

New Application Awards 2020





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Precision Hygiene
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Water tanks
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Stainless steel Hook Joint for Air-Conditioner Refrigerant Pipe
New lean duplex stainless steel 1.4670 with low thermal conductivity for
 building, developed in partnership with an ABC market customer



Best New Technology Case Studies

Stainless Steel Straw

ISSF Member	Aperam South America
Manufacturer	Aperam South America
Location	São Paulo, Brazil
Field	Food and beverage
Environment	Indoor
Grade and surface	304 polished
Competing materials	plastic

Advantage points of using stainless steel

The single use plastic is a big environmental issue worldwide. Plastic straws in particular have a very short lifecycle and are often not recycled, meaning they tend to end up in the landfill or, even worse, in rivers and the sea. In fact, according to the Foresight Future of the Sea Report (UK), it is estimated that 10 million tons of plastic material ends up in the sea, with more than 100 thousand tones being attributed to plastic straws.

The Stainless Steel Straw can be re-used several times and is 100% recyclable. It does not affect the taste of the drink and it even adds a nice, cool aspect.

Product description

Stainless Steel straws create a whole new market, replacing traditional, single use plastic steel straws. Countries around the world are implementing rules and regulations restricting the use of these single use plastic products. These restrictions create a GAP that could open a window for stainless steel to position itself as the perfect material for this application. After all, there are millions of bars, restaurants, and coffee houses around the world that all need straws! Furthermore, because it can be reused several times, the stainless steel straw not only benefits the end user and the environment, it can also be economically beneficial to bar and restaurant owners.



Stainless Steel Straw. Picture courtesy of Aperam South America.



Stainless Steel Straw. Picture courtesy of Aperam South America.

Thermal Imaging Process Control

ISSF Member

Field

Environment

Grade and surface

Competing materials

BAHRU STAINLESS SDN BHD

Industrial machinery and equipment

industrial

Austenitic, Moly and Ferritic / N01, 2D, 2B

Stainless Steel Flat Products

Advantage points of using stainless steel

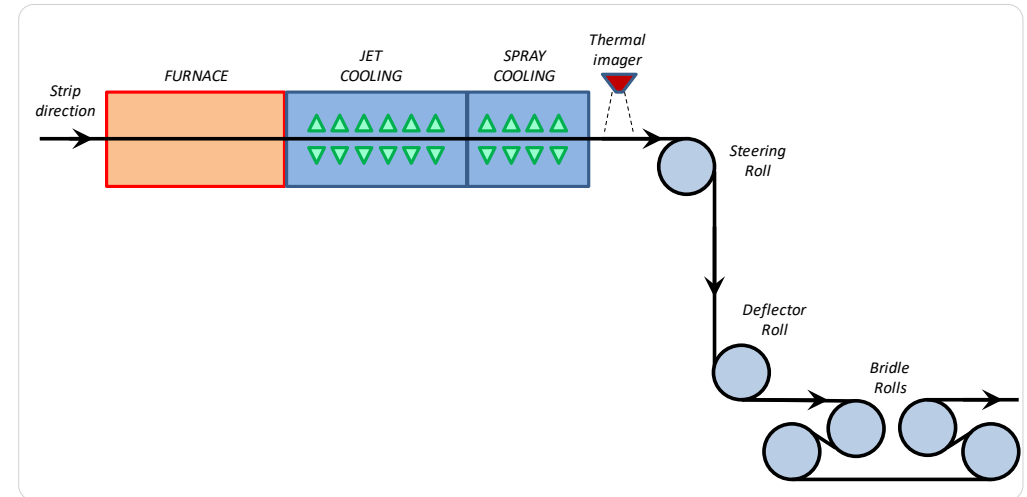
Corrosive resistant & Cosmetically

Product description

Challenge

Continuous production in hot annealing could cause scale accumulates at one end of Jet Cooling sprayers, clogs the nozzles & reduces the effectiveness of the cool spraying at the affected edge on the strip. As pyrometer only measures strip temperature at a single point, it is not able to sense temperature distribution of an area on the strip.

Insufficient cooling at the affected edge may lead to domino effect of burning and melting down the rolls after the cooling chamber, causing particles of the rubber roll stick on the strip and being carried to the entire sections along the line, line stoppages due to roll change and thorough clean-up. To interpret this situation from safety perception, it could cause catastrophic due to fire which could burn the facilities down to ashes and interrupt to the continuity of supplying the products and services into marketplace.



Thermal Imaging Process Control. Picture courtesy of Bahru Stainless.



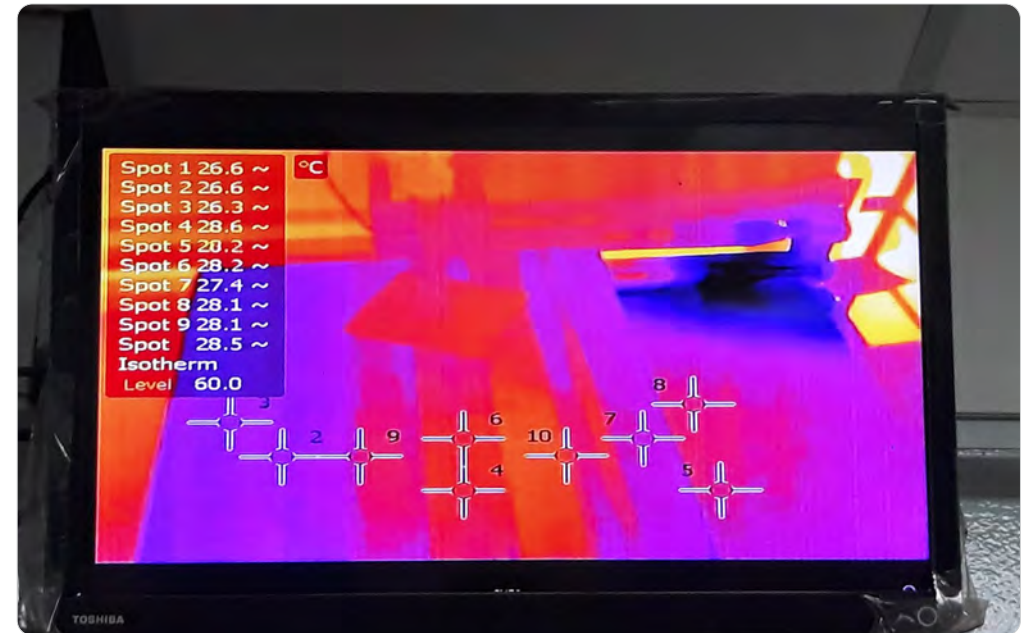
Action

Bahru initiated the usage of thermal imaging technology in process optimization control. A thermal imager is directed to the strip at the exit of the cooling chamber, while sequences of logics were being programmed as actions to achieve desired result as per following table given.

- **Above 60°C** Activation of Spray Cooling valve 1 to 10 & Jet Cool Scrubber Water at Jet Cool 2, 3 & 4
- **Above 65°C** Activation of Jet Cool 4 valve 1 to 6
- **Temperature not reduce to below 65°C after 10 seconds** Activation of Jet Cool 3 valve 1 to 6 while maintaining process speed
- **Above 75°C** Activation of Jet Cool valve 1 to 6 while process speed reduces to 6mpm
- **Above 80°C** Line stoppage
- Process will be back to normal when temperature reduces to 55°C

Outcome

It can be observed that there is no burn mark on the roll as well as the carry-over rubber particles since then. The logics activation also serves as early indicator of conducting maintenance & service for sprayer/nozzle. The automation has been established successfully and prevents over temperature of strip from cooling chamber. It is an error-proof concept that replaced the decision-making which human dependent thus eliminating skill-based error and mistake.



Thermal Imaging Process Control. Picture courtesy of Bahru Stainless.

Stainless steel bottoms for skis

ISSF Member Manufacturer

Centro Inox
Blossom Ski, registered trademark of Penz Srl
– I-23020 Gordona SO (Italy) – Via al Piano
38, phone: +39 0343 36207, info@blossomski.
com, www.blossomski.com / In collaboration
with: Interdepartmental Laboratory CRYOLAB,
Politecnico di Milano (Milano, Italy)
Sports equipment
modified EN 1.4310 (AISI 301)
Ultra High Molecular Weight Poly-Ethylene
(UHMWPE) and carbon steel

Field Grade and surface Competing materials

Advantage points of using stainless steel

Better corrosion resistance and abrasion resistance with respect to the materials commonly employed. This kind of bottom also fulfils the task carried out by the edge, traditionally made of carbon steel. Therefore, with this stainless steel bottom, the edge is no longer needed. This material is also characterized by high mechanical properties and a great resistance to scratches and impacts. All these advantage points translate into an important reduction of the maintenance operations.



Stainless steel bottoms for skis.
Picture courtesy of Centro Inox.



Stainless steel bottoms for skis.
Picture courtesy of Centro Inox.



Stainless steel bottoms for skis. Picture courtesy of Centro Inox.

Product description

A company specialized in artisan downhill skis, located in the province of Sondrio (Italy), with the collaboration of CRYOLAB, a interdepartmental laboratory of Politecnico di Milano, designed and patented bottoms for skis completely in modified EN 1.4310 (AISI 301) stainless steel: starting from sheets having a thickness of 0.5 mm, they are obtained through laser cutting and then assembled with the other components of the ski. The better resistance to corrosion and to abrasion are two of the many advantages to substitute ultra high molecular weight polyethylene (UHMWPE) with stainless steel. Moreover, this material is characterized by high mechanical properties and a great resistance to scratches and impacts: these aspects remarkably reduce the maintenance operations on the skis. The research project is still in progress.

These products can create a new market for stainless steel, because other materials are nowadays employed for the bottoms and the edges of the skis.

Turnkey Modular

ISSF Member
Manufacturer
Field

Location
Environment
Grade and surface

Competing materials

Columbus Stainless
Turnkey Modular
Architecture, Building & Construction;
Electrical equipment & machinery
Johannesburg, South Africa
industrial
3CR12 HRA and No.1 finish for the structure;
304 balustrading
Mild steel, Brick and mortar

Advantage points of using stainless steel

Stainless steel gives the product superior corrosion resistance and instils a level of confidence around longevity. Over and above the corrosion issues the superior strength characteristics of stainless steel allows for the design of lighter weight equivalent structures. Complete stainless steel structures also offer superior lightning immunity and an electrical equity potential environment.

Product description

At the core of Turnkey Modular's business is the packaging of an array of technologies across multiple sectors and markets. The overarching requirements in each application are self-contained structures that are bespoke designed around the particular needs of the solution they house. These diverse and complicated solutions are deployed to the end user 100% commissioned and ready for operation.



Turnkey Modular. Picture courtesy of Turnkey Modular.



Turnkey Modular. Picture courtesy of Turnkey Modular.



Turnkey Modular. Picture courtesy of Turnkey Modular.

To make this possible, Turnkey Modular have developed a fabrication technique that exploits the infinite flexibility and exceptional accuracy of building components that are laser cut and CNC bent from sheet metal. This technique has completely displaced the requirement for any structural steel in any of their structures. The structures rely on the inherent strength within individual components to form an exceptionally strong exoskeleton structure. This has made the product extremely scalable without the need for skilled artisans. The intelligence now resides within each component – making the fabrication process a simple assembly process. Reliability, accuracy and repeatability in this method are unprecedented when compared to traditional large structure fabrication. 3D design and finite element analysis have allowed for optimal structural elements originated from flat sheet metal. The technique has allowed for the building fully compliant blast rated structures in the oil and gas field with surprisingly reduced amounts of steel reinforcing. The technique also allows for the housing of a wide range of technologies that can be quickly and reliably deployed even in the most remote and hostile environments. Currently Turnkey Modular's solutions service clients in the oil and gas and mining industries particularly for large electrical solutions. Single transportable unit structures can weigh up to hundred tons and exceed 10 m in width and 30 m in length. The application of this bill technique is in its infancy and could certainly find its way across a vast array of sectors.

