

Stainless steels: Sports facilitator



Ready?
Set...

Go!

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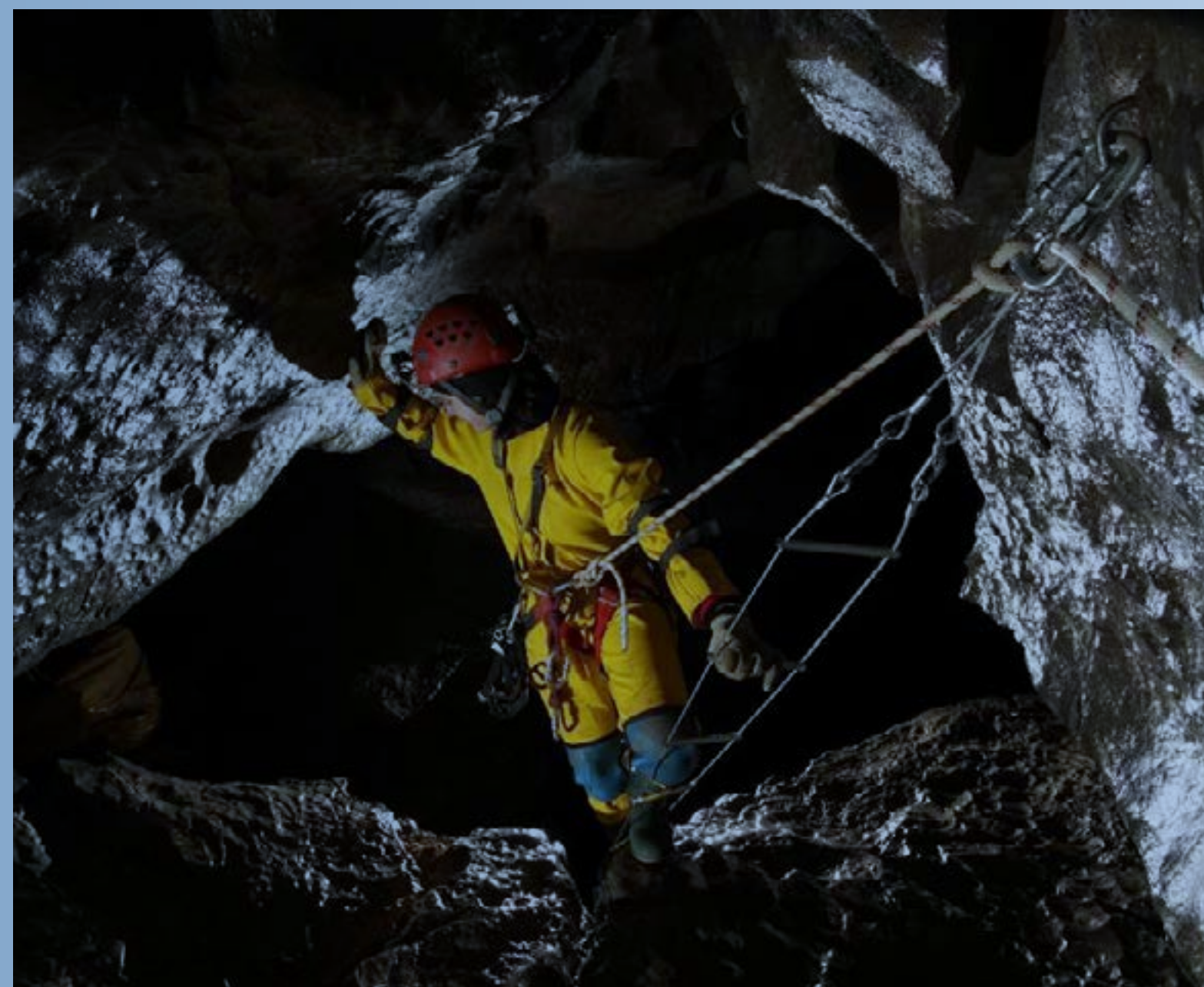
Introduction

Sports are now part of our lives. As more and more people enjoy more leisure and do not exert a physical activity in their professional lives, sports have grown to be the way to keep the body healthy. Sport is recommended for people of all ages, from the young for muscular development, improved coordination and skills to the elderly as a condition for retarding ageing.

All materials are used in the wide variety of sports practiced today. Stainless steel is one of them. Stainless steels are also used as both building materials and within the places and facilities where we practice or enjoy watching sports.



Sports and leisure equipment



Coach and referee whistle

Whistles are used extensively across many sporting activities. Referees and coaches for soccer, football, basketball and hockey and more rely on whistles to control practices and games. Every boat should be equipped with a safety whistle. Lifeguards have one in hand at all times. Scuba divers carry a whistle to signal their boat for pickup. Campers, hikers and skiers should never be without a safety whistle.

If stranded, an individual can yell for help for an hour or two but then lose their voice. However, they can blow a whistle indefinitely to call for help. In addition, the piercing blast from a quality metal whistle is louder than a yell and carries much farther in search of help.

Text courtesy of The American Whistle Corporation



Cycling

Bicycles are hugely popular and now fashionable, with thousands of kilometres of cycling paths available in cities and in the countryside, as an environment-friendly means of transportation or as leisure. The latter activity has developed into an array of sports, on roads, on all-terrains, for acrobatic events, for racing. For each one, specific bikes are available, with an attractive look and more and more sophisticated technology, some of it derived from the automotive or from aerospace industries.

There is a wide variety of designs and of materials used, from the very basic to the highly sophisticated and expensive. Stainless is used in most bikes for cables, fasteners, brake disks and spokes. Less frequently, it is also used for frames, cogs, wheel rims, chain links and headsets.



Stainless steel brake and derailleur cables are strong, smooth and lightweight.



Chains with inner links made of stainless steel for longer wear.



Disk brake rotor for Mountain Bike. AISI 410 -EN 1.4006 stainless steel



Cogs

Golf

There is a well-established use of stainless steel for golf heads.

AISI 431 Grade (EN 1.4057) is a softer stainless steel commonly used in high quality iron heads. It is said to allow the most forgiving and smoothest feeling iron sets available today.

AISI 17-4PH (EN 1.4542) and 15-5PH (UNS15500) grades are harder and found in professional style iron and wood heads. They are less common in iron heads, but popular material for woods.

While the harder material will decrease the soft feel found in grade 431, it makes up for it by creating better ball compression and essentially generating better distance.



Stainless grade 431 Iron club head for softness and durability.

Petanque

In petanque, the goal is to throw hollow metal balls weighing between 650 and 800g as close as possible to a small wooden ball called a cochonnet (literally “piglet”) or jack. Practiced by people of all ages, it is a relaxing sport practiced mostly outdoors during summer vacations.

Steel balls are made of steel, sometimes chromium-plated steel or stainless steel.

