld quality in all position welding. Both NC-36L and NC-317L match respective 316L and 317L stainless steel wrought annealed products in terms of chemical and tensile properties. However, unlike the stainless steel products, both covered electrodes contain a small amount of ferrite to prevent hot cracks.

Table 4: Typical chemical composition and tensile properties of SMAW weld metals (as-welded)

Brand	NC-36L	NC317L	NC-39MoL	NC-329M
AWS class.	E316L	E317L	E309MoL	-
C%	0.023	0.030	0.029	0.030
Si%	0.57	0.50	0.51	0.71
Mn%	1.56	1.17	1.28	0.62
Ni%	12.17	13.28	12.65	9.44
Cr%	18.68	19.11	23.08	24.51
Mo%	2.20	3.50	2.29	3.25
N%	-	-	-	0.16
YS (MPa)	420	440	450	640
TS (MPa)	580	600	630	860
El (%)	45	39	41	28

Table 5 shows the chemical composition and tensile properties of FCAW filler metals listed in Tables 2 and 3. All of these filler metals (flux-cored wires) use either 100% CO_2 or 75-80%Ar-balanced CO_2 mixture for shielding. The chemical and mechanical properties of DW-316LP and DW-317L match those of 316L and 317L stainless steel annealed wrought products. However, these flux-cored wires are tailored to contain a small amount of ferrite in the weld metal to improve their hot crack resistance. The brands with the suffix P such as DW-316LP, DW-309MoLP and DW-329AP offer excellent usability in all position welding.

Table 5: Typical chemical composition and tensile properties of FCAW weld metals (as-welded)

Brand	DW-316LP	DW-317L	DW-309MoLP	DW-329AP
AWS class.	E316LT1-1 E316LT1-4	E317LT0-1 E317LT0-4	E309LMoT1-1 E309LMoT1-4	E2209T1-1 E2209T1-4
C%	0.028	0.025	0.025	0.027
Si%	0.60	0.59	0.62	0.58
Mn%	1.50	1.10	0.81	0.78
Ni%	12.65	13.01	12.44	9.42
Cr%	18.35	19.81	22.60	23.34
Mo%	2.68	3.35	2.21	3.42
N%	-	-	-	0.14
Cu%	-	-	0.05	0.02
YS (MPa)	370	380	540	620
TS (MPa)	540	590	699	830
EL (%)	43	37	30	29

Table 6 shows the chemical composition and tensile properties of GTAW filler metals listed in Table 2. TGS-316L, TGX-316L and TGS-317L match 316L and 317L stainless steel annealed wrought products respectively, except that the filler metals contain a small percent of ferrite to prevent hot cracks in the weld metal. All of these filler metals (filler rods) use DCEN polarity. TGS-316L, TGS-317L and TGS-329M use pure Ar for torch- and back-shielding. By contrast, though flux-cored TGX-316L uses Ar for torch-shielding, it needs no back-shielding gas because it generates slag to prevent the reverse weld bead from oxidation. This is a very economic technique because no gas purging is needed. However, TGX-316L is suitable only for the root pass. If it is used for filler passes, slag will cover the weld bead surface. This can cause slag inclusions. This is why, for the filler passes, TGS-316L is recommended.

Table 7 shows the chemical and mechanical properties of SAW filler metals listed in Table 2. Both brands match their respective 316L and 317L stainless steel annealed wrought products, except that the weld metal contains a small amount of fer-

rite in the weld metal to prevent hot cracks. All of these filler metals (combinations of flux and solid wire) use AC power sources. Commonly, a double-V groove joint is prepared and is completed by single-pass welding on both the backing and final sides of the joint in plate-to-plate joining as shown in Figure 6.