Stainless Steel as used in Exhaust Manifold & Converter for Mazda SKYACTIV-X engines with the world's first Spark Controlled Compression Ignition (SPCCI)

ISSF Member

JFE Steel Corporation

Manufacturer

Mazda Motor Corporation

Field

Automotive; Green energy

Location

Japan, EU, etc.

Environment

urban; rural; coastal; industrial

Grade and surface

Superior heat resistant ferritic Stainless Steel with outstanding formability (modified type 444) / KD(2D)

Competing materials

Cast iron of carbon steel , cast stainless or austenitic stainless steel

Advantage points of using stainless steel

1. Reduction of the heat capacity & weight of parts
2. Sparing rare alloy elements (Ni)
3. The Low thermal expansion coefficient of ferritic stainless steel contributes to simple design.
4. Its high fatigue properties at high temperatures contribute to improving those of parts
5. Not only fatigue property but also high formability of stainless steel contributes to improving the fatigue properties of parts. This is because it can be formed into a shape in which stress is less likely to concentrate.

Product description

Many kinds of stainless steels have been applied to exhaust manifolds and converters for automobile since about 30 years ago. This is therefore a very large market for stainless steel.

On the other hand, recently, the production of EVs has been increasing, but it takes a long time before EVs or fuel cells replace automotive combustion engines. For this reason, improving fuel efficiency and exhaust gas purification

performance of automotive combustion engines is regarded as an essential item for maintaining and improving the environment worldwide. The engine that has the advantages of a spark ignition type gasoline engine (good feeling of acceleration and excellent exhaust gas purification performance) and the advantages of a compression ignition type diesel engine (good fuel efficiency and fast initial response) has been developed (Photo 1).

This engine is named as SKYACTIV-X*) and it is a gasoline engine featuring the world's first Spark Controlled Compression Ignition (SPCCI) system. This is different from conventional gasoline and diesel engine combustion systems and can be called the third combustion system for automobile engines. In the about 130-year history of gasoline engines, the transition from conventional low-compression spark ignition to high-compression Spark Controlled Compression Ignition (SPCCI) can be called epoch-making development. It is clear that achieving a high compression ratio in a gasoline engine would lead



Photo 1: Appearance of Exhaust Manifold & Converter for SKYACTIV-X engines with the world's first Spark Controlled Compression Ignition (SPCCI).
Picture courtesy of Mazda Motor Corporation.

to saving fuel consumption and would contribute to developing a compression ignition type such as a diesel engine, but knocking was easy to occur, and it was difficult to achieve a high compression ratio in a gasoline engine. To increase the compression ratio, it is one of effective methods to reduce high-temperature residual gas in the cylinder. For that purpose, a material with high formability that can form an appropriate exhaust gas path is required. On the other hand, to apply to a high temperature environment, thermal fatigue and high temperature fatigue property are required. To improve the fatigue property of parts, not only the fatigue property of the material itself but also

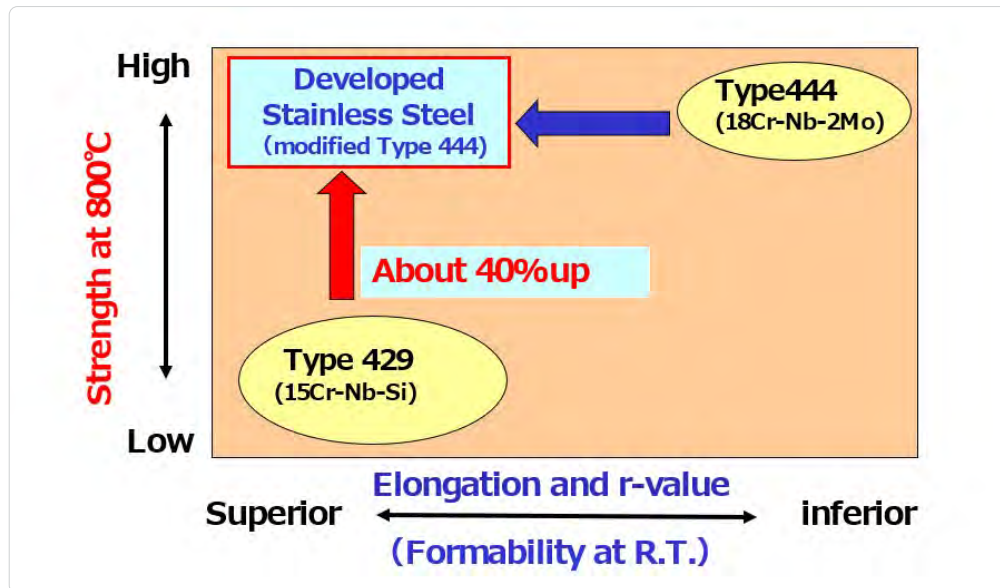


Figure 1: Comparison of Characteristics at R.T. and 800°C between conventional and developed Stainless Steel. Picture courtesy of JFE Steel Corporation.

high formability are required. This is because it can be formed into a shape in which stress is less likely to concentrate.

From these perspectives, the developed ferritic stainless steel (superior heat-resistant steel with outstanding formability) shown in Fig. 1 has contributed to the development of the world's first Spark Controlled Compression Ignition (SPCCI) engine that can be called the third combustion type engine.

Needless to say, in order to maintain and improve the environment worldwide, in addition to developing EVs and fuel cells, it is necessary to improve the fuel efficiency and exhaust gas purification performance of automotive combustion engines.

For this reason, the exhaust system environment of automotive combustion engines is expected to become increasingly severe. Superior heat-resistant ferritic stainless steel with outstanding formability is expected to contribute to such a very large market, and is expected to contribute to maintaining and improving a clean environment as shown in Photo 2 as it is widely applied.

*Examples of Technical Awards for SKYACTIV-X

- Technobest 2019 Award (Autobest in Spain, Feb.2020)
- Q Global Tech Award (Quattroruote in Italy, Feb. 2018)
- Gold in the 2018 Edison Award (Edison Award in North America, Apr. 2018)
- Technology of the Year (Auto Zeitung in Germany, Dec.2017)
- Best of What's New (Popular Science in North America, Oct. 2017)
- Green Innovator (2017 Drive Car of the Year Awards in Australia, Nov. 2017)
- etc.



Photo 2: Mt. Yari and Hotaka Mountains against the background of the clear blue sky. Picture courtesy of Mr. Miyazaki.

Duplex stainless steel beam for Giboshi-bashi Bridge in Tottori Castle

ISSF Member	NIPPON STEEL Stainless Steel Corporation
Manufacturer	Narasaki Seisakusyo Co., Ltd
Field	Architecture, Building & Construction
Location	Tottori Prefecture, Japan
Environment	rural
Grade and surface	SUS821L1 No.1
Competing materials	carbon steel

Advantage points of using stainless steel

- Corrosion resistance (maintenance-free)
- High strength (lighter weight, slim shape)

Product description

Giboshi-bashi Bridge, the cultural asset founded in the Edo period in 1621, is the wooden bridge over the outer moat of the Tottori-jo Castle at the approach to the main entrance of the castle. The world's first "hybrid double bridge construction method" was adopted to restore the Bridge in order to preserve the remains of the bridge piers at the bottom of the moat, a beam was constructed on the original piers under the water and the wooden bridge was placed on it.

The characteristics of duplex stainless steel play an important role in realizing this new method. As a material possessing the sufficient durability and strength to make this construction method possible, duplex stainless steel has been adopted for the entire steel structure from structural members to nuts and bolts. Duplex stainless steel has contributed both to the slimming of underwater beams and to countermeasures against the corrosion of bridge piers, achieving longer life and reduced life cycle costs.



Giboshi-bashi Bridge. Picture courtesy of Tottori-city.

The technology of stainless steel beams can be widely applied to the maintenance work of underground structures, and concrete plans are underway for other restoration works. This restoration project is expected to trigger further progress in the field of infrastructure such as bridges, where the use of stainless steel is expected to progress in the future.

Development of duplex stainless steel technology for Giboshi-bashi Bridge is a winner of the Eighth Monodzukuri Nippon Grand Awards in 2020. The Monodzukuri Nippon Grand Award is a program to recognize outstanding individuals from various generations engaged in monodzukuri (manufacturing). The award has been jointly organized by the Ministries of Japan every other year since 2005 and took place for the eighth time this year.



Giboshi-bashi Bridge. Picture courtesy of Tottori-city.

High Performance Stainless Steel Stencils for Surface Mounting Technology (SMT)

ISSF Member

Manufacturer

Field

Location

Environment

Grade and surface

Competing materials

NIPPON STEEL Stainless Steel Corporation
 TAIYO YUDEN CHEMICAL TECHNOLOGY CO., LTD.
 Industrial machinery and equipment
 Japan
 industrial
 SUS304 H-SR2, NSSMC-NAR-301L SE1
 Copper Alloy, Nickel Alloy, Resin, SUS304 H-SR

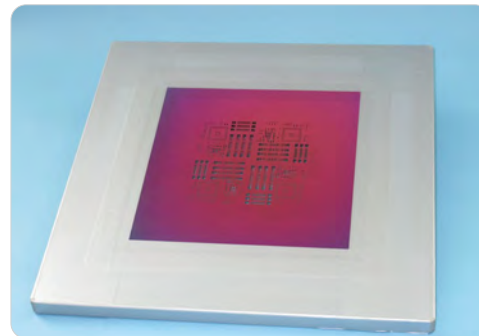
Advantage points of using stainless steel

- vs. Copper Alloy, Nickel Alloy, Resin
: Corrosion Resistance, High-strength, Durability, Reasonable Price etc.
- vs. SUS304 H : Stainless Steel Spring Sheet for General Usage
: Flatness, Low Residual Stress
- vs. SUS304 H-SR : Conventional Stainless Steel Spring Sheet for Precise Processing
: Fine Crystal Grain

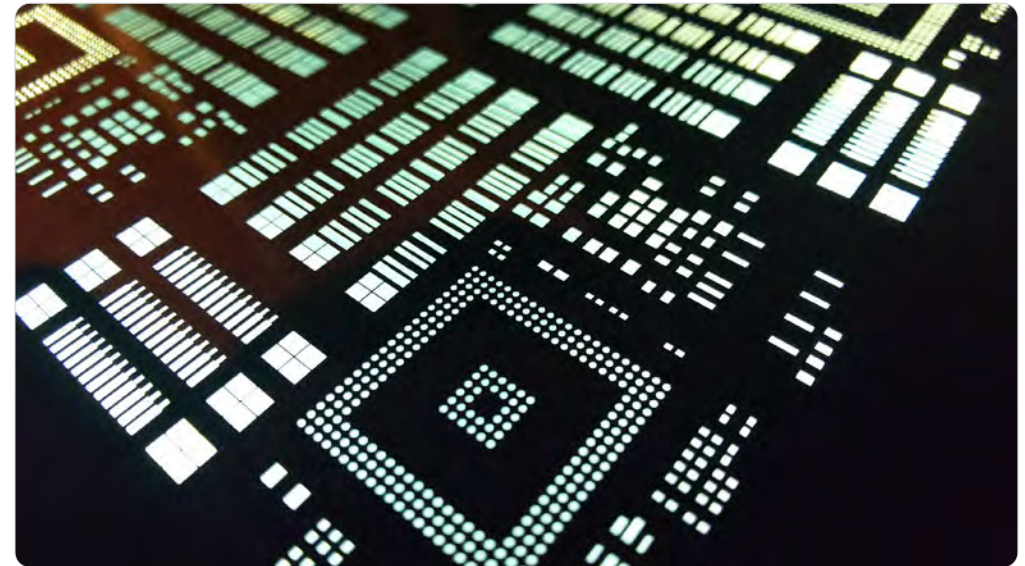
Product description

Background

In recent years, the performance and integration of electronic gadgets such as smartphones have been extremely advanced. And surface mounting electronic devices (SMD) have become small, and those circuit boards have been manufactured using advanced surface mounting technology (SMT). SMD are connected to the circuit board by solder printing technology using a SMT stencil. The performance and quality of the SMT stencil are important factors that determine the packaging density and connection reliability.



