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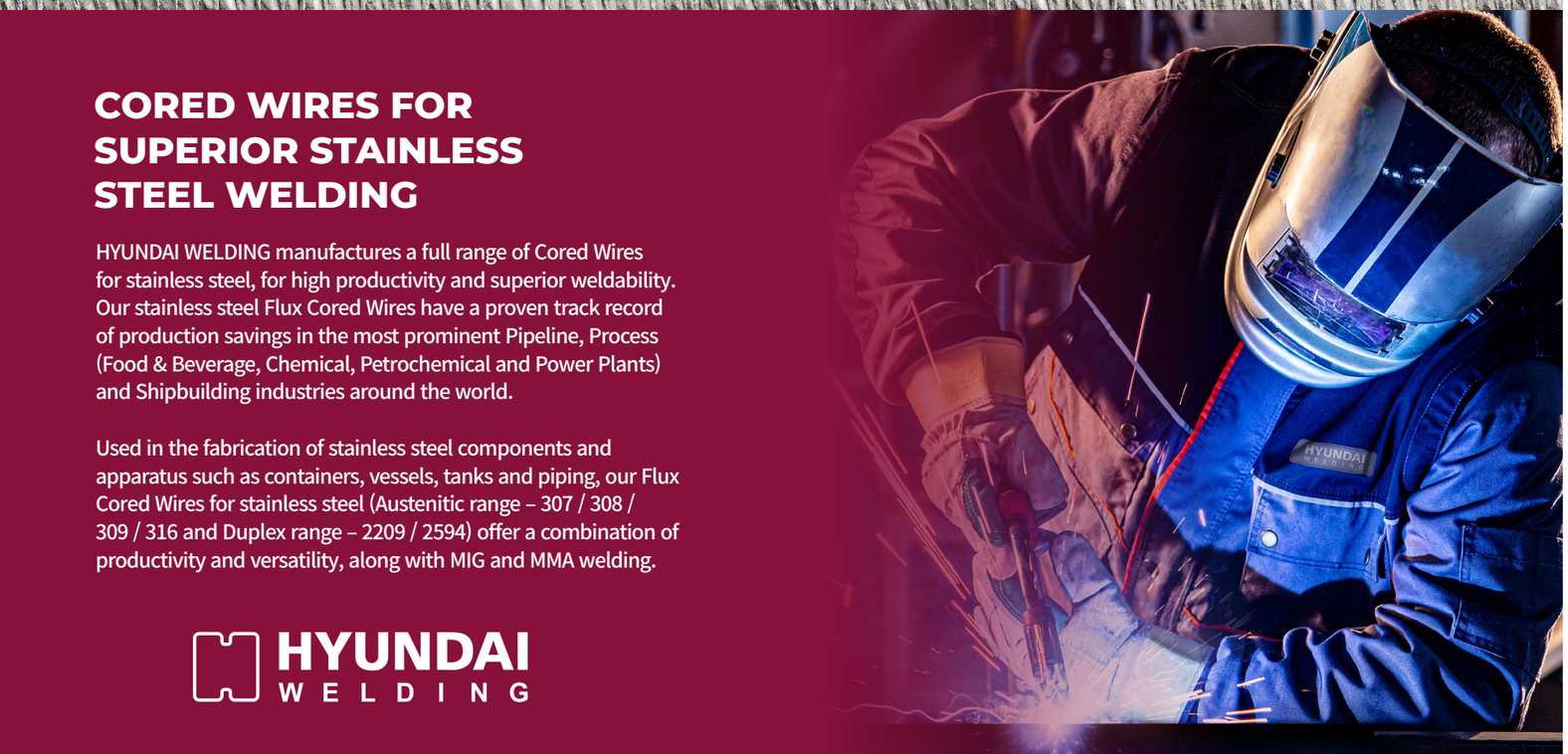
HYUNDAI WELDING

CORED WIRES FOR STAINLESS STEEL



CORED WIRES FOR SUPERIOR STAINLESS STEEL WELDING

HYUNDAI WELDING manufactures a full range of Cored Wires for stainless steel, for high productivity and superior weldability. Our stainless steel Flux Cored Wires have a proven track record of production savings in the most prominent Pipeline, Process (Food & Beverage, Chemical, Petrochemical and Power Plants) and Shipbuilding industries around the world.

Used in the fabrication of stainless steel components and apparatus such as containers, vessels, tanks and piping, our Flux Cored Wires for stainless steel (Austenitic range – 307 / 308 / 309 / 316 and Duplex range – 2209 / 2594) offer a combination of productivity and versatility, along with MIG and MMA welding.

HYUNDAI WELDING

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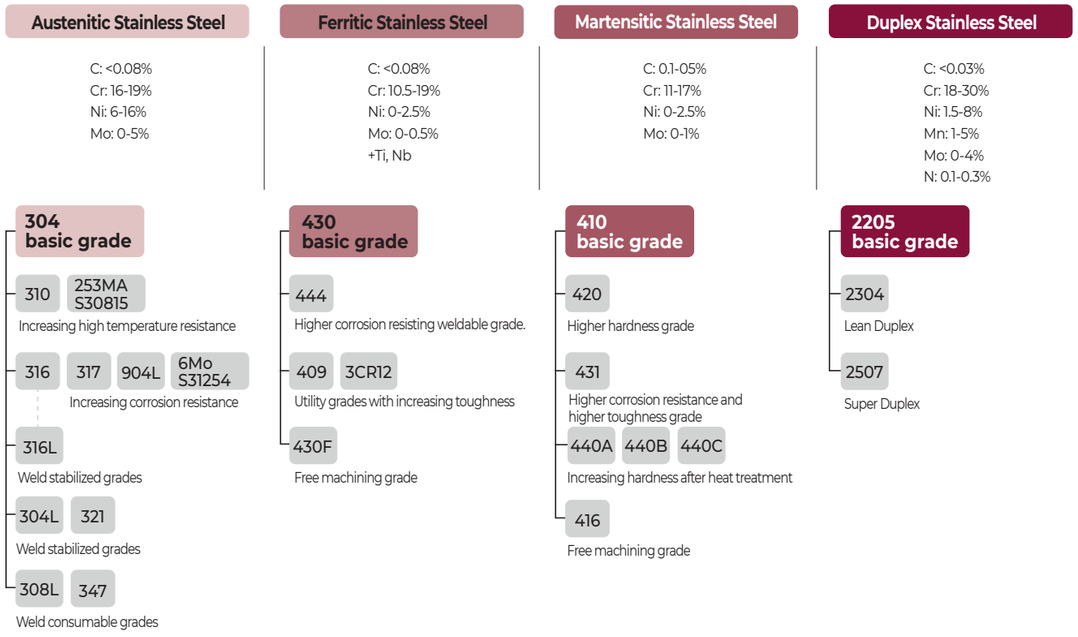
STAINLESS STEEL & USAGE AREAS

Stainless steel represents a family of iron-chromium alloys with resistance to various forms of corrosion and oxidation. It contains at least 11% chromium. Its resistance to corrosion results from a naturally forming, chromium-rich oxide layer that protects the material and is self-healing in the presence of oxygen. Other elements, such as nickel, molybdenum, nitrogen, niobium and titanium are added to enhance corrosion and strength properties of the steel. Due to its versatility, stainless steel is a popular material choice in many different industries.