Martensitic stainless steels are chosen for top quality sets. Depending upon the hardness, a “soft touch” or a “medium hard” touch are available. Stainless steel provides a longer life and does not require any precaution against corrosion, providing you with timeless petanque balls.



Bright stainless steel ball hitting the ground.
Pictures are courtesy of Boule Obut.

Fencing

Fencing has evolved into a sport in the 18th century, with electrical scoring introduced around the mid-20th century. It improves body coordination, agility, balance, strength and cardiovascular endurance. It requires also strategic thinking and excellent focus.



Lame jackets, designed to be electrically conductive and protective (mechanical resistance $(800\text{Newton (N)}/\text{cm}^2 \text{ min})$), are made using stainless steel fine wire. They are extremely durable and machine washable. Picture courtesy of Blue Gauntlet Fencing.



Protective and conductive FIE compliant fencing masks are made of stainless steel wire mesh. They must pass a 1600 Newton punch without failing. Picture courtesy of Leon Paul.

Indoor fitness

While outdoor fitness is recommended – as long as the environment is not polluted - indoor fitness is well suited to urban, sedentary life. Fitness centres are equipped with an increasing variety of machines and devices designed to exercise every part of the body with more and more sophisticated electronics to monitor calories spent, distance, time, etc. ...

Equipment can also be used at home.

Fitness equipment uses a variety of metallic materials, mostly painted carbon steel, Cr-plated carbon steels, cast iron (for weights), aluminium and stainless steel. Stainless steels are likely to be used more often in the future, to allow a better disinfection of the equipment and to provide more aesthetic designs.



| Lifting bar



| Spring chest exerciser



| Pushup handles



| Handgrips



| Dumbbells

Outdoor fitness

Fitness equipment is not confined to indoor use. It has become a familiar sight in city parks, in city squares, on beaches, in playgrounds, along jogging paths, on residential building sun decks, near swimming pools... It is used in winter, in summer, in cold as well as hot climates.



| All pictures are courtesy of Ijslander

Horseback riding

Although it has been said that “Riding isn’t a sport- the horse does all the work!”, riding is about strength and skill. It is having control over every single muscle of the body and knowing what to do without having to think about it. Even after a short ride, non-riders will notice certain muscles will be quite sore. Riding requires a few muscles that aren’t often used in other sports. The control it takes to use rein, leg and seat aids to influence a horse requires refined body awareness somewhat similar to a gymnast. Memorising dressage tests and jump courses, following trail maps, choosing the safest route on a trail ride, deciding the most effective way to handle

a horse that is acting up (that sometimes requires split-second timing) and always being aware of what your horse is thinking, is mental exercise. Riders memorise how they will ride a particular course or cue a horse for a specific move, often within minutes of competing. However, they also need to be mentally flexible enough to change course instantaneously if the horse misbehaves. An old sport, still very well alive!

Stainless steel is used for the metal parts of high quality horse tacks. Glue on steel horseshoes requires stainless steel tabs for optimum adhesion to the hoof.



Horseshoes.
Picture courtesy of
Hanson Farriers



Stirrups.
Picture courtesy of
Hilason



Horse bit
Picture courtesy of
Hilason



Finn Tack Overcheck
Snap
Picture courtesy of
Hilason

Mountaineering

Mountaineering, understood as ascending a complete mountain, uses a variety of skills: ice climbing (shown here), some rock climbing, survival, navigation, endurance etc. ... It is never risk-free. Mountains are known to be treacherous and claim lives every year. At high altitudes the breathing is more difficult, the weather more dangerous, and more equipment must be carried in the backpack. The equipment has to be perfectly reliable in any weather and weigh as little as possible.

High strength/weight ratio is therefore an important consideration in choosing the

equipment (metal components involve fasteners, anchors, ropes, carabiners, descenders, ice axes, etc. ...).

As technical equipment is expensive, it has to be lasting, i.e. not subjected to corrosion that can impair its reliability. In addition, aesthetics and finishes are valued because these products are expected to be attractive to the eye and to feel good when grasped.

Stainless steel offers reliability in any weather, high strength, and good aesthetics. It is used often in combination with Aluminium and/or Titanium alloys.



Ice axe for mountaineering and ice climbing, with a forged stainless steel spike. Spikes are designed to be sharpened like cutting tools. They insure an excellent grip on rock and an efficient penetration into ice. Picture courtesy of Petzl SARL.



Made of stainless steel for a design that won't rust, crampons are lighter weight and durable. Stainless steel resists snow balling. Picture courtesy of Blackdiamond equipment.

Rock Climbing

There are thousands of bolting sport routes available for climbing fans. As this is an unregulated practice, carried out by practitioners who may not have the experience and skill required, accidents may happen, especially if the anchors are corroded and have thereby lost much of their load-bearing capacity. Aggressive environments are to be expected in most places and particularly on rock faces close to the sea in hot and humid

tropical climates. Risk mitigation by visual inspection of bolts and anchors on-site is not reliable and replacement requires a lot of time and effort, in addition to the cost involved.

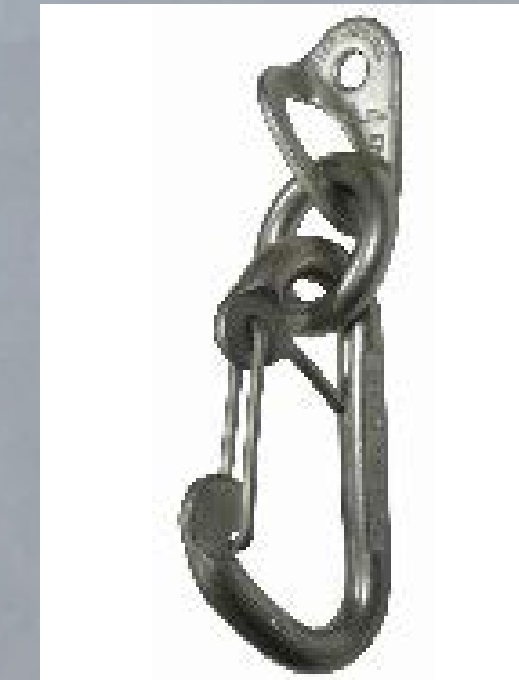
Stainless steel anchors (preferably grade EN 1.4404/AISI 316L or better) provide a maintenance-free, lasting solution and guarantee the best safety conditions.



Stainless steel expansion bolt anchors similar to those used in industry for concrete and rock are very effective, can be used immediately but are suitable only for hard rocks such as granite. Picture Courtesy of Petzl



Adhesive bolt anchors are recommended for softer rocks, offer an excellent mechanical resistance but they are said to be tricky to set and require at least one day to cure.