Table 6: Typical chemical composition and tensile properties of GTAW weld metals (as-welded)

Brand	TGS-316L	TGX-316L	TGS-317L	TGS-329M
AWS class.	ER316L	R316LT1-5	ER317L	-
C%	0.014	0.016	0.010	0.011
Si%	0.41	0.87	0.38	0.30
Mn%	1.74	1.55	1.80	1.02
Ni%	12.29	12.47	13.11	9.13
Cr%	19.22	18.89	18.76	25.05
Mo%	2.19	2.32	3.49	3.31
N%	-	-	-	0.15
Cu%	0.11	0.03	0.03	-
YS (MPa)	390	440	410	660
TS (MPa)	550	600	570	810
EL (%)	43	38	39	34

Table 7: Typical chemical composition and tensile properties of SAW weld metals (as-welded)

Brand	PFS-1M / US-316L	PFS-1 / US-317L
AWS Class. (Wire)	ER316L	ER317L
C%	0.027	0.023
Si%	0.75	0.71
Mn%	1.76	1.80
Ni%	11.90	13.60
Cr%	19.17	18.78
Mo%	2.10	3.37
YS (MPa)	370	410
TS (MPa)	550	590
EL (%)	40	42

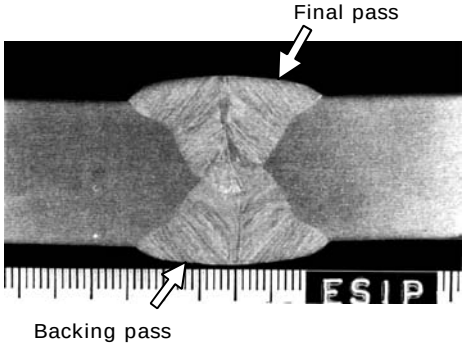


Figure 6: Cross section macrostructure of PFS-1 / US-317L (4.0 mmΦ) weld by double-sided, single-pass welding

Efficient welding consumable for one-sided FCAW

Stainless steel can be welded more efficiently in the flat, horizontal and vertical positions by one-sided FCAW with flux-cored wires and FBB-3 backing material as shown in Figure 7.

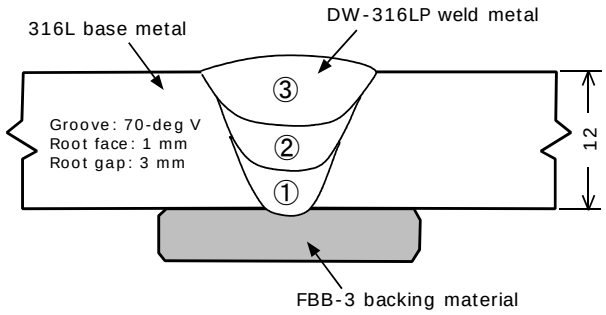


Figure 7: Example of one-sided FCAW of stainless steel using DW-316LP flux-cored wire and FBB-3 backing material

FBB-3 can be set on the reverse side surface of the joint by using the adhesive aluminum tape (Figure 8) without magnet clamping. The molded refractory consists of segmented blocks so that it makes a good contact on the curved surface and be adjustable in length. For, the standard length of FBB-3 is 600 mm, and it can be joined or cut to match the length of the welding joint.

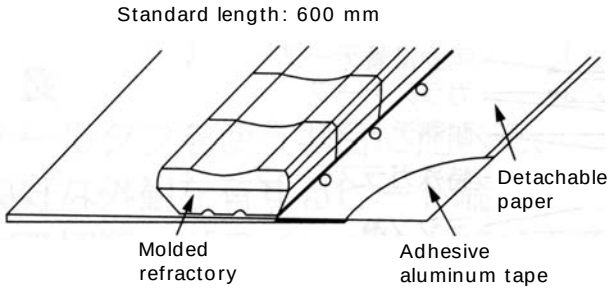


Figure 8: FBB-3 (Type T) consists of segmented molded refractory, detachable paper, and adhesive aluminum tape

Question:

We delivered 304-type stainless steel joints welded with the flux-cored wire, DW-308. Two weeks later, our customer complained that rust was forming on the surface of some of the weld beads. What causes this problem? In addition, we found that the remaining wire of the DW-308 would stick to a magnet. We thought that DW-308 would not stick to a magnet. What has happened with the wire?