Key stainless steel properties are:

- Corrosion resistance: Stainless steel alloys are very suited for use in environments where the material may be exposed to atmospheric, chemical or electro-chemical corrosion.
- Strength: Stainless steel is well-known for its strength and durability which - along with its corrosion resistance – makes it ideal for a wide range of applications in industries such as construction, paper and pulp, food production and medical equipment.
- Heat resistance: Stainless steel maintains it strength at elevated temperatures and offers resistance to oxidation. This makes it useful for applications that require resistance to high heat, such as in exhaust systems or ovens.
- Easy to clean and maintain: Stainless steel is easy to clean due to its smooth, non-absorbing surface. If needed, the passive surface film can be fully restored by a pickling and passivation treatment. It is therefore often used in applications that require high levels of hygiene, such as in the food and pharmaceutical industries.
- Aesthetic appeal: Stainless steel has a sleek, modern appearance that is often used in contemporary design. It is available in a range of finishes and can be polished to a high shine, making it a popular choice for decorative applications.

There is a great variety of stainless steel grades, each with its own unique properties and applications. They are grouped in four different families, according to their alloying and named after the dominant microstructure; austenitic, ferritic, martensitic and duplex.



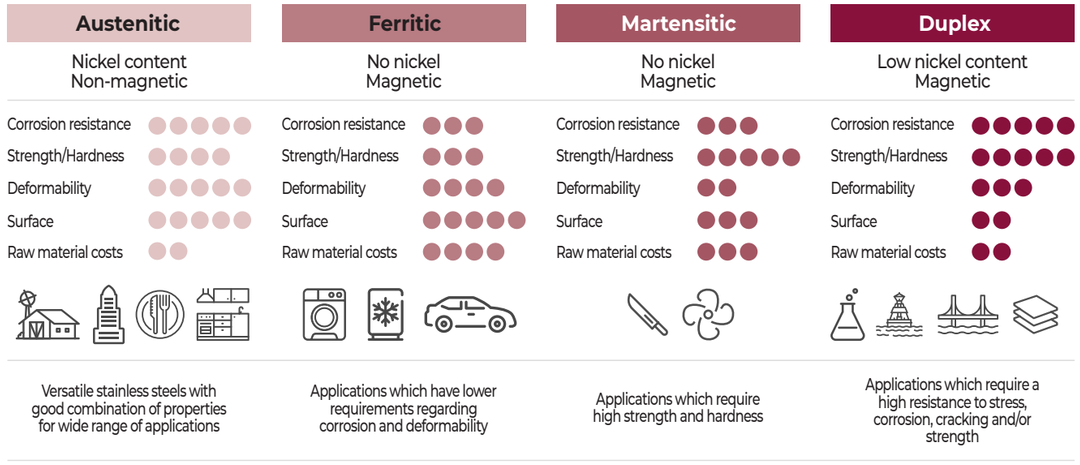
The selection of the type of stainless steel depends on the requirements the particular application poses. The service environment and its corrosive action are normally the driving force. It determines important parameters such as extent of acceptable corrosion and expected life cycle of stainless equipment. Depending on the application, resistance to localised corrosion (e.g. pitting, crevice and intergranular corrosion) and sulphide or chloride stress corrosion cracking may guide material selection. Other important aspects are material costs, machinability and weldability.

Austenitic stainless steel is the most widely used group of stainless steel found in numerous applications. A large number of grades with excellent corrosion resistance have been developed out of the 18%Cr/8Ni base composition. It is ductile, covers a large range of service temperatures, has a good machinability and excellent weldability. Commonly used variants are those which contain Mo to provide improved pitting corrosion resistance, those with Nb or Ti to stabilise against Cr-carbide precipitation causing intergranular corrosion and higher strength N-alloyed grades.

Ferritic stainless steel has properties similar to mild steels but with better corrosion resistance, due to the addition of typically 11-17% chromium. They are comparatively inexpensive due to their low Ni-content and have good resistance to chloride stress corrosion cracking.

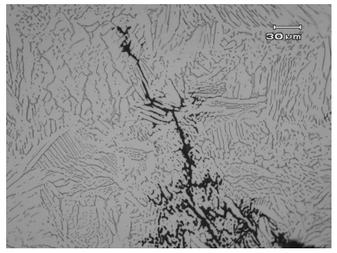
Martensitic stainless steel can be hardened by quenching and tempering, like plain carbon steels. They have moderate corrosion resistance and contain, typically, 11-13% chromium with a higher carbon content than ferritic grades. Martensitic stainless steels are used because of their mechanical strength, hardness and corrosion resistance. Super-martensitic grades have a very low carbon content, improving weldability greatly.

Duplex stainless steels have a micro structure with approximately equal proportions of ferrite and austenite and are therefore named “duplex”. There is a wide range of duplex grades all offering an attractive combination of high strength and good corrosion resistance. Nowadays, the family of duplex stainless steels ranges from more cost-efficient lean duplex grades, through the standard grades to highly alloyed super duplex grades for more demanding applications.



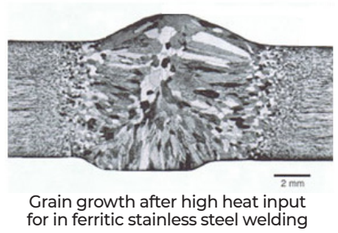
STAINLESS STEEL WELDING CHARACTERISTICS AND FILLER METAL GUIDELINES

Austenitic stainless steel: In general, it has an excellent weldability and can be welded using any of the main welding processes. Consumables generally have a chemical composition similar to the parent metal, with compensation for the burn-off of elements. The weld metal is designed to contain small amounts of ferrite, to absorb impurities and counteract hot cracking. Preheating and excessive heat input should be avoided to further prevent hot cracking. Stainless steels which are stabilized (321 and 347) with Ti and Nb for service at elevated temperatures (to avoid intergranular corrosion) should be welded only with "stabilized" consumables.