High Performance Stainless Steel Stencil for Surface Mounting Technology (SMT)
 Picture courtesy of NIPPON STEEL Stainless Steel Corporation

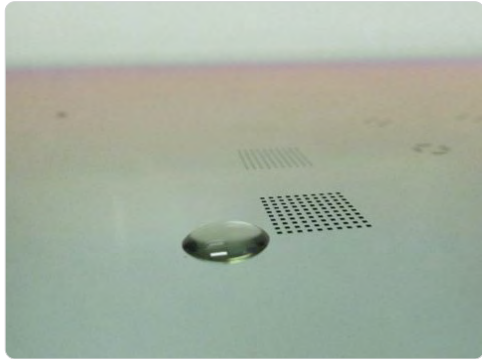


High Performance Stainless Steel Stencil for Surface Mounting Technology (SMT)
 Picture courtesy of NIPPON STEEL Stainless Steel Corporation

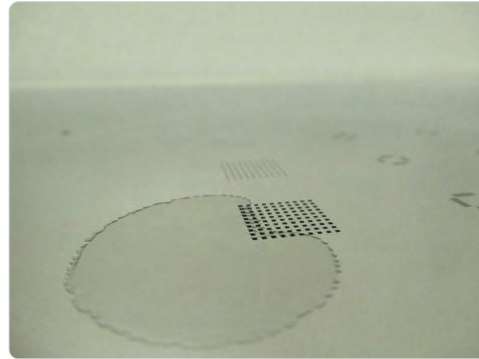
Overview of development

A stainless steel stencil is manufactured by making small holes in a stainless steel sheet of about 0.1 mm thickness using a laser cut and/or a chemical etching processing technique.

In this development, stainless steel sheet with fine crystal grains has been realized for stencils. By fine crystal grains, the surface of the holes formed in the stencil by laser or etching processing was smoothed and dimensional accuracy of those holes was improved. The smoothness of the processed wall surface improved the solder flow excellently.



Developed.
Picture courtesy of TAIYO YUDEN CHEMICAL TECHNOLOGY CO., LTD.



Conventional.
Picture courtesy of TAIYO YUDEN CHEMICAL TECHNOLOGY CO., LTD.

Furthermore, surface treatment technique for supplying hydrophobicity to SMT stencils was developed. The solder releasability was improved significantly by this treatment.

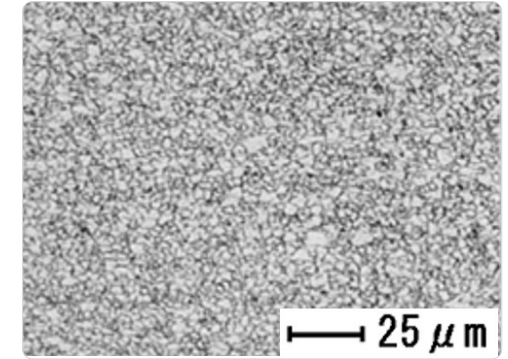
The solder printing quality and mass-production stability have improved by the developed high-performance stainless steel SMT stencil, M2 Coat, having the above-mentioned features.

Results of development

So far, it was not easy to mass-produce circuit boards mounting SMD smaller than fine 0402 chip (0.4 mm x 0.2 mm).

This developed high-performance stainless steel SMT stencil enabled stable solder printing with smaller SMD than 0402 chips, and has been used for high-density circuit board making process in Japan and overseas.

In the near future, high-performance metal stencil is expected to make a significant contribution to the automotive industry, where electronic control will further increase.



Fine Crystal Grain
Picture courtesy of NIPPON STEEL Stainless Steel Corporation

Duplex Gratings for marine and industrial environments

ISSF Member	Outokumpu Oyj
Manufacturer	Meiser
Field	Architecture, building & construction
Location	The North Sea
Environment	marine; urban; rural; coastal; industrial
Grade and surface	Forta EDX 2304 cold rolled sheet
Competing materials	HDG (Hot Dip Galvanized) GRP (Glassfibre Reinforced Plastic)

Advantage points of using stainless steel

General advantages

- Longer lifecycle times
- No or minimum maintenance requirements
- Positive contributions towards improving the carbon footprint

vs GRP

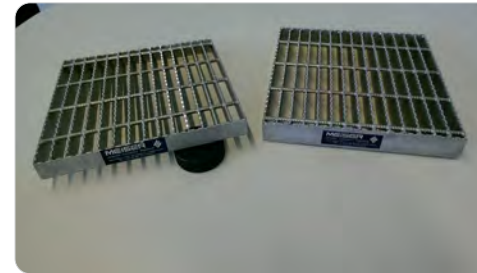
- Fire resistance
- Uniform strength in all direction
- Withstanding low temperature

vs HDG

- Significant weight reductions
- Superior corrosion resistance in saline atmosphere
- Faster installation and easy to adjust and reshape on site
- Hygiene

Product description

With the growing demand of cost reduction on maintenance activities as well as weight reduction solutions, it is necessary to invest in new technology and design solutions in the offshore industry. The use of duplex materials has been on-going for decades but the general structural application in offshore industry, specifically in new platform design and modification activities, has been quite recent. The most commonly used solution in the Norwegian offshore industry is HDG gratings. These gratings are available as ready-use cut-to-length solutions to cover the required surface area from various manufacturers.



Grating segments as produced by Meiser.
Picture courtesy of Outokumpu.

With the mind-set of developing alternative and more sustainable solutions to existing grating options, selection of a superior material type with favourable characteristics such as higher corrosion resistance, mechanical properties and weldability have been the key focus points. The enhanced version of EN 1.4362, Forta EDX 2304 has shown to be a very suitable material to reach up to these criteria, since it has both enhanced

mechanical strength and resistance to localized corrosion compared to the original EN version. In addition, duplex has shown high resistance toward stress corrosion cracking, while 316 SS has failed.

The use of duplex for gratings provides key advantages in weight reductions and superior corrosion resistance in saline atmosphere resulting in longer lifecycle times. The design focus on duplex gratings has been primarily directed to the platforms, staircases and walkways. The design basis for the development of duplex gratings has been the current offshore requirements given in NORSOK standards as well as offshore experience in design and modifications activities.

Depending on the actual environmental parameters, e.g. salinity, temperature and humidity, different grades of Duplex can be selected for this technology.



Installation of gratings. Picture courtesy of Outokumpu

Baffle integrated type STS fuel Tank for PHEV

ISSF Member	POSCO
Developer	ILJIN Co. & POSCO
Field	automotive
Location	Republic of Korea, Europe
Environment	urban
Grade and surface	304XD and 2B
Competing materials	Engineering plastic

Advantage points of using stainless steel

Austenitic stainless steel with improved draw-ability was used to the new concept fuel tank. This ensured equivalent performance (pressure/vacuum fatigue and radiation noise in fuel sloshing) while maintaining a similar weight to the plastic fuel tank. Therefore, it is possible to manufacture new stainless steel fuel tank with excellent price competitiveness.

Product description

Recently, the environmental problems caused by the accumulation of microplastics have become a serious social problem. Microplastics enter the ocean, acting as endocrine disruptors in marine organisms, disrupting ecosystems, and eventually reaching a greater risk for humanity, the end of the food chain. Therefore, activities are needed to reduce the use of plastics or replace them with eco-friendly materials.

Fuel tank is a representative plastic product among automotive parts. Replacing these plastic fuel tanks with recyclable stainless steel can help with environmental issues. PHEVs (Plug in Hybrid Electric Vehicle) have a longer fuel recharging period. So, the pressure by fuel gas vapor in the fuel tank is higher than that of ICEV (Internal Combustion Engine Vehicle). Therefore, the structural rigidity of fuel tank must be enhanced. And additional barriers are needed to meet evaporative gas regulations. These causes the price of the plastic fuel tank to rise. However, using stainless steels, it is possible to reduce the manufacturing cost compared to plastic. In addition, it is easy to modify the design for enhancement

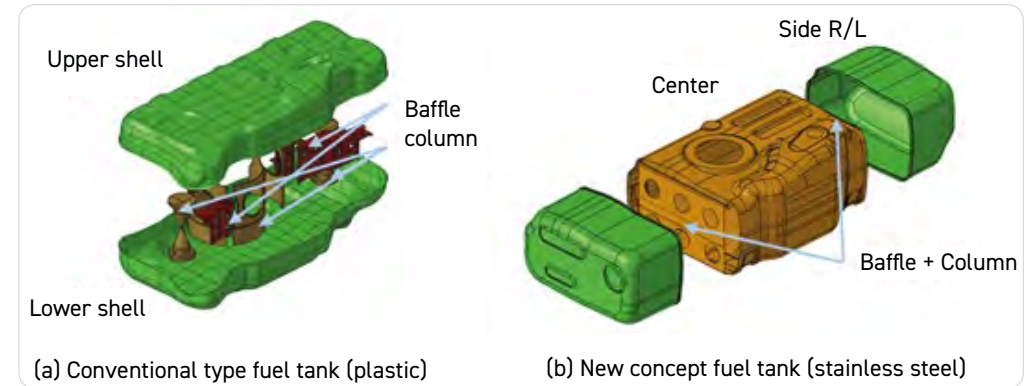


Figure 1 Comparison between conventional type and new concept fuel tank
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of structural rigidity due to the excellent formability. These can be a big merit to automotive makers. Stainless steel fuel tank is used in some high-end PHEV, but more aggressive structural changes are needed to expand the market. To this end, we propose a new fuel tank concept using STS304XD, newly developed stainless steel grade. STS304XD has superior draw-ability to a STS304 by adding Ni and Cu. The new fuel tank concept is divided into three parts to increase the degree of freedom in thickness for extremely lighter weight, and the baffles are manufactured as one of parts of the center part. In general, baffles are



Figure 2 Manufacturing process of baffle integrated part
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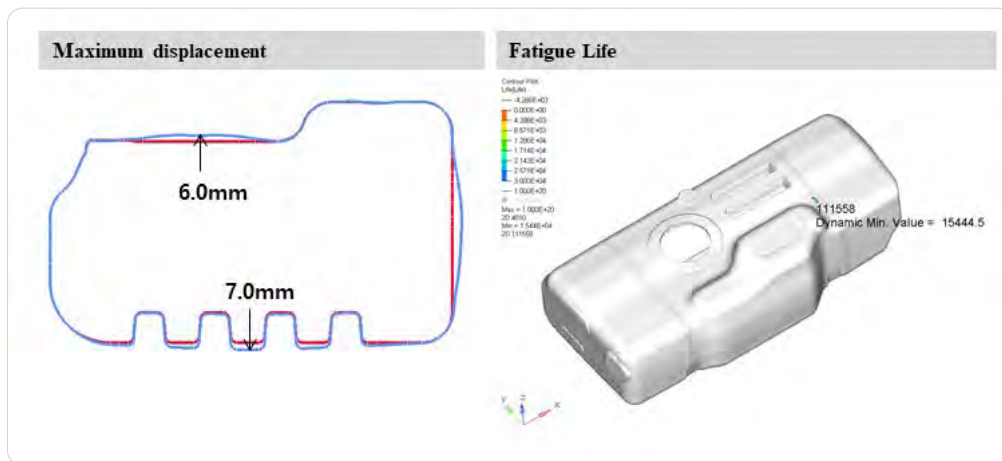


Figure 3 Simulation results of pressure/vacuum fatigue analysis. Copyright 2020. POSCO Co., Ltd. All rights reserved.

installed in the forward / reverse direction of the car to reduce the flow noise, but the baffles in the proposed concept divide the space to decrease the volume of sloshing fuel. In addition the upper and lower baffles were welded to complement the structural rigidity.