EN 1.4401 (AISI 316)
Rock hanger with round ring and carabiner. Picture courtesy of Raumer

Via Ferrata

The via ferrata, invented by the Italian military, is a fixed-aid climbing route, designed to allow non-rock climbers to tackle challenging rock faces using artificial aids which include cables, ladders, iron rungs and pegs or stanchions anchored into the rock. A continuous wire cable runs along the route, making it safe from start to finish as climbers must clip their lanyards onto the cable.

The via ferrata provides high-adrenaline adventure sport without danger.

The best practice is to have all the permanent equipment, steps, anchors and cables made of stainless steel for long, maintenance-free service life. Stainless steel carabiners may also be used to clip the lanyards onto the safety cable.



EN 1.4301 (AISI 304) rebar rung to be anchored into the rock.



EN 1.4301 (AISI 304) Clamp anchors for cable



EN 1.4401 (AISI316) Cable

Hiking

Hiking lets a person experience the beauty of nature in a peaceful, soothing and restoring environment. Hiking trails are found almost everywhere, run over thousands of kilometers in scenic areas and places remote from cities and car traffic. They are given difficulty ratings, from moderate to very strenuous,

suitable for people of all ages and physical condition. Backpacks always carry food and water for a day or more. In the recent years, stainless steel has emerged as the best preferred material for food contact, and water containers as it is sustainable and does not release chemicals into the water or food.



Stainless bottle with carabiner . No plastic, no paint, no phtalates, BPA or other chemicals.



Stainless food jar



Stainless foldable pocket knife
Picture courtesy of Opinel SA

Caving

Although caving equipment shares some features with climbing such as harnesses, ropes and carabiners, it differs in using flexible ladders, diving equipment, headlamps and more. As the environment is usually humid, with sometimes water pouring, corrosion resistance is needed besides the usual strength requirement.

Although caving equipment shares some features with climbing such as harnesses, ropes and carabiners, it differs in using flexible ladders, diving equipment, headlamps and more.



Rope ladders with wire sides made of stainless steels offer vastly superior resistance to corrosion and rust than the galvanised versions.



Steel carabiners are tougher than the aluminium types favoured by climbers, and are much better for uses underground.



Wire Rope Y Spreaders are made from Stainless Steel for longer life. Ideal for use with Caving Ladders.



8 shaped descender.



Aluminum and stainless steel pulley single prussic.

Jogging

These very innovative chainmail minimalist shoes are made from stainless steel chainmail. The shoes are built for strolling, light hiking, and walking on natural surfaces and in water. For more 'urban' environments, "Multi-Paws", attachable soft sole spots based on animal paws that provide grip on smooth and paved surfaces are also available.



| Pictures courtesy of GoSt-Barefoots Germany.

Treetop Adventure parks

Treetop adventure parks are more and more popular to families, and to the young. The zipline course, for instance, allows guests ages 5-91 to traverse cables that make them feel like they are gliding through the air like birds from tree to tree, usually in scenic areas over rivers and valleys. A network of platforms, such as the stainless steel one shown here high in the pine canopy, provides relays from one exciting ride to the next.

This innovative stainless steel platform is suspended in a non-invasive way to the old-growth ponderosa pines, unlike the usual wood platforms. Without need of penetrating the trees with hooks, bolts or screws, it makes it a unique, eco-friendly outdoor adventure as well as a thrilling day

long adventure.

The coarser wrap of some cables is how “zipline” got its name, as it emits a loud, “zipping” noise.

This park uses smooth 19-7 reverse-wrap stainless steel cables, unlike the galvanized 7-19 wrap cables used at other zipline courses. The smooth zipline cables are silent and allow guests to enjoy the serenity of the old-growth forest. They will never flake or rust off the lines as galvanized steel does. This type of cable is used in helicopter rescues and “long-lining.” Ancillary equipment such as e.g. turnbuckles is also often made of stainless steel.

Aqua treadmill and cycling

In aqua-cycling, aka aquabiking, the bikes are placed in a pool for the riders to pedal against the water resistance, with water up to the waist. An aqua treadmill, an aqua gaiter and other devices work in a similar way. Aqua cycling is a fast developing exercise for fitness, physical rehabilitation, weight loss and cardio training. One of the specific benefits is that it is without risk of damage to the joints, a big advantage for those who cannot practice endurance sports based on running. Races involving aqua cycling plus swimming are now taking place.

Stainless steel is the standard material for this equipment as treated pool water is very corrosive.



Aqua treadmill
Picture courtesy of Hydrorider



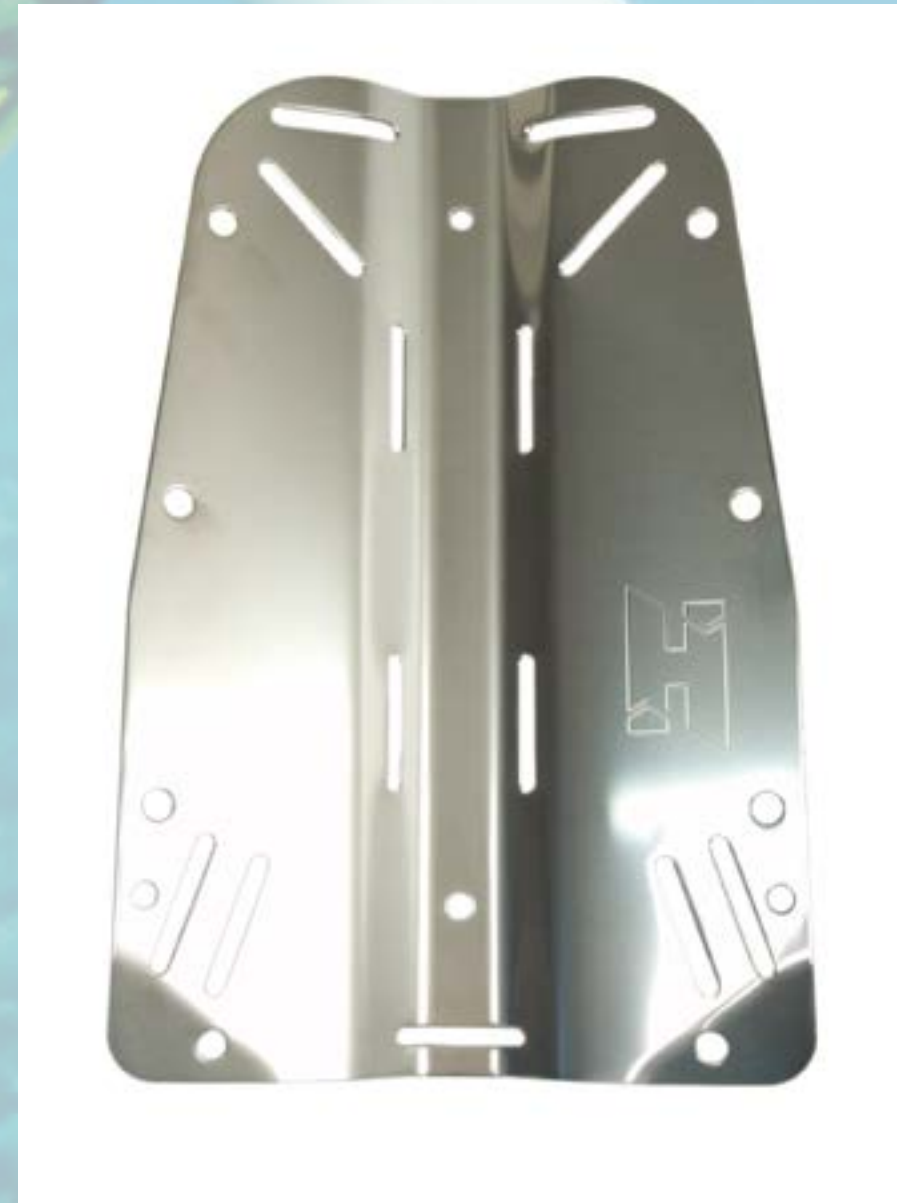
Bikes are made of stainless steel, typically grade EN 1.4404/AISI 316L to resist corrosion in thermal springs, sea water and chlorinated water.
Pictures courtesy of Hydrorider.