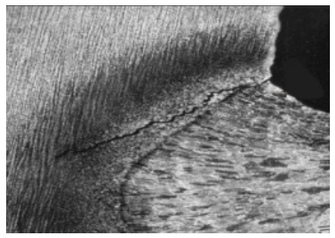
Selective corrosion of type 304 weld along the ferritic phase which has a lower corrosion resistance than the austenitic phase.

Ferritic stainless steel: Its weldability is reasonable, depending on the composition. However, grain growth and subsequent loss of toughness in the HAZ presents a problem with all ferritic steels. Therefore heat input and interpass temperature must be limited. Consumables can be either ferritic with matching composition or austenitic.



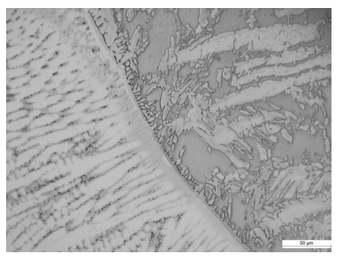
Grain growth after high heat input for in ferritic stainless steel welding

Martensitic stainless steel: It has a rather poor weldability, especially with increasing carbon contents. Brittle zones, which are sensitive to cold cracking, are easily formed in the heat affected zone. Austenitic filler materials are preferred, because their ductile weld metal absorbs residual stresses in the weld zone. Low-hydrogen consumables, preheating, a controlled interpass temperature and slow cooling are commonly applied measures to avoid cold cracking.



Cold cracking in heat affected zone

Duplex stainless steel: In general, it has a good weldability and all main welding processes can be used. Welding consumables have duplex composition, but are higher in elements promoting austenite formation, usually nickel. This is needed to avoid excessive ferrite and maintain a duplex microstructure under practical cooling conditions. Preheating is not necessary, but the heat input needs to be high enough to avoid a high cooling rate and excessive ferrite.



Micrograph of dissimilar weldment of Hastelloy C276 and duplex stainless steel.

DIFFERENCES BETWEEN NON-ALLOYED AND STAINLESS STEEL

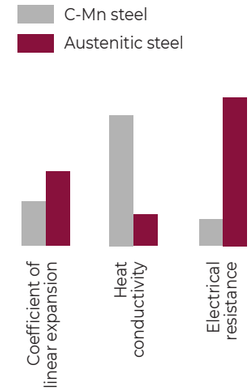
Stainless steel has, in general, good weldability, although it differs in a number of aspects from non and low-alloyed steel. In welding practice, this poses a number of differences that need to be taken into account.

Higher coefficient of thermal expansion and lower strength which means:

- More deformation/distortion will occur
- The root-gap is more likely to close rapidly
- More tack welds have to be made

Low heat conductivity which effects in:

- Heat remains longer in the weld area and weld pool control is more difficult
- Higher risk of burn through in root runs, more difficult to bridge wider root opening
- Different technique in positional welding needs to be applied is more difficult, PF/3G
- A different weld metal solidification behaviour: risk of large end craters



Higher electrical resistance which causes:

- Lower electrical stick-out is applied
- Lack of penetration/fusion risk increases
- More heat generated at lower current, welding process is more current sensitive and lower currents are applied

The above relates predominantly to austenitic stainless steel grades and least to ferritic/martensitic types. Duplex stainless steels with their mixed micro structure show behaviour in between.

HYUNDAI WELDING offers a productive alternative for the welding of stainless steels over SMAW / GMAW welding. HYUNDAI WELDING not only provides a full product portfolio in stainless cored wires, but also ensures high productivity and superb weldability. Whether you are in need of wires for austenitic stainless steel, dissimilar joints and buffer layers, or extreme low temperature applications such as cryogenic LNG storage tanks, we have got you covered. This goes for both flat and horizontal welding, and all positional welding.

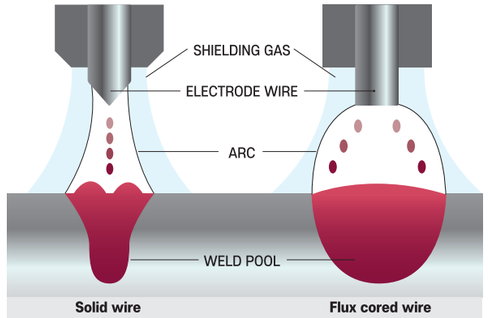
By using HYUNDAI WELDING's flux cored wires for stainless steel, you benefit from:

- Superior productivity (deposition rate and welding speed) compared to SMAW / GMAW welding
- Reliable weld penetration and lower risk of weld defects
- Superb weld appearance and reduced cost and time for post weld cleaning

ADVANTAGES OF USING FLUX CORED WIRES

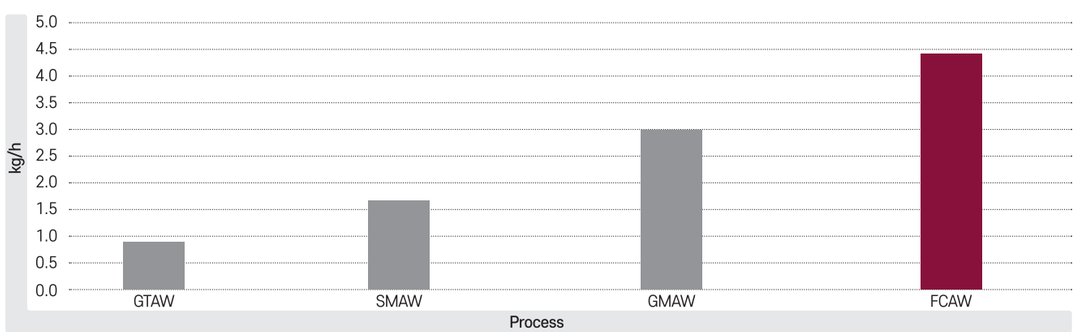
SMAW, GMAW, GTAW and SAW are commonly applied processes for the welding of stainless steel. GTAW and SAW have very characteristic attributes and remain therefore undisputed for specific applications. Weldability and weld appearance of SMAW stick electrodes is optimised through the coating and slag system, but productivity is limited due to a relatively low process duty cycle.

GMAW welding with solid wire has a higher duty cycle and is, therefore, generally faster than SMAW with stick electrodes. It may, however, generate more spatter, oxidised weld deposits or fusion defects related to low current positional welding. Pulsed arc MIG welding is commonly applied to avoid these disadvantages. Shielding gases are argon-base with small additions of oxygen or carbon dioxide.