The detail design was derived from design optimization process while maintaining performance similar to that of plastic fuel tanks, only 8% weight increase. We simulated the pressure/vacuum fatigue test and fuel sloshing test, which are the main performance indexes of the fuel tanks. Fatigue performance is important because fuel tanks, once installed, are used until scraping cars. And the radiation noise of the fuel tank is also an important performance evaluation index in PHEV

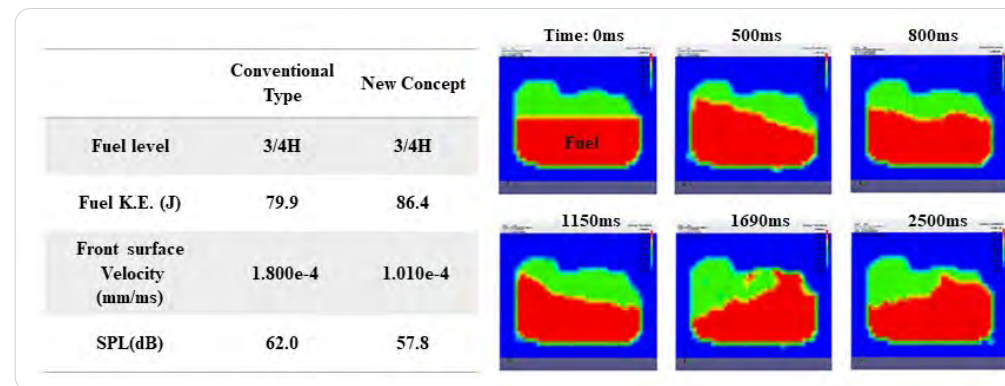


Figure 4 Simulation results of fuel sloshing analysis. Copyright 2020. POSCO Co., Ltd. All rights reserved.

because the noise level of PHEV is reduced significantly. The pressure/vacuum fatigue simulation resulted in a lifespan exceeding 30% of the performance standard, and the fuel sloshing simulation resulted in lower radiation noise approximately 5 dB compared to the plastic fuel tank. Based on the above results, it is expected that the proposed new fuel tank concept will be more suitable for PHEV.

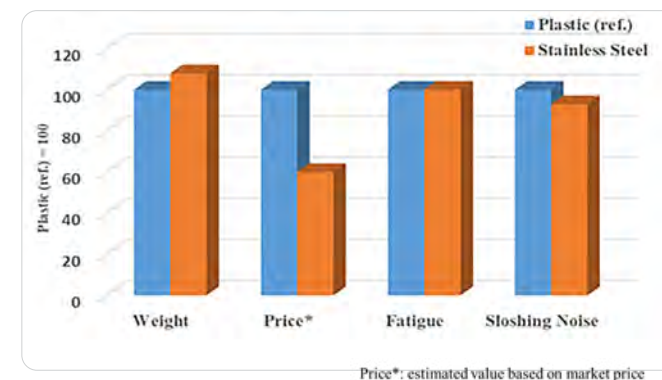


Figure 5 Comparison between plastic and stainless steel fuel tank. Copyright 2020. POSCO Co., Ltd. All rights reserved.



High Interstitial Austenitic Stainless Steel Cold-Rolled for Application in Plastics Extrusion

ISSF Member Manufacturer

Schmolz + Bickenbach Group
Deutsche Edelstahlwerke Speciality Steel
GmbH & Co KG (Schmolz + Bickenbach Group)
and Fraunhofer-Institut für Werkzeugmaschinen
und Umformtechnik IWU

Field

industrial machinery and equipment

Location

Witten/Chemnitz, Germany

Environment

industrial

Grade and surface

Magnadur CN

Advantage points of using stainless steel

The combination of Magnadur CN grade and profile cross rolling allows for a shortened process chain to produce extruder screws featuring a similar wear protection level compared to conventionally used nitriding steel, but additionally showing high resistance to corrosion.

Product description

Deutsche Edelstahlwerke provided Magnadur CN, a high interstitial austenitic stainless steel, for a research project between Fraunhofer IWU and Technische Universität Chemnitz (funded by the European Regional Development Fund (ERDF) and the Free State of Saxony, Germany). This group of steels can be manufactured by means of conventional route, and thus at reasonable cost, compared with high nitrogen austenitic stainless steel, which requires pressurized metallurgy. High interstitial austenitic stainless steels are characterized by high resistance to corrosion (especially localized corrosion induced by chloride ions) combined with superior mechanical properties. The mechanical properties include higher strength (compared with conventional austenitic stainless steels), high toughness, and high cold work hardening potential, which is governed by the positive effect of interstitial elements in solid solution. Even in severely cold-deformed condition, Magnadur CN remains fully austenitic and highly resistant to corrosion. Making use of these properties,



Pictures courtesy of Fraunhofer IWU and Technische Universität Chemnitz

Fraunhofer IWU developed a cold deformation process that combines the advantages of profile cross rolling and surface burnishing. The forming process was applied to a machined preform geometry made of Magnadur CN in solution annealed condition. This geometry was consequently rolled to segments for extruder screws featuring a ready to use surface condition. Thus, an additional surface polishing is avoided. The extruder screws are characterized by a significantly increased hardness in the areas highly exposed to wear, which was achieved by an optimized degree of cold deformation, as well as a very smooth, rolled surface. Laboratory wear testing of axisymmetric specimens against glass reinforced polypropylene (fibers and spheres) both in solid as well as in liquid condition revealed similar wear resistance as compared with conventionally used martensitic nitriding steel, which features higher surface hardness. The introduced material and process can be applied for extrusion of highly corrosive materials.



Best New Development Case Studies

Robotized stainless steel structure for charcuterie & hams

ISSF Member

Manufacturer

Field

Location

Environment

Grade and surface

CEDINOX

HELCESA with ACERINOX material

Food and beverage

Salamanca, Spain

industrial; indoor

AISI 304 tube and sheets

Advantage points of using stainless steel

- hygienic
- lighter
- sustainable
- mechanical properties

Product description

This is an innovative solution for the food industry, it supposes an entire revolution in the way charcuterie and ham are processed and stored.

These structures are tailor-made using AISI 304 stainless steel, 40x40x4 tubes and 3mm sheets. The system is part of the product curation process itself with the most advanced technology. Hooks and frames that form the structures use

an automatic guided vehicle (AGV) to make the upload/unload necessary movements.

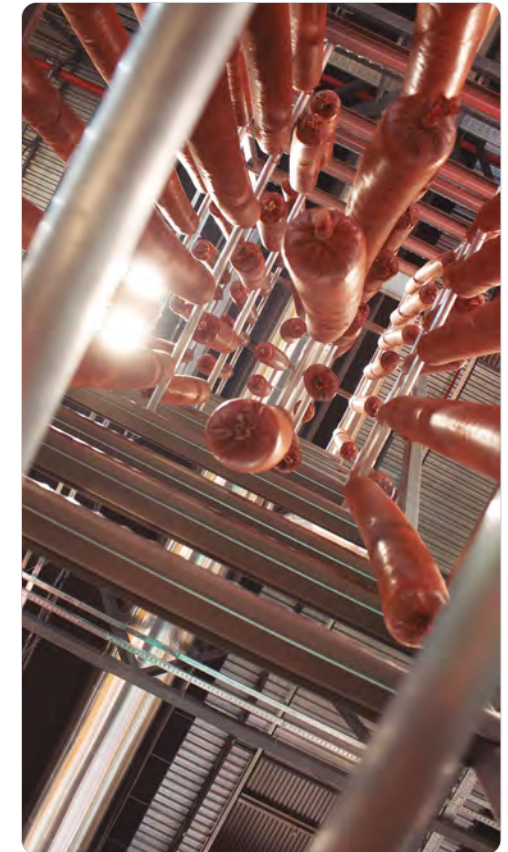
This automatic guide vehicle can be set up by the customer and has a weighing function in order to control the product lessening and can also control the temperature during the curing process.



Picture courtesy of Cedinox



Picture courtesy of Cedinox



Picture courtesy of Cedinox

Omelette production

ISSF Member	Acerinox
Manufacturer	Acerinox, Roldan, Airfrinox S.L.
Field	Food and beverage
Location	Hospitals, schools and many other places
Environment	indoor
Grade and surface	AISI 304L and 316L
Competing materials	galvanized steel

Advantage points of using stainless steel

- hygienic
- faster productivity
- long lasting

Product description

This is a new machine, unique in the world. The Spanish company Airfrinox S.L. has entirely designed and manufactured a new machine for the production of omelettes. The conjunction between experience and high qualification operators has finally resulted in a unique and surprising product.

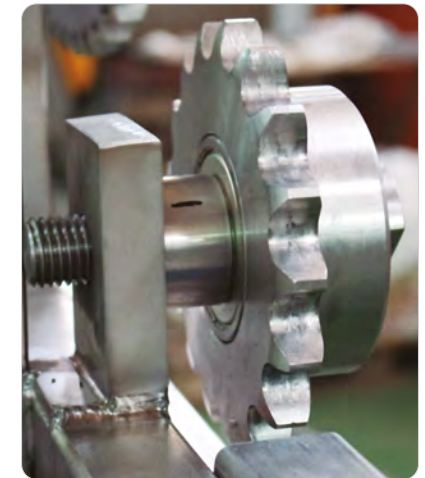
This machine is able to produce more than 20,000 omelettes per hour, in three different weights. Production processes last less than 5 minutes and in each cycle

1670 omelettes are produced.

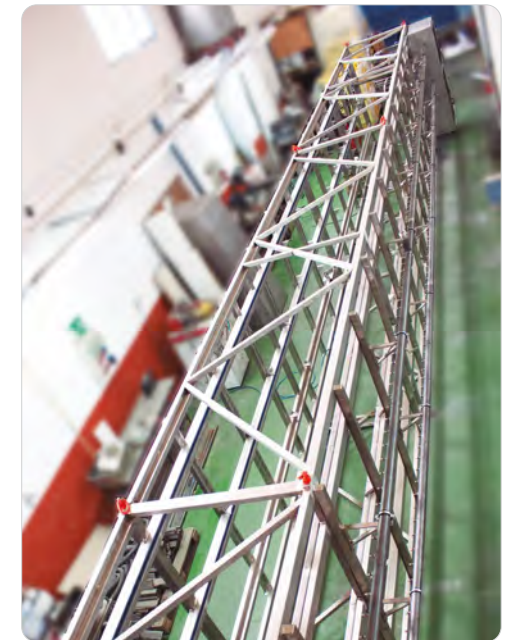
More than 15 tons of stainless steel are used in many products such as tubes, bars or sheets in grades AISI 304L or 316L based on their application and position along the process. Stainless steel was chosen as a material due to its hygienic properties, something that makes it ideal for food industry processes.



Picture courtesy of Cedinox



Pictures courtesy of Cedinox





Repair and reinforcement of violin joists with stainless steel

ISSF Member	CEDINOX
Manufacturer	ACERINOX/ROLDAN
Field	Architecture, building and construction
Location	Alicante, Spain
Environment	coastal
Grade and surface	stainless steel duplex rebars 2304 (Rebarinox 915); polished T316L sheets
Competing materials	concrete among others

Advantage points of using stainless steel

- safer
- worthy
- long lasting solution
- aesthetic
- sustainable

Product description

This new way of restoration developed by the Spanish architects Salvador+Landmann in collaboration with Cedinox, opens a new market for stainless steel.

- A. The work of the example is placed in a garage of a building by the shore of San Juan Beach in Alicante, Spain.
- B. The ceiling joists (beams) of the garage were made of bricks, mortar and concrete, where steel rebar was placed in order to reinforce the structure. Those beams are called "violin joists".
- C. Due to carbon steel rebar corrosion, these violin joists were not able to do their function and suffered from cracks and spalling problems.
- D. What Salvador+Landmann have developed is:
 1. Taking out broken bricks and retiring the concrete that is not in good condition.
 2. Retiring corroded carbon steel rebars and replacing them by stainless steel ones.



Picture courtesy of Cedinox



Picture courtesy of Cedinox



Picture courtesy of Cedinox



Picture courtesy of Cedinox

3. Repairing the bricks and concrete.
4. Finally, they covered all violin joists with a stainless steel sheet adding more security and improving the aesthetic appearance of the garage.

It offers a new and interesting solution for a specific problem while restoring coastal buildings. [Read more here.](#)

Japan's First Stainless Steel Cubic Connection

ISSF Member

Manufacturer

Field

Location

Grade and surface

Competing materials

Aichi Steel Corporation

Aichi Steel Corporation, Tsumura Company
other (playground equipment)

Chippubetsu-cho, Hokkaido, Japan

SUS304A (JIS Standard); 46tons

Ordinary Steel (+ plate processing)

Advantage points of using stainless steel

- Corrosion resistance
- Cracking resistance at low temperatures

Product description

Cubic Connection Cubic play structure consisting of vertical and horizontal bars. In addition to containing approximately 20 types of athletic elements, such as a jungle gym and hammock, the structure features a barrier-free structure for the first two stories, accommodating access by wheelchair and stroller users.