Scuba diving

Scuba diving allows mankind to enjoy the beauty and diversity of the underwater world. The underwater environment is however unfamiliar and hazardous, especially for deep diving. In order to ensure diver safety, procedures must be followed. Most of them are intended to reduce the risk of drowning, and many of the rest reduce the risk of barotrauma and decompression sickness. In some instances, in which getting lost is a serious hazard, specific procedures must be followed. Checking the reliability of the equipment, especially the breathing system is part of the routine. Cutting tools such as knives, line cutters or shears are often carried by divers to cut loose from entanglement in nets or lines

Sea water, especially in warm tropical climates, is very corrosive and stainless steel grades that resist corrosion, typically EN 1.4404/AISI 316 are widely used.



Backplate
Picture courtesy of Halcyon Inc.



Dual manifold with isolation valve



Bailout whip
Picture courtesy of American Diving Supply



Swivel eye snap bolt
Picture courtesy of Halcyon Inc.

Sailing

The sea has always been seen as a character, a god, a setting for adventure and for discovery, an image touching all the human senses, a metaphor for the unseen world beyond the senses. No wonder sailing has never failed to attract men and women.

*"Free man, you will always cherish the sea!
The sea is your mirror; you contemplate your soul
In the infinite unrolling of its billows;
Your mind is an abyss that is no less bitter".*

Charles Baudelaire

Back on day to day reality, huge technical advances have been made but one basic requirement stays, i.e. to resist corrosion and provide a long service life with as little maintenance as possible.

Stainless steel enjoys the status of the reference material for the hardware.



| Winch



| Rigging screw



| Cleat



| Cable



| Anchor



| Carabiner snap hook
Picture courtesy of
Wichard SA

Rowing

A very ancient means of transportation, then a sport as well, still practiced for competition, for fitness or for leisure. Rowing is one of the few non-weight bearing sports that exercise all the major muscle groups and not only the arms as it is often thought.

Competition rowing is practiced with different boat classes, from an individual shell to an eight-person shell. Fitness rowing, still practiced by those who have the opportunity of a suitable water stretch, can now also be practiced outside the water and has become so popular that it is now a standard feature in fitness gyms.

The design of rowboats varies widely depending on their intended use.

Stainless steel is one of the materials used for the high strength metal parts, along with aluminium.



Oar lock and base



Sliding seat system with grooved rollers sliding on round stainless steel guide rails. Rugged, comfortable and low maintenance design. Picture courtesy of Puuvenepiste Oy

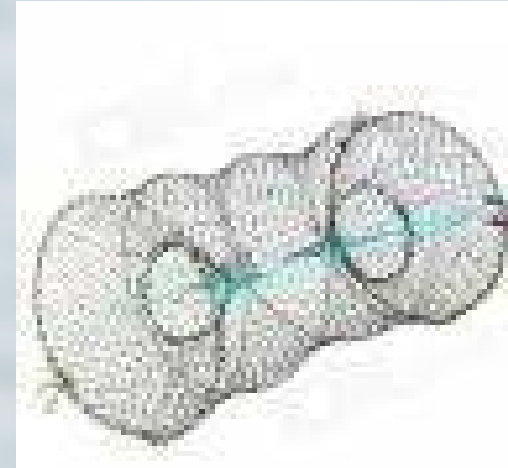
Fishing

In sport fishing, the primary challenge is to find and to catch the fish. Pressure from conservationists, combined with a genuine concern about fish stocks, have caused many sport fishers to begin releasing their catch alive, sometimes after fitting them with identifying tags and recording their details so as to aid fisheries research (known as tag and release). Unlike commercial fishing, which causes a lot of damage, the only equipment used is a hook, a rod and a reel.

Hooks are made of stainless steel and reels and ancillary equipment, mostly for sea fishing, are usually made of stainless steel.



Fishing Spinning Reel.



Fishing Standing keep net.



Trident

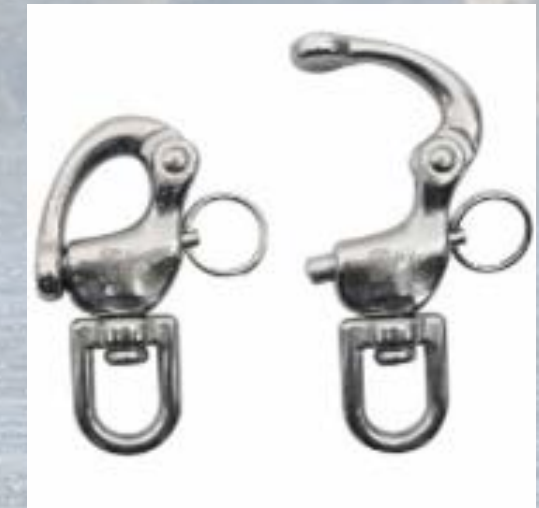


Hook and Wobler

Water skiing

Water skiing is a surface water sport in which an individual is pulled behind a boat or a cable ski installation over a body of water, skimming the surface on two skis or one ski. The sport requires sufficient area on a stretch of water, one or two skis, a tow boat with tow rope, two or three people and a personal flotation device.

Sea water, especially in warm tropical climates, is very corrosive and stainless steel grades that resist corrosion, typically EN 1.4404/AISI 316 are widely used.



Stainless steel AISI 316 quick release, useful in all situations where you may need to quickly disengage from the attachment point (water skiing, long positioning, etc ...)



Stainless Steel Water Ski Tow Hook / Eye



316 Water Ski Quick Release

Ice sports

Stainless steel is one of the choice materials for runners for ice sports, as hardness, toughness and aesthetics are essential.