Left: Pulsed arc GMAW with Ar-base shielding gas needed to control arc behaviour in positional welding.

Right: FCAW with CO_2 shielding gas giving a smooth droplet transfer and round penetration profile.



HYUNDAI WELDING SS CORED WIRES

Cored wires offer the possibility to influence welding characteristics through the filling. The range of HYUNDAI WELDING cored wires for stainless steel offer fabricators a genuine opportunity for increased quality and productivity over both SMAW and GMAW welding. The HYUNDAI WELDING range applies two different rutile slag systems:

- Rutile with a fast freezing slag for versatility and productivity in all-positional welding
- Rutile with a slow freezing slag for travel speed in flat and horizontal-vertical (fillet) welding.

Both types feature:

- Extreme ease of use (welder friendly) due to a fine spray arc droplet transfer over a wide range of applicable welding currents. Allows the less demanding (trailing) backhand technique.
- Use with conventional non-pulsing power sources (easy parameter setting).
- Up to 30% increased deposition rate over solid wire GMAW and three times that of SMAW.
- Excellent slag release, even in V-butt joints.
- Nice flat and bright welds with nice side-wall wetting and virtually no spatter, requiring no or only minimal cleaning.
- Designed for use with both Ar/CO2 mixed gas and 100% CO2. The latter provides reduced gas costs, lower radiated heat (welder comfort) and rounder and deeper weld penetration.
- Possibility of very productive welding of high-quality root passes on ceramic weld metal support.

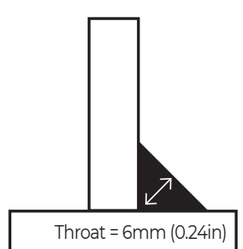
The HYUNDAI WELDING range of rutile cored wires covers all commonly applied types of austenitic, martensitic and duplex stainless steels, including types for buffer layers and dissimilar joints.

Types for ferritic steels are metal-cored, because they were mainly developed for the robotic welding of exhaust systems in HYUNDAI's automotive manufacturing.

A number of types are indicated to be free of bismuth. Bi-free stainless cored wires are needed when joining alloys such as 347, 347H, 321, 321H or 308H intended for high temperature service and also when cladding over creep resistant steel that will be subjected to a PWHT.

Productivity
Vertical-up fillet joint 6mm throat. 0.33 kg weld metal/m.

Process	Typical process duty cycle* (%)	Consumable	Diameter mm (in)	Current (A)	Deposition rate kg/hr (lb/hr)	Net deposition kg/hr (lb/hr)	Weld length m/hr (ft/hr)
SMAW	25	S-308LT.16	3.2 (0.13)	90	1.0 (2.2)	0.25 (0.6)	0.76 (2.5)
GMAW**	45	SM-308LSi	1.0 (0.04)	100	1.6 (3.5)	0.72 (1.6)	2.3 (7.6)
FCAW	40	SW-308L Cored	1.2 (0.045)	150	2.8 (6.2)	1.12 (2.5)	3.4 (11.2)



* Arc time/total welding time. Typical process duty cycle for manual/semi-automatic welding according TWI-Global

** Pulse arc

APPLICATION OF AUSTENITIC STAINLESS CORED WIRES

1) Chemical and Petrochemical Plants

Stainless steel is the ideal material choice for a wide range of chemical and petrochemical plant applications. Its strength and resistance to corrosion are incomparable. A stainless steel filter and seamless pipe combination is a mainstay of modern fluid systems. Chemical plants deal with acids and oxidizers, which can damage many materials. Stainless provides the best overall resistance to a wide range of chemicals, and its shapes are smooth and robust enough to handle virtually any type of cleaning process. HYUNDAI's Supercored series for flat and horizontal welding is used for overlay on carbon steel, and the all-positional SW Cored series is used for welding types 347H, 321, 304, or duplex 2205 and 2207.

Part or Base metal	Product
Overlay on Carbon Steel	Supercored 308L, 309L, 309MoL, 316L
STS 347H, 321	SW-347 Cored
STS 304	SW-308 Cored
2205 (Duplex)	SW-2209 Cored
2207 (Super Duplex)	SW-2594 Cored

2) Seawater Desalination

Seawater has the potential to become one of our main sources of fresh water. Seawater desalination requires a material that can resist the aggressive corrosion caused by seawater and brine. The optimal method is to use stainless steel, which ensures low maintenance costs, durability, and high recyclability. Approximately 80% of stainless steels are recycled at the end of their life, which make it an economical choice in the long run. Austenitic STS 316L is the predominant material used to make the components of a desalination plant. High performance stainless steels, including LDX 2101 lean duplex and 2205 duplex grades, are being more widely used due to their resistance to stress corrosion cracking (SCC). SW-2209 Cored can be used to weld both of these grades.

Part or Base metal	Product
STS 316L	SW-316L Cored
LDX 2101 (Lean Duplex) 2205 (Duplex)	SW-2209 Cored

3) Power Plants

Power plants are critical for economic growth, as they provide the energy necessary for businesses to operate and expand. They often use water or other corrosive fluids to generate electricity. Stainless steel is highly resistant to corrosion and heat, making it an ideal material for use in pipes, heat exchangers, and other equipment that comes into contact with these fluids at high temperatures. The most commonly used alloy is 304L, applied to blocks and accumulator tanks. 309L and 316L are used in steam separators, and 2205 and 254SMo are used in sea water cooling condensers and storage tanks for nuclear waste.

Part or Base metal	Product
STS 304L	SW-308L Cored
STS 309L	SW-309L Cored
STS 316L	SW-316L Cored
LDX 2101 (Lean Duplex)	SW-2209 Cored
2207 (Super Duplex)	SW-2594 Cored

4) LNG & Offshore Industries

Stainless steel has a critical advantage in the LNG & Offshore Industries. Types 304L and 316L are widely used for cryogenic service and LNG storage tankers. All-positional "Controlled Ferrite" SW-308LT and SW-316LT have good impact value at cryogenic temperatures of up to -196°C (-321°F). Duplex 2205 and super duplex 2207 are used in parts for LNG-FPSO (Liquefied Natural Gas-Floating Production Storage and Offloading) structures. SW-2209 Cored and SW-2594 Cored have you covered for these applications.