Answer:

It is often said that stainless steels do not rust. This is not true; however, they are less likely to generate rust compared to conventional carbon and special steels. It is helpful to understand the way that each type of steel forms rust.

The case you described of rust forming on the beads was likely a type of rust that forms on dissimilar metals like a combination of carbon steel and stainless steel. This type of rust can be caused by such external factors as carbon steel powders generated by nearby grinding and brushing with carbon steel wire brushes, adhering to the surface of the stainless steel weld beads. Therefore, we guess that some carbon steel powders that had adhered to the surface of the DW-308 weld beads caused the rust in your case.

Figures 1 and 2 show examples of bead appearance. The rusty bead in Figure 1 had been brushed with a carbon steel wire brush, while the other metallic, lustrous one in Figure 2 had been brushed with a stainless steel wire brush. The former one clearly has brown rust even on the base metal. You can therefore understand that stainless steel wire brushes are essential for brushing stainless steel welded joints.

You might have thought that the magnet and the wire were attracted to each other due to some ingredients contained in the DW-308 wire. The DW-308 wire indeed does react magnetically because of the stress-induced martensite on the surface of the wire. The martensite structure is formed by work hardening the surface of the wire during the process of drawing into the designated diameter. The stress-induced martensite, however, has nothing to do with rusting.

The DW-308 weld metal also behaves magnetically. This phenomenon is caused by a small amount of ferrite contained in the weld metal. With the desire to keep the cracking susceptibility of the weld metal as low as possible, DW-308 is designed to contain small amounts of ferrite in the weld metal. The ferrite structure also has nothing to do with rust.

If the rust problem described above is not so serious, it can be wiped off with a sponge or cloth soaked with neutral detergent or soapy water. Careful washing with water is necessary afterward so as not to leave any neutral detergent or soapy water. When it is serious, use an exclusive cleaning solution for stainless steel or 15% diluted nitric acid. Polishing with sand paper or brushing off with a stainless steel wire brush is also effective. When followed by cleaning with soapy water, it will be perfect for obtaining beautiful welds.

Figure 1: Rusty appearance of a weld bead after brushing with a carbon steel wire brush

Figure 2: Metallic, lustrous appearance of a weld bead brushed with a stainless steel wire brush

<> References <>

(1) E. Kumagai: Kobe Steel Yohsetsu Dayori, Gijutsu Guide, Vol. 39, 1999, 11 (No. 355), p.11

(2) http://www5.mediagalaxy.co.jp/hokusei/teire.html

High Attendance at the 53rd AWS Welding Show

Venue photo source: www.dallasconventioncenter.com

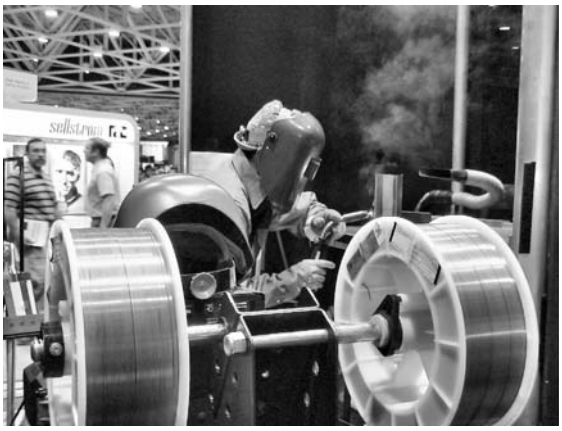
Show-opening photo source: www.aws.org

The AWS Welding Show 2005 was held at the Dallas Convention Center in Texas from the 26th through 28th of April, 2005. A total of 7600 people attended, a record number compared with the last show in Chicago.