Stainless steel skating blades are usually made of AISI 420C (EN 1.4028) grade. Blades made of AISI 440C (EN 1.4125) grade, the hardest stainless steel is said to hold an edge up to 4 times longer than C-steels.

Re-sharpening stainless steel runners is straightforward and does not require any further precaution to prevent any rusting. Stainless steel runners are used for luge, skeleton and bobsleigh racing... but details are kept secret to provide material advantages amongst competing teams.



Figure blades (left) and runners for hockey skates (right).



Stainless steel runners are used for luge skeletons and bobsleigh racing



Ash sleigh runners. Picture courtesy of Sirch.

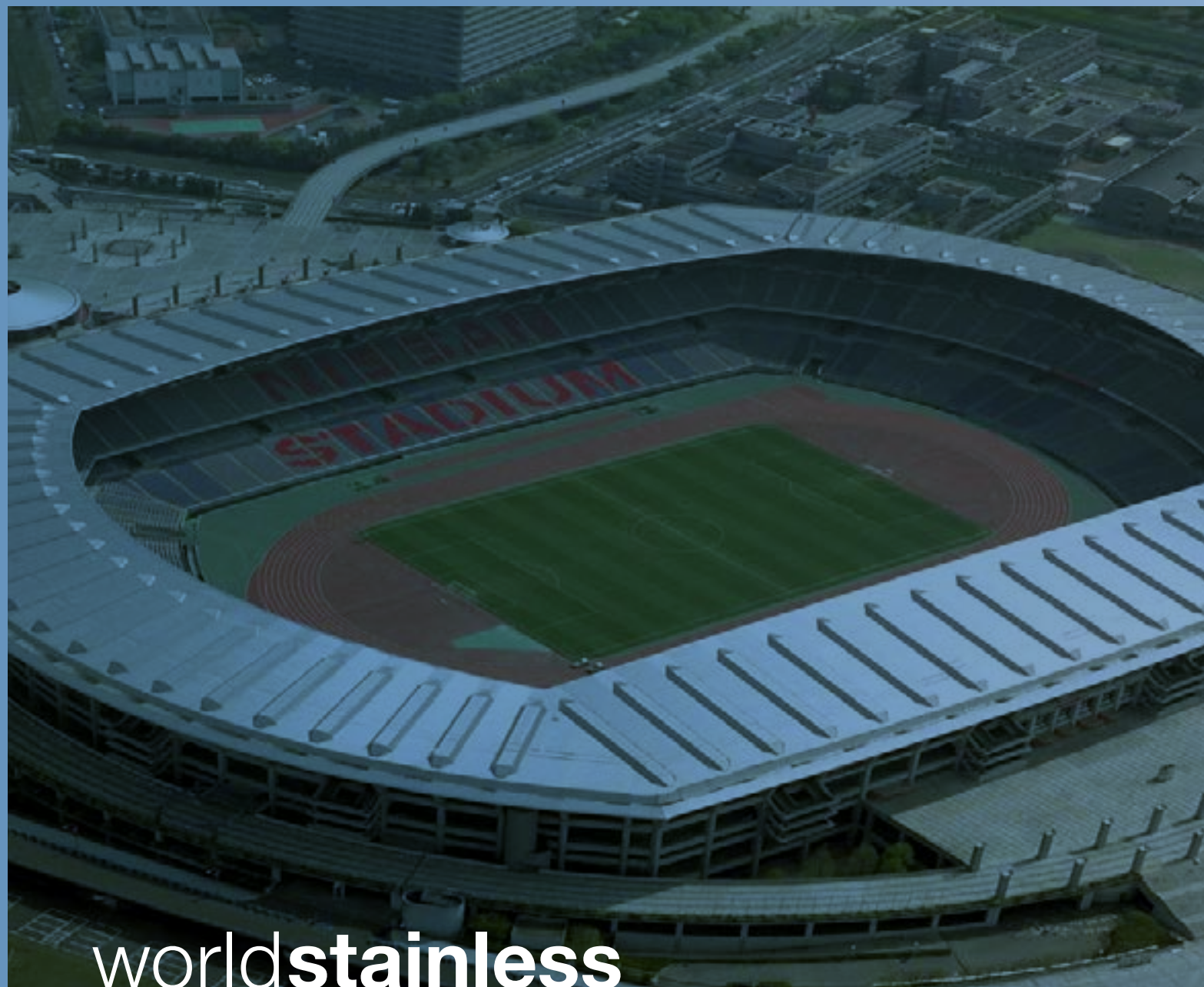
Skiing

A company specialized in artisan downhill skis, with the collaboration of CRYOLAB, an 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 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 bottoms of these skis are made of stainless steel to improve their resistance to corrosion and abrasion.
All pictures courtesy of Centro Inox.

Sports stadia: outdoor



Sportcampus Zuiderpark

The Hague, Netherlands

Located at the heart of the historic Zuiderpark, the €50 million sports campus is an innovative collaboration of alliances between education, sport, sport science and the community, for both the municipality of The Hague and its private partners: the Haagse Hogeschool and ROC Mondriaan.

The overriding aim is to emphasize the importance of sport and exercise through learning and engagement, for the amateur as well as the elite athlete, using sport as the inspiration to deliver a healthier society. The 33,000 m² sports campus includes a gymnastics hall, beach sports hall, spectator arena and a multi-purpose sports hall, as well as a variety of sports science and education spaces.

Our design solution is an interpretation

of the brief to embody within the campus the principles of 'motion and activity'. This is expressed externally in the fluid movement of the elevational treatment. At ground level, the curved form of the plan is expressed by a simple plinth constructed from textured precast concrete panels. The upper part of the elevation is expressed as a metallic 'ribbon' that narrows and twists to reveal glazing on the elevation. Constructed from brightly polished stainless steel, the dynamic ribbon changes colour with different lighting conditions and cloud patterns, as well as reflecting the animation of its natural setting.

The municipality of The Hague has the ambition to be climate neutral by 2040. This informed the client's desire for a sustainable campus.

The building is designed to be as compact

as possible, whilst providing the necessary space for the range of sport and education facilities. When combined with a well-insulated shell, energy loss is therefore minimised. The 20,000 m² roof is covered with over 15,000 m² of heat-regulating green sedum, as well as photovoltaic solar panels to generate energy for the building and solar collectors to produce hot water for the showers. The energy generated by the roof is supplemented by a ground water heating and cooling system which utilises two wells excavated to different depths. In the summer when there is a demand for cooling, groundwater is pumped from the shallower 'cold' water well and fed through a heat exchanger to provide cooling for the building. Due to this energy transfer the water returns warmed and is fed back into the deeper 'warm' water well. In the winter the system is reversed to provide heating to the building.