Part or Base metal	Product
STS 304L (Cryogenic)	SW-308LT
STS 316L (Cryogenic)	SW-316LT
2205 (Duplex)	SW-2209 Cored
2207 (Super Duplex)	SW-2594 Cored

5) Food & Beverage Industry

In the food and beverage industry, tanks with high strength and corrosion resistance are required for storage. Duplex stainless steel offers a number of economical benefits, allowing for thinner gauges for lighter structure and smoother surfaces for easy washing. Lean duplex LDX 2101 and duplex 2304 are most commonly used in this industry. Duplex is used for a variety of tank fabrication, such as tanks for wine storage, beer kegs, sugar syrup, and palm oil. It is advisable to use cored wires for stainless steel depending on the type of duplex and its pitting resistance equivalent number (PREN). Stainless type 304L is primarily used to weld beer kegs.

Part or Base metal	Product
STS 304L	SW-308L Cored
STS 316L	SW-316L Cored
LDX 2101 (Lean Duplex) 2205, 2304 (Duplex)	SW-2209 Cored
2507 (Super Duplex)	SW-2594 Cored

6) Pulp & Paper Industry

While the pulp and paper industry continues to evolve and refine its processes, one thing remains constant: the importance of stainless steel parts and equipment. Despite having reduced waste production and optimized techniques, the industry still uses highly corrosive chemicals. Ensuring that piping, heat exchangers, and structural elements can withstand constant exposure to these chemicals is critical. Stainless steel provides a solution to these problems, with its advantages in corrosion resistance and thermal characteristics. Types 304, 304L, 316, and 316L are frequently used in bleach towers, cooking optimizers, and water recirculation/purification systems. Lean duplex LDX 2101 is used to weld white liquor tanks.

Part or Base metal	Product
STS 304	SW-308 Cored
STS 304L	SW-308L Cored
STS 316	SW-316 Cored
STS 316L	SW-316L Cored
LDX 2101 (Lean Duplex)	SW-2209 Cored

WELDING APPLICATIONS FOR SS CORED WIRES

APPLICATION OF FERRITIC STAINLESS CORED WIRES

Automotive Industry

Metal-cored wires for ferritic stainless steel are widely used for welding automotive exhaust systems in cars. HYUNDAI WELDING cored wires for the automotive industry are specifically designed to weld manifolds, mufflers, converters, and other components. These metal-cored wires excel in the welding of these components and show very good capability to bridge gaps. The hot end of exhaust systems include the exhaust manifold, front pipe, and catalytic converter, and the cold end consists of the center pipe, muffler, and tail pipe. The material used in mufflers differs by manufacturer, so the cored wire should be used according to the components' type of stainless steel. Austenitic wire SW-309LNS Cored is used for welding of dissimilar connections between stainless steel and non/low alloyed carbon steel. The remaining ferritic wires are all used for type 400 series group of stainless steels, such as types 409, 430, 436, and 439. HYUNDAI WELDING's wires for automobiles naturally have a long history, as its Motor Group is a global leader in the automotive industry.

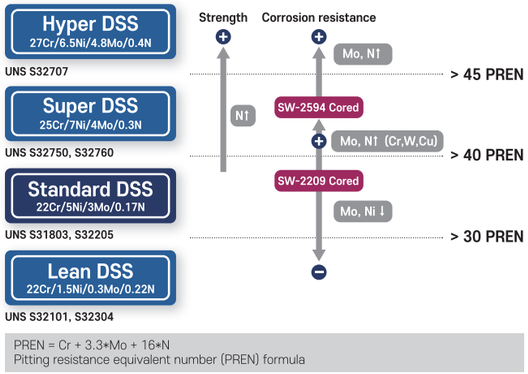
Applications	Product
· Welding of dissimilar metals (stainless and carbon alloy steel)	SW-309LNS Cored (Austenitic)
· Type 409 stainless	SF-409Ti
· Type 409 and 430 stainless	SF-430
· Type 409 and 430 stainless · Applied for exhaust manifolds at high temperature	SF-430Nb
· Type 409, 430, 436 stainless	SF-436
· Type 409, 430, 436, 439 stainless	SC-439Ti Cored

APPLICATION OF MARTENSITIC STAINLESS CORED WIRES

Martensitic stainless steel is a type of stainless steel that has a high level of strength, hardness, and wear resistance. It belongs to the family of stainless steels that can be hardened by heat treatment, and is characterized by a high carbon content (usually between 0.1% to 1.2%) and comparatively low levels of chromium. Martensitic stainless cored wires are used in applications where corrosion resistance is less of a concern but more wear resisting properties are required:

Applications	Product
· Type 410, 405, 420 martensitic stainless steel · Overlay of carbon and low-alloy steels for resistance to corrosion, erosion, or abrasion · Overlay of valve seat	SW-410 Cored
· Welding of 410NiMo martensitic stainless steel · Overlay of continuous casting rolls, valve seat, etc. · Welding and repair of hydroelectric turbines (against hydro-cavitation)	SW-410NiMo Cored

APPLICATION OF DUPLEX STAINLESS CORED WIRES



PREN = Cr + 3.3*Mo + 16*N
Pitting resistance equivalent number (PREN) formula

Duplex stainless cored wires are a common choice for pipelines and pressure vessels in the petrochemical industry, as well as pipework systems, such as risers and manifolds in the oil and gas industry. HYUNDAI WELDING offers all-positional cored wires for both duplex (NAS 329J3L, UNS S31803) and super duplex (NAS 329J4L, UNS S32750) stainless steel. They are called SW-2209 Cored (E2209T1-1/-4) and SW-2594 Cored (E2594T1-1/-4), and their properties are illustrated in the graphic. The pitting resistance equivalent number (PREN) is a predictive calculation of a stainless steel's resistance to localized pitting corrosion based on its chemical composition. The higher the PREN value, the more resistant the stainless steel is to pitting corrosion by chloride. Both lean and standard duplex stainless steel offer great opportunities in many industries because of their improved corrosion resistance properties and higher mechanical strength. Super duplex offers greater corrosion endurance and strength but is more difficult to process. Hyper duplex is used when higher mechanical and corrosion performances are necessary such as oil, gas, offshore, and petrochemical applications.

ADDITIONAL INFORMATION

Duplex stainless steel has a two-phase microstructure consisting of grains of ferritic and austenitic stainless steel. This protects the structure against intergranular corrosion and stress corrosion cracking (SCC). The duplex structure gives this family of stainless steels a combination of attractive properties such as strength, ductility, and corrosion resistance. Duplex stainless steels also show very good stress corrosion cracking (SCC) resistance, which can be a problem for standard austenitics such as Types 304 and 316 under certain circumstances (chlorides, humidity, and elevated temperature).