Kobelco Welding of America (KWAI) attended as an exhibitor, recording its 16th appearance in the AWS Welding Shows. KWAI used the opportunity to highlight the technical superiority of high-quality stainless and mild steel flux-cored wires (DW and DWG series major alloys, DW-50, Frontiarc-711, and MXA-70C6) through live welding demonstrations, audio-visual presentations on a 60-inch plasma TV screen as well as by displaying weld bead samples.

KWAI also celebrated its 15th Anniversary through such events as the “Kobelco Invitational Golf Tournament” and the “15th Anniversary Reception.” At the reception, the KWAI staff cheered during the traditional “Kagami-Wari” ceremony, in which Mr. Aida, the President of the Kobe Steel Welding Company, broke open a large barrel of Sake (Japanese rice wire) and offered free Sake to all the attendees. We had a happy time!

The KOBELCO booth displayed with the spool of excellence: Unsurpassed DW and DWG series stainless FCWs and highly reputed carbon steel FCWs. The KWAI staff were busy all day long with coming and going visitors.



Through live demonstrations using DW-308L at the KOBELCO booth, many visitors knew its excellence: unmatched low fume, less spattering, arc stability, slag removal, weld pool wetting and bead appearance.

This AWS Show was the society’s last stand-alone exhibition. In future it will be held jointly with FABTECH, which is organized by the Society of Manufacturing Engineers (SME) and the Fabricators and Manufactures Association (FMA). The new AWS & FABTECH show, North America’s Largest Metal Forming, Fabrication, & Welding Event, is scheduled to be held in Chicago from Nov. 13-16 this year, and it will continue every year throughout the United States to attract many more exhibitors and attendees.

Reported by
Andrew Sawada, KWAI

Hearty Greetings from KSL

Toshiyuki Okuzumi
General Manager
IOD, Welding Company
Kobe Steel, Ltd.

Toshiyuki Okuzumi is my name. I was transferred to the International Operations Department (IOD) last March from the domestic sales department. My career at Welding Company of Kobe Steel consists of 16 years in domestic sales and five years of international activity, when I was stationed in Thailand from 1995 to 2000 and engaged in local sales and exports to ASEAN countries.

With respect to the global environment of the welding material business, demand has been increasing consistently, but there have been corresponding price hikes and shortages of raw materials due mainly to the rapid growth of the Chinese economy. This compels us to raise our prices in order to maintain a stable supply of welding materials to customers. We sincerely hope you will understand this situation. Under these difficult circumstances, what must we do to expand our customer's usage of our well-reputed KOBELCO welding materials? I believe that we must continue to provide our customers with our unique added value such as high and uniform quality, excellent technical service, constant and stable supply, and new technology and products.

Led by the sharp increase of consumption in China, the global demand for welding materials has now surpassed three million tons a year, and KOBELCO's aggregate overseas sales volume is about to surpass that of domestic sales. Assigned to the post of the General Manager of the IOD at such a time, I understand the responsibility taken on by the IOD. At the same time, it is a pleasure to try to go into the areas where we have not established our existence as yet. Yes, it is worth the work. Though I myself am not equipped with linguistic talent and am inexperienced in many ways, I will go forward with a challenging spirit. I hope you will support me and will give me whatever advice you may think necessary.

A Newcomer in the IOD

Yoshiteru Sasaki
IOD, Welding Company
Kobe Steel, Ltd.

It is an honor and privilege to be given an opportunity to introduce myself in Kobelco Welding Today. My name is Yoshiteru Sasaki. I have been transferred from our Technical Development Department. Now I am an engineer-turned-salesman two years after joining Kobe Steel fresh from college.

In the international Operations Department, I am in charge of the ASEAN countries. This market is quite an attractive area for our business with a brisk business in shipbuilding, offshore structures, automobiles, and steel building. I will try to grasp the needs of our customers in these counties so that I can propose the choice of welding materials that is best in performance and usability. As I will do my best to be a reliable bridge between you and the KOBELCO Group, please feel free to contact me at any time.