Environment: urban

Material: grade: 316
size: thickness 0.8 mm
finish: polished with
Inox spectral finish
(gold-red)

Architects: Faulkner Browns Architects

Photographs: Scagliola Brakkee,
Hufton+Crow,
Arjen Schmitz

More information: faulknerbrowns.co.uk

Yamuna Stadium

New Delhi, India

The portfolio of famous sporting venues with metallic mesh reflects the virtually inexhaustible formal language and functionality of this industrial base material in stadium construction. The most recent example is the Yamuna Stadium in New Delhi, India, which was opened in the summer of 2010 for the largest sporting event in the city's history, the Commonwealth Games. With 272 competitions in 17 sporting disciplines, as well as over 7,000 athletes and officials from the Commonwealth states, this event enjoys reverence comparable with the Olympic Games among the countries that take part. The venue for the archery and table tennis events was the

Yamuna Sports Complex in the 16-million metropolis of New Delhi. With seating for 5,000 spectators, 10 practice areas and a multifunctional hall, the planners at Peddle Thorp Architects, Melbourne, developed a stadium that can hold its own against any other venue worldwide. The façades of the circular building employ 86 "Tigris" stainless steel mesh panels to create a visually seamless shell. With intelligent interplay of reflection and transparency, its woven skin transforms the sporting venue into a modern interpretation of coexistence. At the same time, the mesh provides effective sun protection for the subtropical climate in New Delhi with temperatures well in excess of 40°C.

Environment:	urban
Material:	316 stainless steel
Manufacturer:	GKD-Tigris
Architects:	Peddle Thorp
Photographs:	GKD/Badri Narayan
More information:	gkd-group.com

Allianz Parque, Palmeiras Stadium



São Paulo, Brazil

The Allianz Park Palmeiras is a multi-functional arena that specifically serves the needs of a well-known São Paulo soccer team. Stainless steel tube and strip are combined into a proprietary facade system called “Stripweave”. It provides an optimal balance between transparency and reflectivity for the hot and sunny climate of the region. As a material, higher alloyed ferritic grade 444 was identified as the best choice for the project. As an iron, chromium, molybdenum alloy, it is particularly price stable. The added molybdenum provides the necessary corrosion resistance for an urban environment.

Environment: urban outdoor

Fabrication process: perforation

Grade and finish: 444, 2B

Total weight of the stainless steel used in the project: 210 tons

Date of completion: 2014

Architects: Edo Rocha, São Paulo

Manufacturing companies: WTorre (contractor), Permetal (perforated sheet) and Hunter Douglas (façade)

Material supplier: Aperam South America

Photographs: Aperam South America

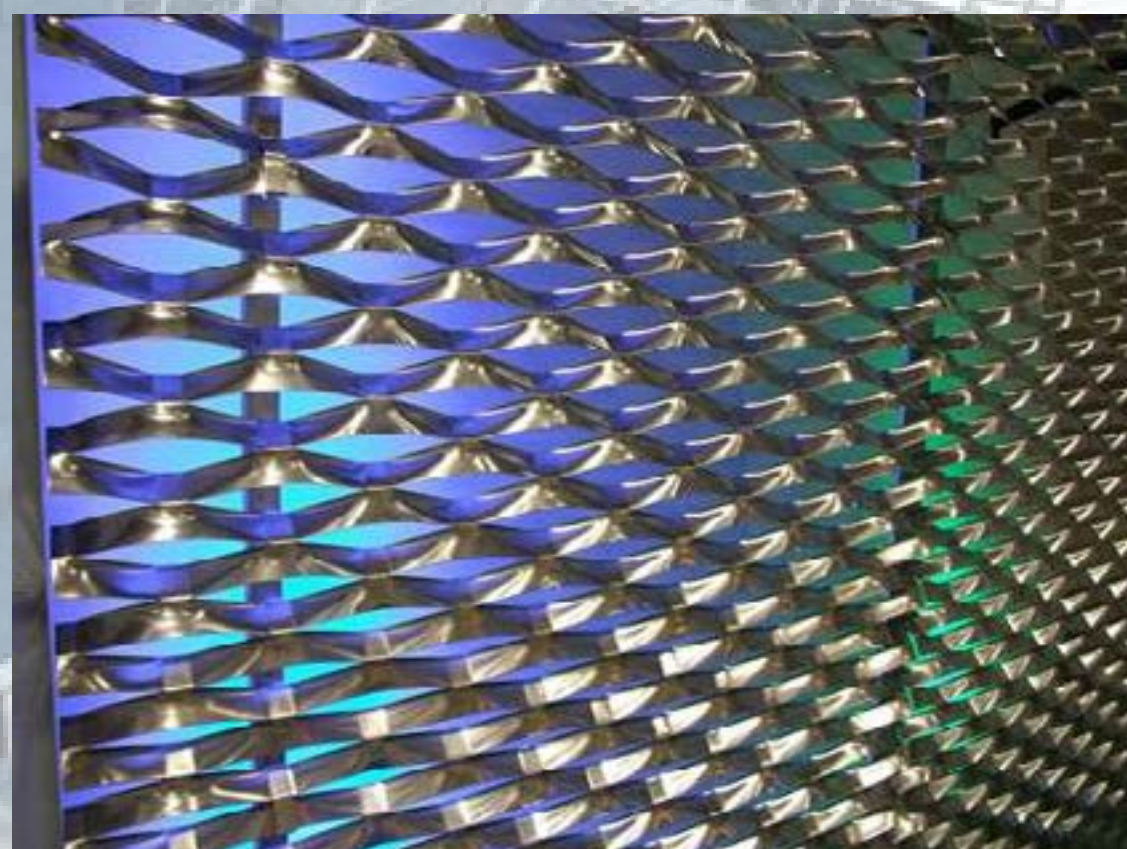
More information: aperam.com

Governador Plácido Castelo Stadium - Castelão Arena

Fortaleza, Ceará, Brazil

The stadium in Fortaleza city in the North East of the country, called Castelão, hosted six World Cup matches. Designed for 64,000 persons and initially opened in 1973, it recently went through two years of refurbishments. The façade was entirely rebuilt using stainless steel stretch metal. The principle: by slitting sheet metal and expanding it, the material naturally shapes into a structurally optimal geometry. The stretching process is carefully controlled

to produce the desired ratio of open and closed surfaces. Although the original 2B surface used is quite bright, the reflection of the stretch metal is diffuse. It reflects heat away from the building without causing glare. The molybdenum-bearing ferritic grade 444 was found to be technically and economically an optimal solution for the environment. In addition to the external frame, stainless steel was used on railings, handrails at VIP areas, lavatories and locks of the stadium.