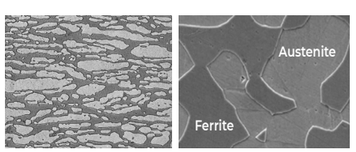
Features of Ferritic Grades
Strength,
Stress Corrosion Cracking(SCC) Resistance

+

Features of Austenitic Grades
Toughness,
Corrosion resistance

Duplex Stainless Steels offer the merits of both ferritic and austenitic grades.

MICROSTRUCTURE OF DUPLEX STAINLESS STEEL



As demonstrated in the graphic, duplex stainless steel has a dual-phase microstructure consisting of both ferritic and austenitic grains. The most stable of microstructures is when the phase balance is equal; approximately 50% ferrite and 50% austenite. In comparison with austenitic stainless steel, duplex stainless steel has a larger thermal conductivity and stress corrosion cracking (SCC) resistance, but has a higher nitrogen (N) content and larger microstructure transformation at the heat affected zone (HAZ). In this heat affected zone, the austenitic grains dissolve into the ferritic phase and then precipitate during the cooling process, creating a dual microstructure.

Product	Specifications		Shielding Gas	Chemical Composition (Typical Values)											Mechanical Properties				Diameter mm(in)	Characteristics and Applications
	AWS A5.22/ SFA5.22	EN ISO 17633-A		C	Si	Mn	P	S	Cr	Ni	Mo	N	Fe	Nb	TS MPa (lbs/in2)	EL(%)	Temp °C (°F)	CVN J (ft·lbs)		
Austenitic Stainless Steel																				
SW-307NS Cored		T 18 8 Mn M M13/I1	Ar + 2% O_2, 100% Ar	0.072	0.61	7.35	0.019	0.008	18.3	8.6	0.10				610 (88,500)	43	-60 (-76)	71 (52)	1.2, 1.6 (0.045, 1/16)	· Metal-cored · Joining and overlay applications on 13Mn steels · Welding of dissimilar steels (high Mn to carbon steel)
SW-309LNS Cored	A5.9 EC309L	T 23 12 L M M13/I1	Ar + 2% O_2, 100% Ar	0.025	0.53	1.80	0.016	0.005	24.0	13.0					590 (85,600)	45	-20 (-4)	60 (44)	1.0, 1.2, 1.6 (0.040, 0.045, 1/16)	· Metal-cored · Non-slag type for automotive mufflers · Welding of dissimilar metals such as stainless and carbon alloy steels
Supercored 308L	E308LT0-1/-4	T 19 9 L R M21/C1 3	100% CO_2	0.024	0.48	1.35	0.014	0.010	19.0	9.5					550 (79,750)	44	-60 (-76)	39 (28)	0.9, 1.0, 1.2, 1.4, 1.6 (0.035, 0.040, 0.045, 0.052, 1/16)	· 18%Cr-8%Ni stainless steel
			80% Ar + 20% CO_2	0.028	0.55	1.40	0.015	0.012	19.5	9.6					570 (82,650)	42	-60 (-76)	34 (25)		
Supercored 309L	E309LT0-1/-4	T 23 12 L R M21/C1 3	100% CO_2	0.033	0.52	1.38	0.012	0.001	22.6	12.7					570 (82,650)	35	-60 (-76)	33 (24)	0.9, 1.0, 1.2, 1.6 (0.035, 0.040, 0.045, 1/16)	· 23.5%Cr-13%Ni stainless steels · Dissimilar welds between carbon, low alloy steels to stainless steels
			80% Ar + 20% CO_2	0.035	0.58	1.45	0.015	0.007	23.2	12.9					580 (84,100)	34	-60 (-76)	34 (25)		
Supercored 309MoL	E309LMoT0-1/-4	T 23 12 2 L R M21/C1 3	100% CO_2	0.033	0.50	1.23	0.010	0.003	22.0	12.4	2.3				680 (98,600)	35	-60 (-76)	32 (23)	0.9, 1.0, 1.2, 1.6 (0.035, 0.040, 0.045, 1/16)	· 22%Cr-12%Ni-2.5%Mo stainless steels · Dissimilar welds between carbon, low alloy steels to stainless steels
			80% Ar + 20% CO_2	0.034	0.58	1.35	0.011	0.004	22.5	12.6	2.5				690 (100,161)	32	-60 (-76)	35 (25)		
Supercored 316L	E316LT0-1/-4	T 19 12 3 L R M21/C1 3	100% CO_2	0.023	0.52	1.21	0.014	0.005	17.8	12.1	2.6				550 (79,750)	40	-60 (-76)	41 (30)	0.9, 1.0, 1.2, 1.6 (0.035, 0.040, 0.045, 1/16)	· 18%Cr-12%Ni-2%Mo stainless steels
			80% Ar + 20% CO_2	0.024	0.58	1.38	0.013	0.006	18.1	12.2	2.7				560 (81,200)	39	-60 (-76)	40 (29)		
Ferritic Stainless Steel																				
SF-409Ti	A5.9 EC409		Ar + 2% O_2, 100% Ar	0.03	0.50	0.55	0.012	0.010	12.5	0.8(Ti)					500 (72,600)	20			0.9, 1.0, 1.2, 1.4 (0.035, 0.040, 0.045, 0.052)	· Stainless steel type 409 · For automotive exhaust systems
SF-430	A5.9 EC430		Ar + 2% O_2, 100% Ar	0.03	0.30	0.50	0.005	0.010	16.5	0.45(Ti)					500 (72,600)	40			1.2, 1.6 (0.045, 1/16)	· Stainless steel types 409 and 430 · For automotive exhaust systems
SF-430Nb		ISO 12072 G Z 17 L Nb	Ar + 2% O_2, 100% Ar	0.03	0.40	0.17	0.010	0.010	16.5	0.40(Ti)				0.50	520 (75,400)	24			1.2 (0.045)	· Stainless steel types 409 and 430 · For automotive exhaust systems
SF-436			Ar + 2% O_2, 100% Ar	0.03	0.60	0.40	0.008	0.006	16.8	0.45(Ti)	0.78				500 (72,600)	35			1.2, 1.4 (0.045, 0.052)	· Stainless steel types 409, 430 and 436 · For automotive exhaust systems
SC-439Ti Cored	A5.22 EC439		Ar + 2% O_2, 100% Ar	0.03	0.30	0.60	0.005	0.010	18.5	0.60(Ti)					500 (72,600)	40			1.2 (0.045)	· Stainless steel types 409, 430, 436, 439 · For automotive exhaust systems

· All products are fully approved by most common societies. Please contact HYUNDAI WELDING for more information on approvals.