Description: Although there are many large-size play structures throughout Japan that use cubic connections utilizing lumber and ordinary steel, the one in Bell Park Chippubetsu is extremely large, with a width of 50 m, a height of 13 m, boasting six stories. This is the first time stainless steel has been used for cubic connections in Japan.

Chippubetsu-cho, Hokkaido, where this play structure is located, is well-known for heavy snowfall. In winter, most of the play structure would be covered by snow, which tends to cause paint to peel off. Thus, there were concerns about potentially high maintenance costs. To address this concern, we used 46 tons of stainless steel, which possesses excellent corrosion resistance and resists cracking even at low temperatures, for the pillars and beams. This allowed us to reduce the post-installation running cost while achieving a play structure that is safe and secure, with a high degree of designability.



Picture courtesy of Aichi Steel Corporation



Picture courtesy of Aichi Steel Corporation



Picture courtesy of Syoradio.
<https://hokkaido-child.com/>

Ultralight Concrete Mixer Truck

ISSF Member	Aperam South America
Manufacturer	Convicta+Volkswagen
Field	industrial machinery and equipment; transport
Location	São Paulo, Brazil
Environment	urban
Grade and surface	410M and ENDUR®, both #1 finish
Competing materials	alloyed carbon steel

Advantage points of using stainless steel

- 2.4t lighter than conventional models made of carbon steel
- Aprox 50% improved lifetime
- Transport ~1 m³ more concrete within the law per viagem
- Reduce diesel consumption ~11lt per day
- Reduced drum and blade maintenance
- Better traffic security
- Reduced emissions due to diesel consumption and use of green steel Aperam
- Reduced wear (impact) on roads and therefore reduce public spending

Product description

A worldwide innovative and economic solution for the industry. Produced with Aperam's green steel, concrete companies will significantly increase concrete transported per trip (~1m³), significantly reduce cost per m³ transported (up to 40%) thanks to longer life-time and decreased diesel consumption, reduce emissions and finally minimize impact on public roads. Finally this solution allows a much safer driving conditions due to reduced weight for the drivers and others in traffic

The project was developed in cooperation with the Brazilian Association of Concrete Service Companies (ABESC), the Volkswagen Trucks and Convicta and Aperam. The drum is made of 410M and Endur300 was used in the manufacturing of the blades.



Picture courtesy of Aperam

This ultralight cement mixer brings exceptional benefits to the marketplace and stands out as a truly innovative and economic solution. The companies not only reduce their costs up to 40% per m³ transported but also transport more concrete within the law. The Ultralight cement mixer is not only an economic solution but also a very environmental friendly option. Produced with Aperam's green steel, the ultralight cement mixer allows up to 11lt of diesel consumption savings.



Picture courtesy of Aperam



Carrier Cane Slats

ISSF Member	Aperam South America
Manufacturer	General Chains
Field	green energy
Location	Brazil (Ribeirão Preto/SP)
Environment	industrial
Grade and surface	DIN WS 1.4003 /#1
Competing materials	Low Carbon Steel (1008)

Advantage points of using stainless steel

- Higher resistance to corrosion and wear than low carbon steel
- Possible to reduce thickness by 25% due to higher mechanical properties than low carbon steel
- Lower maintenance cost
- 300% increase in lifespan

Product description

This application could create a new market for stainless steel (e.g., sugar and alcohol sectors). The application also has the potential to be expanded to other segments, including grains (soybean, corn, agricultural machinery).



Picture courtesy of Aperam



Picture courtesy of Aperam



Anemometric tower

ISSF Member	Aperam
Manufacturer	IS Industria
Field	green energy
Location	Maranhão/Brazil
Environment	coastal
Grade and surface	304L
Competing materials	galvanized carbon steel; aluminium; weathering steel

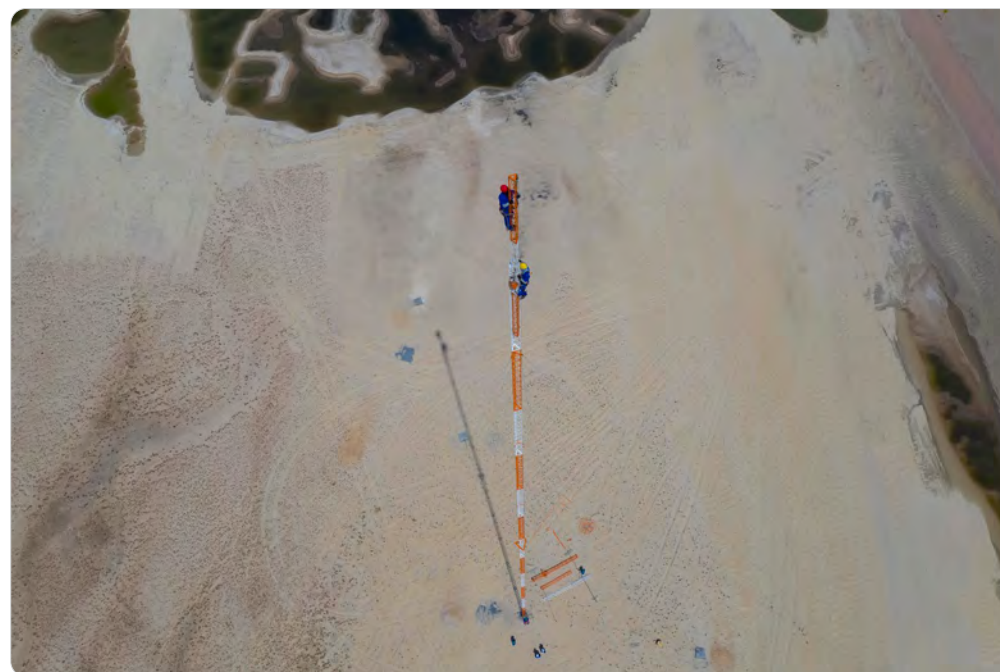
Advantage points of using stainless steel

- Significant life-time increase (at least 4 times)
- Significant reduction of maintenance cost aprox 50%
- Faster manufacturing due to:
 - No galvanizing
 - Simplified painting scheme
 - No sand blasting requirement
 - More lean operations due to reduced logistics
 - Reduced risk of death of staff
- Improved safety of operations
- Improved wind velocity measurement due to tower stability and reliability
- Lower risk of fines due to operational failure

Product description

An anemometric tower is used in wind power parks for measuring wind speed in order to guarantee energy generation efficiency. The measurement devices are attached to these towers and used in data collection both for operational and governmental control. Small failures can result in huge fines therefore the companies are looking for a reliable and economical solution.

Most of the wind parks in Brazil are located in the Northeast coastal regions with severe weather conditions. Currently, galvanized and weathering steel options



Picture courtesy of Aperam

have had a very short-lifetime even after applying expensive and complicated painting schemes. The maintenance is very expensive and dangerous with low effectiveness. There are several cases where the towers fail in less than 3 years much before expected lifetime.

Stainless steel anemometric towers has many advantages for the manufacturer and also end-user including:



End-user

- Increased life time (at least 4 times)
- Significant maintenance cost reduction (aprox 50%)
- Reduce death risks during maintenance
- Improved reliability of measumen

Manufacturer

Efficient manufacturing process

- No galvanizing
- More lean operations due to reduced logistics
- Simplified painting scheme
- Reduced energy consumption
- No sand blasting requirement
- Reduced takt-time
- Improved overall quality (surface, welding, transport)



Picture courtesy of Aperam

LNG storage

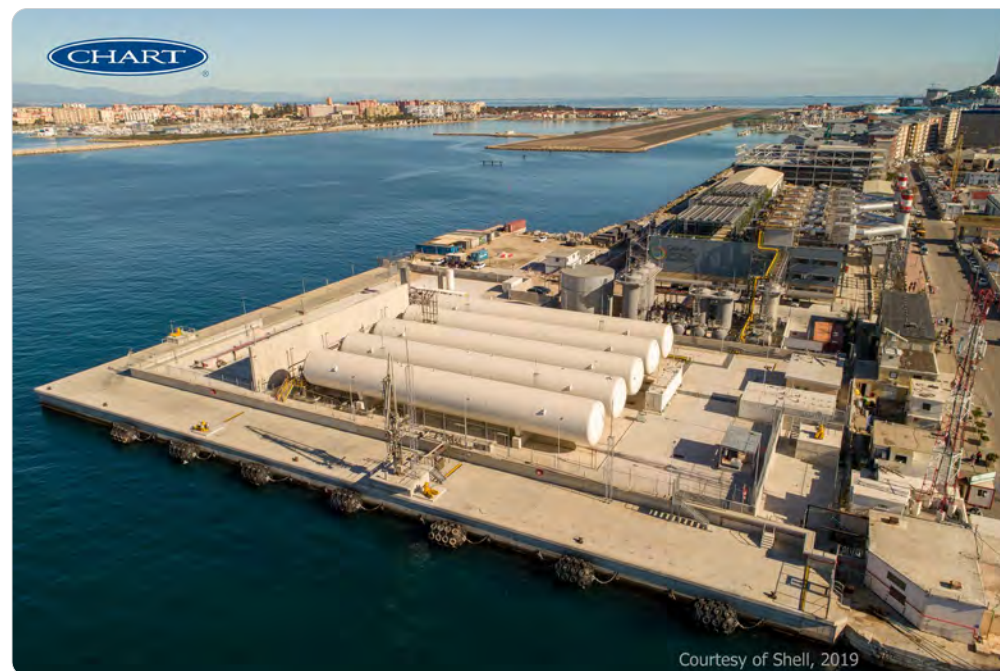
ISSF Member	Aperam Stainless Europe
Manufacturer	Aperam Stainless Europe
Field	transport
Location	worldwide
Environment	marine
Grade and surface	201LN
Competing materials	carbon steel; aluminium alloy; concrete

Advantage points of using stainless steel

- Low thermal conductivity means less heat loss compared to other materials
- No embrittlement in cryogenic environment

Product description

Aperam is a leading provider of stainless steels for cryogenic applications, including Liquefied Natural Gas (LNG) storage. Recently, Aperam provided the stainless steel used in the construction of a new, small-scale LNG facility in Gibraltar. The regasification terminal is part of the territory's transition away from diesel power generation to cleaner burning LNG. Designed by CHART, each of the five cryogenic tanks are 50m long, 5.8m in diameter, and have a capacity of 1 million litres. Once online, the 80 megawatt sustainable power plant is expected to lower NOx emissions by 80% and virtually eliminate SOx emissions. Several stainless steel grades are suitable for such uses, including classic austenitics and such high strength low alloy, economical material, as our 201LN grade, which is specifically tailored to meet the needs of cryogenic equipment fabrication.



Picture courtesy of Shell, 2019



Murray Irrigation PIIOP Round 3 Project

ISSF Member

Australian Stainless Steel Development Association (ASSDA)

Manufacturer

AWMA Water Control Solutions

Field

water equipment

Location

Riverina, New South Wales, Australia

Grade and surface

The fabrication of the water control gates for this project required over 250 tonnes of stainless steel including:

- Approx. 200 tonnes of grade 304 plate
- 1.43km of grade 304 wire rope
- Over 27,000 stainless steel bolts
- 260 stainless steel hinges
- 282m of 120mm diameter stainless steel shafts
- Stainless steel welding wire to complete over 7.5km of welding

Stainless steel grade/s and surface finish used:

- Grade 304 plate with a number 1 finish, also cable
- Grade 2205 round bar for LayFlat hinges and cable pins
- Grade 326 fasteners
- Grade 431 round bar for LayFlat shafts

Aluminium

Competing materials

Advantage points of using stainless steel

Stainless steel was specified for its longevity and durability, particularly with the water control gates being submerged in irrigation water. In addition, stainless steel was chosen over aluminium in the project's material specification to extend the nominated asset life from 25 years to 50 plus years. The gates have been integral to improving the efficiency and productivity of water delivery, and the



Picture courtesy of AWMA

use of stainless steel offers an economically maintainable and longer lasting infrastructure solution.