Environment:	urban outdoor
Fabrication process:	stretch forming
Grade and finish:	444, 2B
Total weight of the stainless steel used in the project:	80 tons
Date of completion:	2012
Manufacturing company:	Martifer, Fortaleza, and Permetal, Ribeirânia, Ribeirão Preto
Architects:	Viglicca & Associados, São Paulo (refurbishment)
Material supplier:	Aperam South America
Photographs:	Aperam South America
More information:	aperam.com

Gwangju World Cup Stadium

Gwangju, South Korea

The Gwangju World Cup Stadium is a building that symbolizes the image of Gwangju, the village of light. The shape of the pillars that support the roof and stands of the stadium were made in the form of the letter Y to indicate the head of Go used in Go-fighting games, and the low slope and finishing curves of the roof are said to express the skyline of Mudeungsan Mountain, the true mountain of Gwangju. The roof is made of stainless steel. The Gwangju World Cup Stadium, where the roof was finished with steel materials like the stadiums in Ulsan, Daejeon, Suwon, and Jeonju, is the only instance where stainless steel plates were used, among 10 stadiums.

Environment:	urban
Material:	316L stainless steel
Finish:	dull finish
Photographs:	POSCO
Material supplier:	POSCO
Photographs:	POSCO
More information:	posco.com

Nissan Stadium

Yokohama, Japan

On June 30, 2002 while the Brazilian team captain Cafu holds the golden cup high up in the air and some 2.7 million paper cranes flew down from the sky, the 2002 FIFA World Cup™ “the Stage of a Dream” closed its curtain. At Nissan Stadium, which was called International Stadium Yokohama at that time, four games including the finals were held, and it was crowded with 260,000 spectators from Japan and abroad. We have received high praise for wonderfulness of a stadium with a seating capacity of 70,000.

Having been recognized by the global community, Nissan Stadium will continue

providing “the Stage of a Dream”, by hosting international sports events, live concerts of various artists, and by offering the guided stadium tour and its running track open for public.

With 72,327 seats, the stadium has the largest spectator capacity in Japan. All the seats are individually sectioned with 90 cm of space between rows, so spectators can sit back and enjoy the games in comfort. To ensure that spectators do not miss any of the drama, large screens are installed on both Side Stands for instant replays of outstanding plays and scores. Additionally, the sound coming from the 528 loudspeakers adds emotion and

excitement to the game. Three quarters of the seating area is covered by a large roof.

In this stadium, a roof by stainless steel vibration damping steel plate welding method was adopted. This roof is designed to emphasize the airiness of the roof using a gentle curved line that takes into consideration the surrounding environment, a landscape as a park facility, an image as a sports facility. Especially by adopting the welding method of stainless steel damped steel plate, in addition to preventing metal sounds caused by rain and wind, beautiful shape with more durability is further enhancing the sense of quality.

Environment: urban

Material: 304 and 316 stainless steel

Weight: 146 tonnes

Manufacturer: Nippon Metal Industry Co. Ltd.

Architect: Takenaka Corporation a.o.

Pictures: Yokohama Sports Association

More information: nissan-stadium.jp

Pyeongchang Winter Olympic Ice-Hockey Stadium

Kwandong, Korea

For the 2018 Pyeongchang Winter Olympics, lean duplex stainless steel was applied to the exterior of the Kwandong Hockey Centre.

The stadium is located 7 km away from the coast and it was required that the steel have at least 316L-grade corrosion resistance. Because of budget overrun concerns, POSCO recommended its Lean Duplex 329LD Steel. Its corrosion resistance is above that of the required 316L steel and because of its high strength, thinner applications of the steel could be used in the final design. In addition, vibration surface treatment was applied in order to add texture to the surface of the exterior, giving the building a more modern touch.

Environment:	marine urban
Grade:	STS 329LD (duplex)
Surface Finish:	vibration
Date of completion:	2017
Manufacturer:	posco.com
More information:	posco.com

Kaufmann Stadium

Kansas City, USA

The Kauffman Stadium renovation for the Royals Ballpark in Kansas City was lead by the architects at Populous. Zahner, producer of highly crafted architectural metalwork, provided an exterior stainless steel façade as well as improvements to the interior experience. The Zahner scope also included the Royals Crown artwork which can be seen atop the ballpark's digital scoreboard.

The new structure at the Royals stadium features two sections which use selective perforations in stainless steel to create the image of the Royals logo on the surface of the metal. This perforated surface wraps the entire building, yielding a mesh façade which provides light, air control,

and a visually intriguing artistic aesthetic. A pattern of perforations and dimples allows glimpses of the original structure and the emblazoned the Royals' graphic adds visual delight. Daylight and air transverse the façade, and the result is a breezy atmosphere which anticipates the excitement of the ballpark within.

The details show the exquisite stainless steel surface, a process Zahner developed for a soft semi-reflective surface known as Angel Hair® stainless steel. The detail photos also reveal how the logo is composed of a dimpled and perforated façade. When standing a hundred feet from the facade, these dimples and perforations disappear to the naked eye, becoming the Royals graphic.



Environment:	urban
Material:	perforated stainless steel
Surface:	Angel Hair®
Date of completion:	2009
Architects:	populous.com
Photographs:	Mike Sinclair and A. Zahner Company
More information:	azahner.com