Overlay of pipe flange
Supercored 309MoL

Nozzle overlay in pressure vessels
Supercored 316L

Muffler
SW-309LNS Cored

Exhaust manifold
SF-430Nb

Product	Specifications		Shielding Gas	Chemical Composition (Typical Values)											Mechanical Properties				Diameter mm(in)	Characteristics and Applications
	AWS A5.22/ SFA5.22	EN ISO 17633-A		C	Si	Mn	P	S	Cr	Ni	Mo	N	Fe	Nb	TS MPa (lbs/in2)	EL(%)	Temp °C (°F)	CVN J (ft·lbs)		
Austenitic Stainless Steel																				
SW-307 Cored	-	T 18 8 Mn P M21/C1 2	100% CO_2	0.037	0.79	5.15	0.012	0.007	17.8	9.2	0.10				595 (86,275)	47.2	-60 (-76)	67 (49)	1.2, 1.4, 1.6 (0.045, 0.052, 1/16)	· Joining and overlay applications on 13Mn steels · Welding of dissimilar steels (high Mn to carbon steel)
			80% Ar + 20% CO_2	0.047	0.88	5.74	0.012	0.008	17.9	8.9	0.10				602 (87,290)	46.6	-60 (-76)	62 (45)		
SW-308L Cored	E308LT1-1/-4	T 19 9 L P M21/C1 2	100% CO_2	0.025	0.62	1.31	0.015	0.010	18.7	10.2					567 (82,215)	48.4	-60 (-76)	53 (39)	1.0, 1.2, 1.4, 1.6 (0.040, 0.045, 0.052, 1/16)	· 18%Cr-8%Ni stainless steel
			80% Ar + 20% CO_2	0.023	0.70	1.42	0.015	0.010	18.9	10.0					573 (83,085)	46.5	-60 (-76)	54 (39)		
SW-308LT	E308LT1-1/-4	T 19 9 L P M21/C1 2	100% CO_2	0.019	0.65	1.35	0.012	0.009	18.5	9.8					570 (82,742)	47.5	-196 (-321)	34 (25)	1.2 (0.045)	· 18% Cr-8%Ni stainless steels · Cryogenic service such as LNG applications
			80% Ar + 20% CO_2	0.020	0.71	1.40	0.012	0.009	18.8	9.9					576 (83,613)	47.0	-196 (-321)	36 (25)		
SW-309L Cored	E309LT1-1/-4	T 23 12 L P M21/C1 2	100% CO_2	0.027	0.74	1.27	0.021	0.006	23.4	13.0					540 (78,300)	41	-60 (-76)	46 (33)	0.9, 1.0, 1.2, 1.4, 1.6 (0.035, 0.040, 0.045, 0.052, 1/16)	· 23.5%Cr-13%Ni stainless steels · Dissimilar welds between carbon, low alloy steels to stainless steels
			80% Ar + 20% CO_2	0.026	0.86	1.43	0.021	0.006	23.5	12.8					580 (84,100)	39	-60 (-76)	40 (29)		
SW-309MoL Cored	E309LMoT1-1/-4	T 23 12 2 L P M21/C1 2	100% CO_2	0.031	0.64	1.39	0.021	0.010	22.2	12.4	2.37				693 (100,485)	32.4	-60 (-76)	44 (32)	1.2, 1.4, 1.6 (0.045, 0.052, 1/16)	· 22%Cr-12%Ni-2.5%Mo stainless steels · Dissimilar welds between carbon, low alloy steels to stainless steels
			80% Ar + 20% CO_2	0.035	0.75	1.35	0.021	0.015	22.3	12.5	2.20				661 (95,845)	29.6	-60 (-76)	42 (31)		
SW-316L Cored	E316LT1-1/-4	T 19 12 3 L P M21/C1 2	100% CO_2	0.025	0.90	1.25	0.013	0.008	17.4	11.8	2.63				550 (79,750)	45.6	-60 (-76)	45 (33)	0.9, 1.0, 1.2, 1.4, 1.6 (0.035, 0.040, 0.045, 0.052, 1/16)	· 18%Cr-12%Ni-2%Mo stainless steels
			80% Ar + 20% CO_2	0.026	0.92	1.38	0.013	0.008	17.5	11.7	2.65				555 (80,475)	42.4	-60 (-76)	40 (30)		
SW-316LT	E316LT1-1/-4	-	100% CO_2	0.020	0.69	1.45	0.016	0.008	17.4	12.2	2.20				535 (77,575)	47	-196 (-321)	32 (23)	1.2 (0.045)	· 18% Cr-12%Ni-2%Mo stainless steels · Crygenic service such as LNG storage tank
			80% Ar + 20% CO_2	0.018	0.77	1.51	0.015	0.009	17.2	12.2	2.20				542 (78,590)	46	-196 (-321)	33 (24)		
SW-317L Cored	E317LT1-1/-4	-	100% CO_2	0.029	0.61	1.41	0.022	0.007	18.3	12.7	3.35				585 (84,825)	36.8	-60 (-76)	32 (23)	0.9, 1.0, 1.2, 1.6 (0.035, 0.040, 0.045, 1/16)	· 316, 317 type stainless steels
			80% Ar + 20% CO_2	0.028	0.67	1.55	0.022	0.007	18.5	12.9	3.38				595 (86,275)	35.4	-60 (-76)	31 (22)		
SW-347 Cored	E347T1-1/-4	T 19 9 Nb P M21/C1 2	100% CO_2	0.053	0.64	1.20	0.014	0.008	18.7	10.1				0.56	640 (92,800)	40.8	-60 (-76)	53 (39)	0.9, 1.0, 1.2, 1.4, 1.6 (0.035, 0.040, 0.045, 0.052, 1/16)	· 347 and 321 type stainless steels · Stainless steel boilers
			80% Ar + 20% CO_2	0.053	0.70	1.15	0.014	0.008	18.8	10.1				0.60	648 (93,960)	40.6	-60 (-76)	52 (38)		
SW-308HBF	E308HT1-1/-4	ISO 17633-B TS 308H-F M21/C1 1	100% CO_2	0.053	0.58	1.09	0.014	0.009	18.8	10.1					580 (84,100)	41.0	-60 (-76)	52 (38)	0.9, 1.0, 1.2, 1.4, 1.6 (0.035, 0.040, 0.045, 0.052, 1/16)	· Welding of 18%Cr-8%Ni stainless steels for high temperature service
			80% Ar + 20% CO_2	0.050	0.63	1.00	0.019	0.008	19.1	10.2					585 (84,825)	42.0	-60 (-76)	53 (39)		
SW-309HBF	E309HT1-1/-4	ISO 17633-B TS 309H-F M21/C1 1	100% CO_2	0.063	0.72	1.42	0.014	0.009	22.8	12.7					570 (82,650)	40.0	-60 (-76)	50 (39)	0.9, 1.0, 1.2, 1.4, 1.6 (0.035, 0.040, 0.045, 0.052, 1/16)	· Welding of dissimilar metals such as stainless steel and carbon steel or stainless steel and low alloy
			80% Ar + 20% CO_2	0.060	0.78	1.49	0.015	0.008	23.0	12.9					574 (83,230)	42.6	-60 (-76)	54 (39)		
SW-316HBF	E316HT1-1/-4	ISO 17633-B TS 316H-F M21/C1 1	100% CO_2	0.057	0.72	1.57	0.015	0.010	18.0	11.9	2.59				577 (83,665)	41.8	-60 (-76)	60 (44)	0.9, 1.0, 1.2, 1.4, 1.6 (0.035, 0.040, 0.045, 0.052, 1/16)	· Welding of 18%Cr-12%Ni-2% Mo stainless steels for high temperature service
			80% Ar + 20% CO_2	0.058	0.77	1.62	0.016	0.010	18.2	12.3	2.62				580 (84,193)	41.9	-60 (-76)	58 (42)		
Martensitic Stainless Steel																				
SW-410 Cored	E410T1-1/-4	-	100% CO_2	0.053	0.57	0.51	0.010	0.003	12.5	0.4					600 (87,000)	23.0	0 (32)	14 (10)	1.2, 1.4, 1.6 (0.045, 0.052, 1/16)	· 410, 410S, 405 stainless steels · Welding of ASTM CA6NM castings · Weld metal of martensite stainless steel
			80% Ar + 20% CO_2	0.058	0.60	0.55	0.006	0.004	12.6	0.5					610 (88,500)	22.5	0 (32)	13 (9)		
SW-410NiMo Cored	E410NiMoT1-1/-4	T 13 4 P M21/C1 2	100% CO_2	0.032	0.74	0.43	0.008	0.008	11.8	4.4	0.50				890 (129,050)	17.0	0 (32)	35 (25)	1.2, 1.6 (0.045, 1/16)	· Martensite stainless steels (ASTM CA6NM) · Hardfacing of continuous casting rolls, valve seat, etc.
			80% Ar + 20% CO_2	0.038	0.78	0.50	0.009	0.007	12.1	4.5	0.53				900 (130,500)	16.0	0 (32)	30 (22)		
Duplex Stainless Steel																				
SW-2209 Cored	E2209T1-1/-4	T 22 9 3 N L M21/C1 2	100% CO_2	0.028	0.37	0.84	0.012	0.006	22.4	8.7	3.60	0.13			817 (120,350)	28.8	-20 (-4) -50 (-58)	45 (33) 35 (25)	1.2 (0.045)	· Duplex stainless steel (NAS 329J3L, UNS S31803)
			80% Ar + 20% CO_2	0.030	0.45	0.91	0.012	0.008	23.1	8.8	3.70	0.12			828 (121,800)	26.0	-20 (-4) -50 (-58)	44 (32) 34 (25)		
SW-2594 Cored	E2594T1-1/-4	T 25 9 4 N L P M21/C1 2	100% CO_2	0.023	0.42	0.74	0.013	0.002	25.5	9.2	3.74	0.24			896 (129,920)	24.2	-20 (-4)	27 (19) 20 (14)	1.2 (0.045)	· Super Duplex stainless steel (NAS 329J4L, UNS S32750)
			80% Ar + 20% CO_2	0.029	0.52	0.75	0.012	0.001	25.7	9.1	3.78	0.23			891 (129,195)	26.0	-20 (-4)	37 (27) 30 (22)		