Picture courtesy of AWMA



Picture courtesy of ERTECH

Product description

Murray Irrigation's Private Irrigation Infrastructure Operator Program (PIIOP) Round 3 is a modernisation project focused on upgrading larger infrastructure within the main canals of its irrigation assets, including Mulwala and Wakool Canals.

Mulwala Canal is Australia's largest irrigation canal, and together with Wakool Canal runs 157 km long. It has the capacity to deliver more than 1,500,000 ML of water per year to irrigators in the Southern Riverina, helping to generate more than \$500 million of gross agriculture revenue per year for the region.

ASSDA Member AWMA Water Control Solutions successfully delivered 91 stainless steel water control gates across the project's irrigation system assets. This modernisation program has substantially increased water efficiencies, improved water flow, enabled ordering flexibility and significantly reduced water leakage through infrastructure upgrades.

The works included 21 Mulwala Canal sites (65 LayFlat gates and 26 Undershot gates), Lawson Syphons (two Undershot gates), the Edward River Escape (two Bulkhead gates) and the Wakool Canal Offtake (three Undershot gates).



Picture courtesy of Murray Irrigation

Stainless steel is playing an important role in delivering effective infrastructure to achieve water savings, securing a sustainable environment and future for irrigation communities in Australia.

The life-cycle advantages stainless steel offers extends the service life of critical infrastructure for irrigation communities, and this project example can be promoted to influence the materials specification for similar projects globally, where aluminium is a competing material. This also extends to influencing similar infrastructure in applications such as flood barriers, dams, and other water infrastructure.

Stainless steel dissipator in seismic devices

ISSF Member
Manufacturer

Centro Inox
Girardini Srl – I-38079 Tione di Trento TN (Italy)
– Via Fabbrica 90/92 – phone: +39 0465 339111 –
girardini@girardini.it – www.girardini.it
Architecture, building & construction
indoor
EN 1.4301 (AISI 304) stainless steel

Field
Environment
Grade and surface

Advantage points of using stainless steel

High mechanical properties, high corrosion resistance and hygiene.

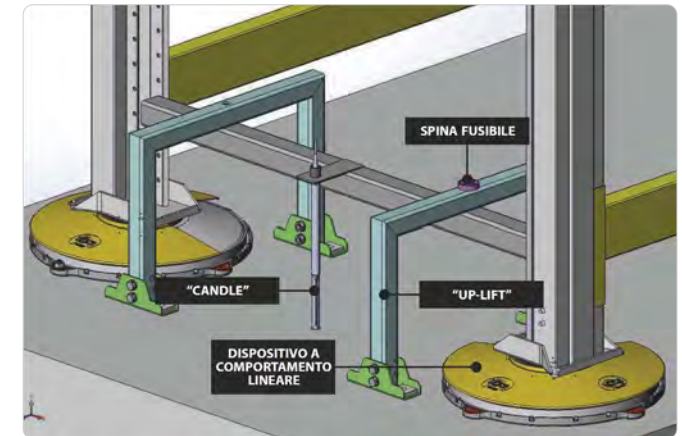
Product description

A patented seismic device, recently introduced onto the market, allows to decouple the ground motion from the one of the shelving during the earthquakes, with consequent drastic reduction of the risks caused by these devastating events towards both people and stored goods.

Among its many components, the dissipator (the “CANDLE”), that controls the resonance phenomena induced by the earthquakes, has to be characterized by specific levels of mechanical properties, ductility, corrosion resistance and hygiene. These requirements are fulfilled by using EN 1.4301 (AISI 304) stainless steel, in the form of a round bar with a diameter of 16 mm.



Picture courtesy of Centro Inox



Picture courtesy of Centro Inox



Picture courtesy of Centro Inox



Picture courtesy of Centro Inox

Stainless steel telescopic ladder

ISSF Member Manufacturer

Centro Inox
Nautinox Srl – I-20080 Casarile MI (Italy) – Via
Meucci 14/16 – tel. +39 02 90093718 –
info@nautinox.it – www.nautinox.it
other: boats
marine
EN 1.4404 (AISI 316L), mechanically polished

Field Environment Grade and surface

Advantage points of using stainless steel

Better corrosion resistance towards the marine environment and seawater

Product description

Ladders are a necessary accessory for boats; however, they can sometimes represent an “obstacle” in a boat against the simple and clean design that designers want for their customers. Ladders can be removable or fixed and the latter can include folding and telescopic versions.

A Milanese company has just launched a type of telescopic ladder on the market, featuring integrated lift handles that appear automatically when the ladder is extracted manually from the watertight box. As a result, the hydraulic pumps, present in other telescopic ladders, are no longer necessary: this is an advantage because these pumps are expensive and need periodic maintenance.

When designing this product, the company opted for EN 1.4404 (AISI 316L) stainless steel: tubes with a diameter of 19, 25, 32 and 40 mm and a thickness of 1.5 and 2 mm were used for the ladder, and sheets with a thickness of 2.5 and 3 mm for the watertight box.

This product can be seen as an evolution of the ladders already present on the market. They don't need the hydraulic pumps anymore, so they are more convenient and this can lead more users to buy them (expansion of the market area).



Picture courtesy of Centro Inox



Picture courtesy of Centro Inox



Picture courtesy of Centro Inox



Picture courtesy of Centro Inox

Chicken Transportation Truck

ISSF Member	Columbus Stainless
Manufacturer	SA Truck Bodies
Field	automotive; transport
Location	Patterson, South Africa
Environment	rural; coastal
Grade and surface	3CR12 closed sections and sheet metal
Competing materials	Galvanized/Coated mild steel traditionally used in similar applications

Advantage points of using stainless steel

Corrosion resistance allows longevity because trailers are disinfected and washed twice per trip.

Product description

Traditionally, mild steel is used in similar applications for livestock transportation vehicles. For this particular application, the correct choice of steel was very important for two main reasons, namely strength and corrosion resistance. The material needs to exhibit sufficient strength as it forms part of the supporting structure and has to withstand aggressive cleaning agents as the trailer twice per trip to disinfection and washing regime during application.

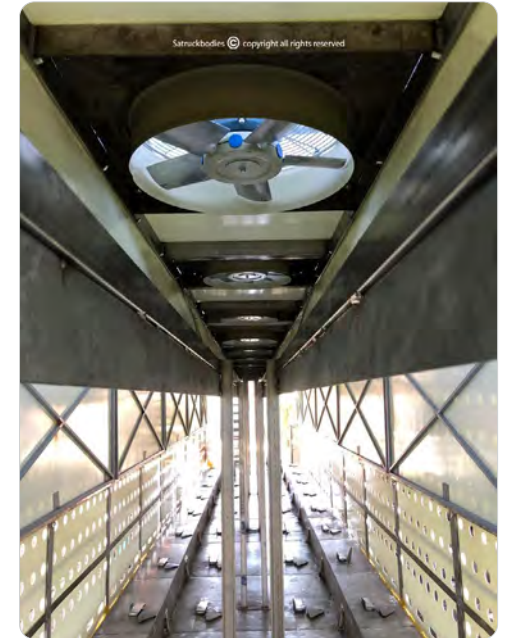
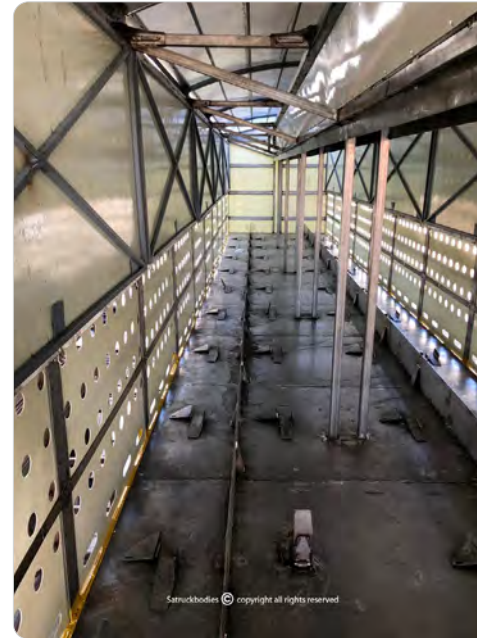
To meet these requirements, three different grades of stainless steel were explored as the material of choice. The grades evaluated were 316, 304 and 3CR12. 3CR12 was ultimately chosen as the viable material for the following reasons:

- Cost of material: The cost of 3CR12 compared to 316 and 304 made the project more economically viable.
- Corrosion resistance: The corrosion resistance of 3CR12 (including PRE) was deemed adequate for this project.
- Weldability of material: The CO₂ welding machines used in our factory were easy and cost effective to adapt. Their current welding operators could also easily work with this material and no special training was required.



- Malleability of material: When bending 3CR12 it reacts very similar to the material the end user is familiar with, hence again no special tools or training was required.
- 3CR12 is also available in a variety of forms which include sheet metal rolled/pressed/punched with a certain profile/pattern and closed sections are also possible.

For this application, 3CR12 is an excellent alternative to the more expensive stainless steel grades. Without 3CR12 this project would not have been viable.



Following this project we have also designed and built various livestock trailers from 3CR12. We can now use this project as an example for various clients to showcase the versatility of this material.

Precision Hygiene

ISSF Member
Manufacturer
Field

Columbus Stainless
Precision Hygiene
architecture, building and construction; transport;
other
South Africa
indoor
441 Sheet No.4 brushed finish
Carbon Steel & Plastic (in the low cost market)

Location
Environment
Grade and surface
Competing materials

Advantage points of using stainless steel

Corrosive resistance, Health & Hygiene.

Ferritic stainless steel offers a more cost competitive product (to the traditional austenitic stainless steel grades) – thus maintaining market share for stainless steel in this tough economic climate.

Product description

Stainless steel AISI 304 has dominated the high end market for bathroom accessories. However, in this challenging economic climate, other competing metals are becoming more and more popular replacement.

In the recent years, a company in South Africa has introduced a more cost competitive ferritic equivalent product in the market. AISI 441 has made stainless steel accessible enough to replace the painted mild steel and plastic components competing in this market sector.

For this indoor application with exposure to mild corrosive agents/cleaning detergents, grade 441 performs satisfactorily without compromising corrosion properties, thus maintaining consistent aesthetic appeal in application. Grade 441 also exhibiting good formability and weldability which make fabrication of these components ideal.

The growth potential is exponential. The current product has an annual consumption of 60 – 80 tons per annum and has grown since the product's inception.



Picture courtesy of Columbus Stainless

Tokyo Tower Top Deck

ISSF Member	Japan Stainless Steel Association
Manufacturer	KAZ SHIRANE Studio
Field	architecture, building and construction
Location	Tokyo, Japan
Environment	indoor
Grade and surface	SUS304
Competing materials	glass mirror; aluminum mirror

Advantage points of using stainless steel

Mirror-finished stainless sheets have in processing versatility and durability. Even though glass would make better mirrors, it cannot be properly processed and is less durable. Aluminum is less durable too.



Picture courtesy of KAZ SHIRANE Studio



Picture courtesy of KAZ SHIRANE Studio

Product description

As part of an extensive renovation project to commemorate the 60th anniversary of Tokyo Tower, the interior of the top observation deck located at the height of 250 meters was changed to "space entirely covered with polyhedral mirrors" to give visitors a new experience and thrill. The space which provides such experience is composed of approximately 1,000 triangular mirror-finished stainless steel sheets producing a fantastic atmosphere and irregularly reflecting the townscape of Tokyo down below, and may be called "what people have never seen before". During the night hours the space is illuminated with LED light and this allows the visitors to enjoy added pleasure.

The use of stainless steel is based on full understanding of its characteristics and has opened up new possibilities for the metal.