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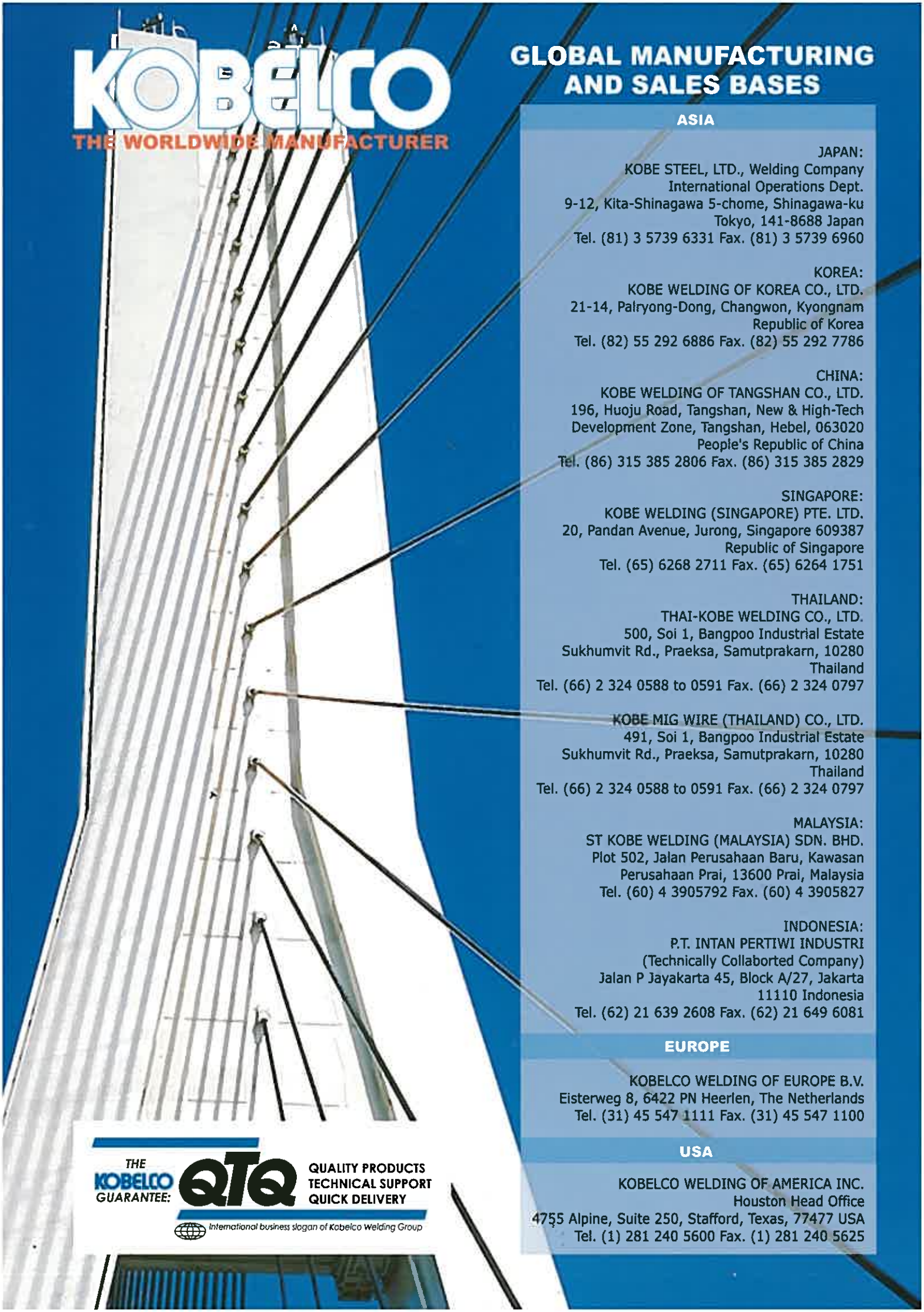

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QUALITY PRODUCTS
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QUICK DELIVERY

International business slogan of Kobelco Welding Group