Stainless Steel for Cryogenic Applications
SW-316LT

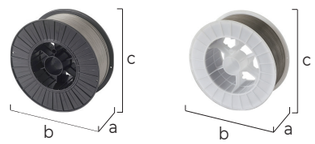
Paper and Pulp Mill
SW-308L Cored, SW-316L Cored

Stainless Steel Boilers
SW-347 Cored

Wine Storage Tank
SW-2209 Cored

PACKAGING SPECIFICATIONS

PLASTIC SPOOLS FOR CORED WIRES

Type	Spool
Spool Type	
Wire	5kg(11lbs) / 12.5kg(27.6lbs) / 15kg(33lbs)

Spool Size mm (in)		
	5kg (11lbs)	12.5 / 15kg (27.6 / 33lbs)
a	64 (2.5)	110 (4.3)
b	210 (8.3)	270~280 (10.6-11.0)
c	215 (8.5)	270~280 (10.6-11.0)

VACUUM BAG

Stainless steel cored wires (flux-cored and metal-cored) are more sensitive to moisture pick-up compared to non- and low-alloyed cored wires. Not only to protect the products from moisture pick-up but also from other contaminants, HYUNDAI WELDING provides stainless steel cored wires with vacuum bag.

The most significant advantage of using a vacuum bag is the protection of the wire from moisture and other contaminants. With vacuum bag, the wire is protected from humidity and can maintain its quality for a longer period. As a result, customers can have greater confidence in the consistency of their welds and can store the wire for longer periods without worrying about it losing its effectiveness.

HYUNDAI WELDING is a global manufacturer of welding consumables and equipment. As the top leading manufacturer of welding consumables in Korea, and with a Global network of sales, distribution and manufacturing plants, HYUNDAI WELDING have developed into a key player in the international welding industry.

Our company is fully committed to the ever-changing needs of our customers and has evolved in just under 50 years to provide welding expertise and breakthroughs in welding technology. HYUNDAI WELDING understands customer needs and offers customers world class products and world class global solutions.

HYUNDAI WELDING's solutions for stainless steel cored wire welding meet customer requirements and are backed with a superior customer service and support. By using high quality consumables and equipment of HYUNDAI WELDING, our customers are experiencing increases in productivity and competitiveness.

HYUNDAI WELDING is a world-class manufacturer that specializes in providing optimum welding solutions to its customers, by supplying top-notch welding consumables and equipment. HYUNDAI WELDING has contributed to the development and success of the global welding industry for almost 50 years since its foundation in 1975.

For more information on HYUNDAI WELDING, please visit www.hyundaiwelding.com

E-book

HYUNDAI WELDING

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