Stainless steel wave water tank

ISSF Member

Manufacturer

Field

Location

Environment

Grade and surface

Competing materials

POSCO, Korea Iron and Steel Association

POSCO E&C / Daemyung SES Co.

water equipment

Park One Tower, Seoul, Korea

urban

329LD Duplex Stainless Steel

SMC (Sheet Molding Compound);

PDF (Polyethylene Double Frame);

PE (Polyethylene);

FRP (Fiber Reinforced Plastics); concrete

Advantage points of using stainless steel

329LD has enabled a curved panel design of water tanks to increase seismic resistance and to withstand high water pressure.

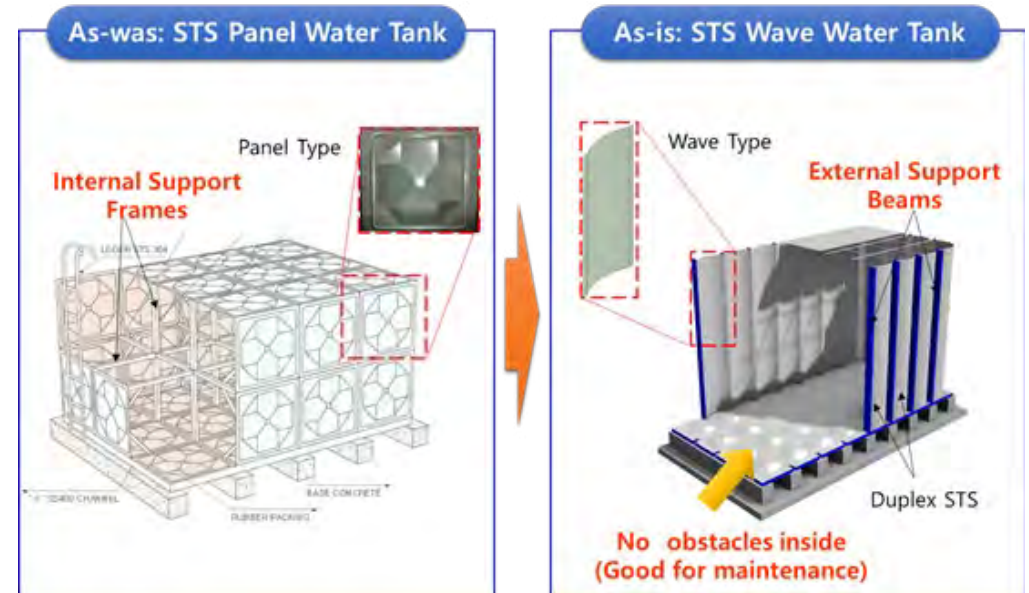
Product description

After the earthquake in Gyeong-ju in 2016, the Korean government decided to strengthen anti-seismic design guidelines for all buildings. Water tanks were also revised to require seismic design guidelines to provide seismic performance. This made it difficult to use the stainless steel water tank, which was ordinary used, because it didn't meet the new seismic design guidelines.

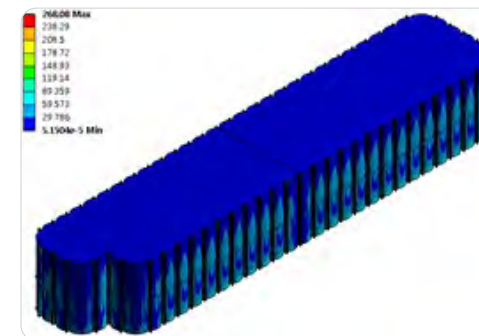
Due to that reason, POSCO has developed a waved/curved stainless steel panel concept for water tanks to provide excellent water pressure distribution and seismic resistance. The wave tank mainly consists of wave panels to form the outer wall and wide flange beams to support wave panels.

First of all, using STS329LD duplex stainless steel, which is twice the yield strength of austenitic stainless steel, was used to reduce thickness and improve the seismic performance while also increasing corrosion resistance.

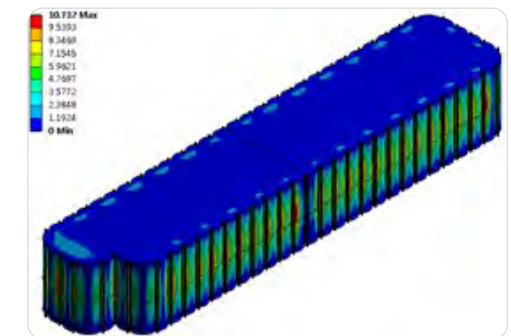
The wave shape panel can distribute water pressure to the circular panel surface to improving structural stability. This design, unlike conventional rectangular water tanks, there are no internal support frames, making it suitable for cleaning



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Contour plot of stresses



Contour plot of displacements

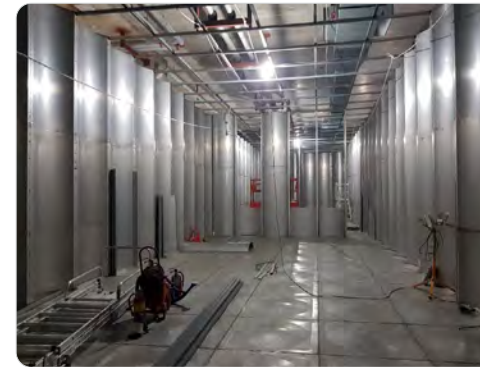
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and maintenance, and space utilization has improved as well as cost reduction is possible.

In 2019, POSCO collaborates with customers, installed 33 units of stainless steel wave water tanks containing from 25 to 900 cubic meters at the "Park One Tower", a new skyscraper in Seoul. The biggest tank was subject to a pressure of 0.9 bar (seismic loading included) in a wave panel wall of 29 meters. All of the tanks were very stable after filling of water and showed no deflection problems at all. The construction was completed successfully.

Stainless steel wave tank has turned the disadvantages of existing water tanks into advantages through use of new design and duplex. It shows excellent seismic performance, maintenance, space utilization and cost improvement compared to existing products. This new product is expected to greatly contribute to expanding the stainless steel water tank market, replacing the demand for water tanks using other materials as well as stainless steel products.



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Stainless Steel for Gun Barrels

ISSF Member	North American Stainless (NAS)
Manufacturer	North American Stainless /Round Ground Metals
Field	other
Location	USA
Environment	urban; rural
Grade and surface	416-R GBQ
Competing materials	carbon steel

Advantage point of using stainless steel

Resistance to heat erosion and corrosion

Product description

Traditionally barrels for rifles have been manufactured in carbon steel, however in recent years martensitic grades of stainless steel have begun to make inroads in the firearms industry, with major manufacturers using stainless for the barrels of some of their rifles.

The Sporting Arms industry in the U.S. is considered a key industry for the economic impact that it represents. According to the "Firearms Industry Trade Association", the industry generates a many as 311,991 direct and indirect jobs and it was estimated that in 2018 it was responsible for as much as \$52 Billion in total economic activity.

According to the U.S. Bureau of Alcohol Tobacco and Firearms (ATF), a total of 2.8 million rifles and 536



Picture courtesy of Jordan Shelton

thousand shotguns were manufactured in the U.S. in 2018. At present the amount of these types or firearms that use stainless steel barrels is small, but owing to the total overall number produced it is evident that the potential for the growth of stainless is large.

A major concern for owners of sporting rifles has always been the erosion that barrels suffer as a result of firing bullets. The pressure and heat released at the time of firing added to the physical wear produced as the bullet passes through the barrel of a rifle leads to heat erosion that can affect the accuracy of the firearm and eventually can lead to failure. The advantage of using stainless steel barrels is that compared to other alternatives such as carbon steel, the resistance to heat erosion is much greater using stainless coupled to a greater resistance to corrosion in all of the stainless components of a firearm.

One of the Stainless Steel grades currently being evaluated by major firearms manufacturers is NAS martensitic grade 416R-GBQ (Gun Barrel Quality). The quality required by the Industry resulted in North American Stainless (NAS) working closely with Round Ground Metals to develop best practices for selection of raw materials, as well as melting and rolling practices in order to produce the required level of consistency in material cleanliness, microstructure, heat-treatability, machinability and desired mechanical properties.



Picture courtesy of Round Ground Metals



Picture courtesy of Round Ground Metals

Stainless Steel Water Filling Station

ISSF Member

North American Stainless (NAS)

Manufacturer

Elkay Manufacturing Company

Field

water equipment

Environment

urban

Grade and surface

T304 2D

Competing materials

Plastic, Aluminum

Advantage points of using stainless steel

Corrosion Resistance, Longer Life cycle, Environmentally Friendly

Product description

The Stainless Steel Water Filling Stations manufactured by Elkay Manufacturing Company are a great example of how Stainless Steel can be used for an application that is both appealing to the consumer and at the same time can be a solution to the environmental problem of plastic water bottle waste. By giving consumers the possibility of repeatedly filling up their own containers with municipal drinking water as opposed to buying and then discarding bottled water the filling stations can reduce the amount of plastic bottles that end up in landfills and our oceans. In the U.S. alone in 2017 the total bottled water volume consumed reached 13.7 Billion gallons, while world wide it surpassed 99 Billion. It has been estimated that more than 60 million plastic water bottles are thrown away every day in the U.S. and only about 17% are recycled.

The Elkay Water Filling Stations are designed for ease of use by consumers, and have a number of features that make them attractive to both consumers as well as those companies and institutions that install them. Included in these are energy saving measures by being designed so that refrigeration can be turned off when not in use, new filter recognition systems as well as self-diagnostic systems for easier maintenance. NAS Stainless Steel T304 grade is used in order to maintain corrosion free areas, provide a long term life cycle and an clean look so that consumers feel comfortable with the water provided.



Pictures courtesy of Elkay Manufacturing Company



Steel-Container-Type Solar Panel Stands

ISSF Member	NIPPON STEEL Stainless Steel Corporation
Manufacturer	TOMIYASU & CO., LTD.
Field	green energy
Location	Ibaragi Prefecture
Environment	coastal
Grade and surface	NSSC FWM 2B (Tandem rolled)
Competing materials	Zn coated carbon steel

Advantage points of using stainless steel

- Long life due to high corrosion resistance
- Maintenance-free
- Installation even in coastal area

Product description

For the Steel-Container-Type Solar Panel Stands, steel containers containing heavy materials such as stones, earth and sand are installed on the ground as the panel mounting base. Therefore, it is possible to install a solar power generation system regardless of the ground environment and conditions.

Since the site where the container was installed is located a few hundred meters from the Pacific coast, stainless steel containers made of NIPPON STEEL Stainless' resource-saving stainless steel (SUS430LX class NSSC FW series) have been used for the first time in consideration of corrosion resistance and durability.

In the construction method using steel containers where stainless steel suitable for the environment can be freely chosen, it is possible to install a solar power generation system in an environment or area where it was previously difficult to install by the conventional method. Demand for such a method using stainless steel is expected to increase.

By applying resource-saving stainless steel together with a solar power generation system, which is a renewable energy source, this method has greatly contributed to reducing the social environmental impact.



Picture courtesy of Sojitz Mirai Power Corporation



Pictures courtesy of NIPPON STEEL Stainless Steel Corporation

Highly durable emergency supplies warehouse

ISSF Member

Manufacturer

Field

Environment

Grade and surface

Competing materials

NIPPON STEEL Stainless Steel Corporation

Fukusuke Kogyo Co.,Ltd

architecture, building and construction

rural

SUS821L1 2B/No.1

Aluminium alloy

Advantage points of using stainless steel

- Corrosion resistance (excellent aesthetics and protection against salt damage, acid rain and termites)
- High strength (3 times stronger than aluminium alloy for storms and earthquakes)
- Maintenance-free

Product description

As natural disasters intensify due to global climate change etc, the importance of disaster prevention to protect people's lives and assets is increasing. This "Highly durable emergency supplies warehouse" is a warehouse that stores the minimum necessary food, drinking water, blankets and other necessary supplies in case of a disaster and protects from high temperature, humidity, storms and earthquakes.

Until now, steel containers for logistics have been converted into warehouses and used for storing emergency supplies. However, they have been unsatisfactory due to corrosion and maintenance etc. Following that, aluminum warehouses have been introduced, and they have been installed in evacuation shelters etc, and governments are supporting them with subsidies.

Recently, warehouses whose main components are made of stainless steel have been developed and they are increasing throughout Japan. The stainless steel warehouse uses high-strength duplex stainless steel for the outer walls and frames, and is a high-performance and maintenance-free warehouse that has both robustness and corrosion resistance.

In particular, corrosion caused by contact with dissimilar metals is prevented by using duplex stainless steel, and it can be used for a long period of time maintenance-free in preparation for natural disasters. In the case of aluminum,



Picture Copyright of FUKUSUKE Kogyo

anodized aluminum plate is used. However, the parts where the aluminum surface is exposed by cutting and drilling come into contact with stainless steel bolts and there is a concern that aluminum corrosion may be accelerated due to the contact with dissimilar metals. Periodic inspection and maintenance are required. However, there are many places where visual confirmation is difficult such as next to the ground, and there have been cases where the occurrence of corrosion has been overlooked.

This is an example of fulfilling the social tasks of protecting human lives from disasters by using the advanced technology of processing high-strength stainless steel, and of creating new stainless steel demand by replacing aluminum.

Water tanks

ISSF Member	Outokumpu Stainless USA
Field	architecture, building and construction
Location	Mexico
Environment	urban; rural
Grade and surface	304 2B, evaluating also 441 and/or 439
Competing materials	Conventional Plastic

Advantage points of using stainless steel

Stainless Steel water tanks offer a much more durable (better life cycle) and sanitary solution, easy to clean, better aesthetics compared to alternative options. Stainless steel does not require chemical coatings to avoid corrosion. The product has no detachment of particles that can contaminate the water. Stainless steel does not deteriorate with the sun's rays thus no need of UF filter. This solution requires no concrete base or special structure for installation or standard stability. Features on this solution also have special outlet for sediments.

Product description

New market for Stainless Steel in Mexico

Outokumpu Stainless - Mexinox hopes to achieve further growth on increased demand for the use of stainless steel as a substitute for other materials. The project is based on the introduction of "Stainless Steel Water Tank" manufacturing in Mexico by replacing other materials (e.g. asbestos, cement fiber and plastic). In Mexico, residential water supply is very erratic, and the



Picture courtesy of Outokumpu



Picture courtesy of Outokumpu

water pressure is often inadequate. Consequently, buildings generally have rooftop water tanks that are filled using motorized pumps. The water is then fed into the building's plumbing system by means of gravity or additional electric pumps. Because of this, nearly every building/house requires a water tank.

Because of the many advantages of a stainless steel solution, the product

has already been marketed with great success in other countries of Latin America and Asia.

Currently, two companies own 85% of the water tank market in Mexico made of from plastic. There are five different water tank capacities; the most common 750 liter (62% of the market). According to Cámara Mexicana de la Industria de la Construcción (CMIC), from 2010 – 2015, the estimated average growth was 660,000 new houses constructed per year. This alone is a large opportunity for stainless demand because the average weight of a stainless steel water tank is 20 kg.

Outokumpu Mexinox is not responsible for selling the tanks, the aim is to encourage stainless steel processing companies to produce new products sourced from Outokumpu Stainless - Mexinox. Outokumpu Stainless sees the key is within the approach to the big construction companies, authorities, and associations by convincing them of alternative solutions.



Picture courtesy of Jorge Abascal

Stainless Steel Airtight Container

ISSF Member	POSCO
Manufacturer	CNTKOREA Co., Ltd
Field	food and beverage
Location	South Korea
Environment	urban
Grade and surface	STS 304, 2B
Competing materials	plastic; glass

Advantage points of using stainless steel

In the market before stainless steel products came out, glass and plastic containers were used. However, glass is fragile and plastic has an environmental hormonal issue, and there is a need for a product that can compensate for this. The stainless steel container is very hygienic because it is easy to clean thoroughly and not a hospitable environment for the growth of bacteria. It is also not transfer stench, which is a common complaint about plastic container.

Stainless steel products are unbreakable and have been tested for harmful substances. In addition, it can be dissolved in scrap at the time of disposal, so it has excellent advantages for environmental protection.

Product description

It has created new demand for stainless steel by replacing other



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materials, and recently showed its potential as a substitute as environmental issues for plastic products become an issue. In addition, the surface of the airtight container was applied stain prevention technology using satin polishing technology, and the maximum capacity compared to the same size was realized by differentiated compression technology. This can be a good example of alternative application to other industries, and it is expected to contribute to the vitalization of the market utilizing stainless steel's formability and environmental harmlessness.



Stainless steel Hook Joint for Air-Conditioner Refrigerant Pipe

ISSF Member	POSCO
Manufacturer	Evertech Corporation
Field	architecture, building and construction
Location	Gangneung-City, Korea
Environment	urban; rural
Grade and surface	STS304, STS304J1 / 2B
Competing materials	copper

Advantage points of using stainless steel

Stainless steel is more durable than copper and competitive in price from the point of materials and from the point of view of connecting pipe to pipe; Hook Jointing has more safety, construction convenience and economy than welding method.

Product description

Currently, the refrigerant pipes which are applied inside the air conditioner itself or used as the connecting pipe between air conditioner and the outdoor unit, are

usually made using copper. On the other hand, stainless pipes show not only a better performance in durability as compared to copper pipes, but the price per unit is more competitive, thus making it an attractive alternative for copper pipes. Normally, each end connection part of the air-conditioner and the outdoor unit are installed by welding stainless and copper tubes. However, there is a risk of quality and construct ability should welding be conducted between dissimilar metals, as well as a safety issue due to the use of firearms not to mention additional costs. These factors act as obstacles in the application and demand expansion for stainless pipes.

The non-welding 'hook-joint for refrigerant pipe' developed by Evertech Corporation has solved this problem. This device is capable of 'one-touch insertion' using only human force without the help of equipment or tools, thus improving fire safety and construction dramatically. Through various performance tests, the UL Mark was obtained due to the quality performance of the weld joint. Therefore, this product is expected to contribute greatly in increasing demand for stainless pipes in the air conditioning refrigerant piping market.



Hook Joint Socket



Adapter Socket and Elbow

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Welding



Non-welding joining

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New lean duplex stainless steel 1.4670 with low thermal conductivity for building, developed in partnership with an ABC market customer

ISSF Member

Manufacturer

Field

Location

Environment

Grade and surface

Schmolz + Bickenbach Group

Ugitech (Schmolz+Bickenbach Group)
architecture, building and construction

Ugine, France

urban; rural; coastal

This new steel has been designed for concrete reinforcing bars (rebars) of any building construction, to improve its thermal insulation by limiting thermal bridging phenomena. Grade 1.4670 is a lean duplex stainless with innovative chemical composition. Steel number 1.4670 was recently allocated by the European Steel Registration Office. Introduction in EN 10088-1 has also been requested for next review.

This steel is made with conventional AOD, ladle metallurgy and continuous casting. After hot rolling and pickling, it is transformed into high mechanical properties rebars by cold notching process developed at Ugitech.

carbon steels or stainless steels like 1.4301, 1.4362, 1.4482 or 1.4062 classically used for rebars

Competing materials

Advantage points using stainless steel

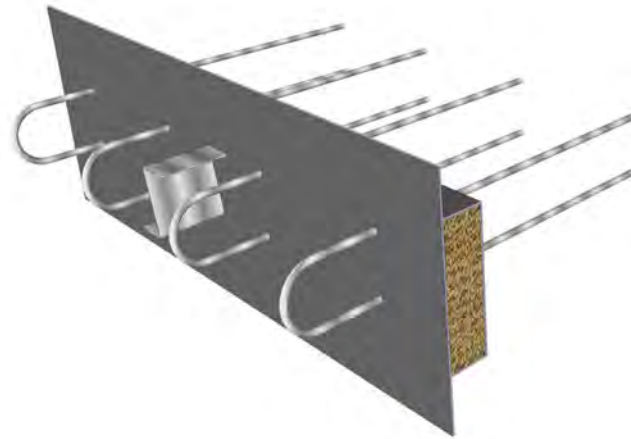
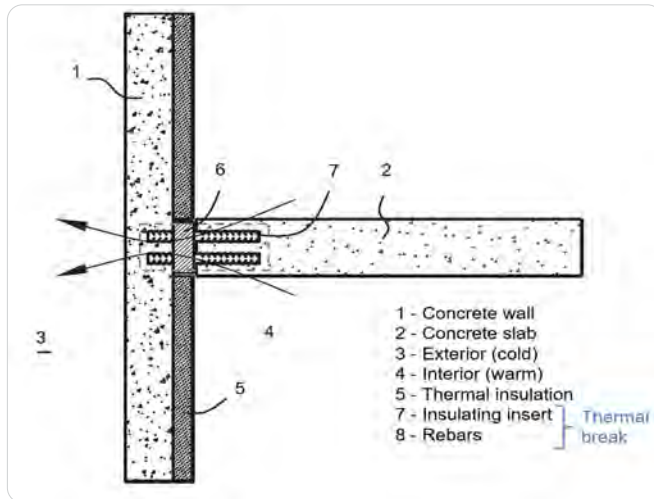
Reducing energy consumption in buildings represents a major challenge for the construction industry, especially in the current context of rising environmental awareness. This innovation provides:

- the best compromise between mechanical properties, corrosion resistance, low thermal conductivity and material's cost, in order to guarantee structural integrity, durability and low energy consumption of buildings;
- Compared to 1.4301 (AISI 304), the new grade 1.4670 will offer higher use values in every domains: mechanical properties, corrosion resistance, material cost and thermal conductivity.

Product description

At balcony-to-wall junctions or floor-to-wall junctions in the case of internal insulation, the continuity of the insulating envelope of the building is cut. That creates a preferential thermal transfer path between interior and exterior of the building, the latter being even promoted by increased conduction through steel reinforcing bars, placed at the junction for structural reasons, and having higher thermal conductivity than concrete. The energy lost at junctions by the previously described mechanism, also called thermal bridging, is really important.

Thermal regulation (e.g. French RT2012) request to address thermal bridges at junctions to get thermally efficient building. A solution consists of using thermal breaks as depicted by the attached figure. This system limits the thermal flux at the junction thanks to an insulating layer and mechanical forces are transmitted by rebars. It allows reducing the U-factor, ability to transmit heat, by a factor 3. However, new thermal regulation (e.g. French RT2020) become more and more stringent on the transmission factors of thermal breaks, the latter being essentially controlled by conduction through the rebars. Possibilities for thermal breaks manufacturer are then to reduce the section of the materials at the expense of mechanical performance, or to find new materials with equivalent



Scheme and example of a thermal break made of an insulating insert to interrupt thermal path and rebars to transmit loads on both sides.

Courtesy of Ugitech S.A.

mechanical properties but lower thermal conductivity. Our new lean duplex stainless steel was designed in this context with the partnership of a thermal breaks manufacturer. The addition of silicon, not classical on duplex, was found to have an important effect on thermal conductivity. The chemical composition was then tailored to ensure thermal conductivity below 12 W/m/K, i.e. 25% lower than the state of the art for lean duplex stainless steels, and equivalent mechanical properties, corrosion resistance. This grade is also cost competitive because its nickel content does not exceed 4% which is similar to 1.4362.

C%	Si%	Mn%	P%	S%	Ni%	Cr%	Mo%	N%	Cu%
0.03	1.5 to 3.0	4.0 to 6.0	0.040	0.010	3.0 to 5.0	18.0 to 21.0	0.60	0.10 to 0.15	1.0

Chemical composition of new duplex 1.4670 / X2CrMnNiSiN20-5-4-2 for rebars.
Table from Ugitech S.A.



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About ISSF

The International Stainless Steel Forum (ISSF) is a not-for-profit research and development organisation which was founded in 1996 and serves as the focal point for the global stainless steel industry.

Vision

Sustain our future with stainless steels

Membership of the ISSF

ISSF has two categories of membership namely:

- a. [company members](#) who are producers of stainless steels (integrated mills and re-rollers)
- b. [affiliated members](#) who are national or regional stainless steels industry associations.

The ISSF now has 57 members in 26 countries. Collectively they represent approximately 90% of the total production of stainless steels.

More information

For more information about ISSF, please consult our website worldstainless.org.

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