Estadio Wanda Metropolitano

Madrid, Spain

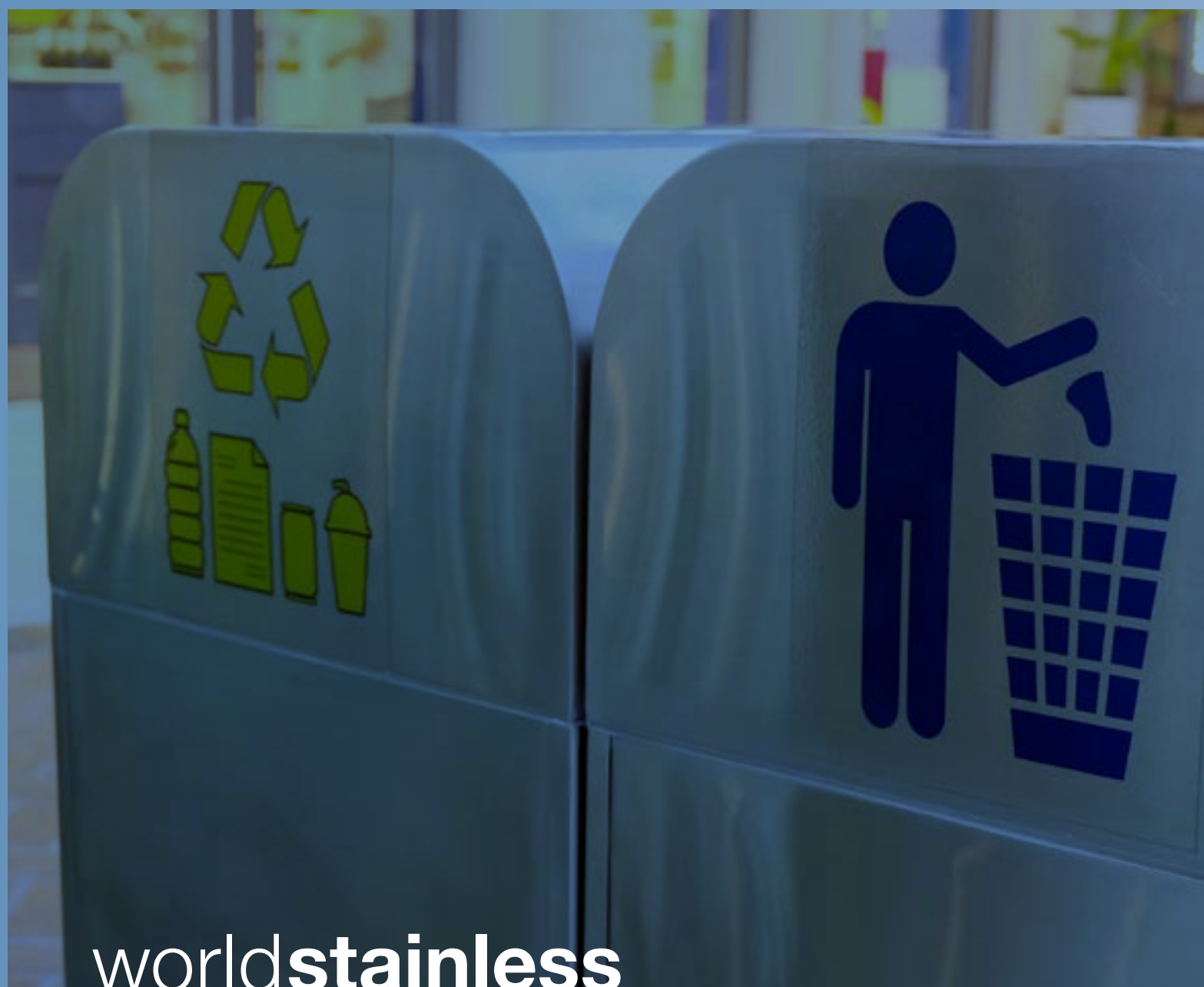
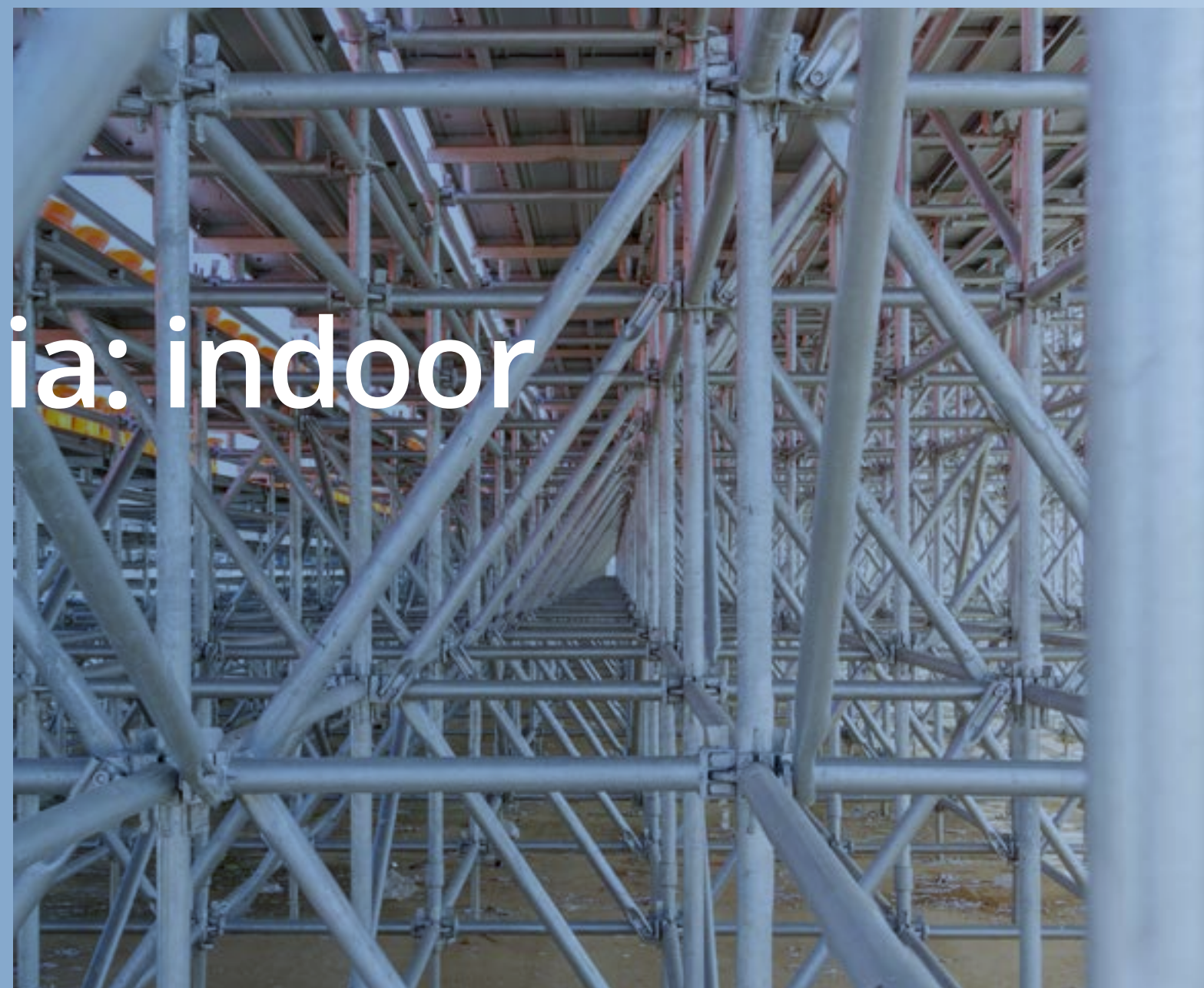
Bigger, more convenient, more spectacular: the new stadium of the top Spanish club Atlético Madrid is among the very elite of European soccer arenas. After six years in construction, the tradition-steeped club opened the doors of the Estadio Wanda Metropolitano in the north-east of the Spanish capital. A large screen on the western façade above the main entrance gets arriving fans in the mood for the match ahead with video sequences from previous games and emotional images. Yet the transparent MEDIAMESH® system from GKD nevertheless blends in perfectly with the puristic façade design. As a result, the spectacularly sweeping roof with integrated LED bands, the bright,

horizontally perforated façade and the MEDIAMESH® display all blend in together perfectly.

The stadium did not have to wait long to score its first major success: just a few days after it was opened, the European soccer governing body UEFA awarded the Champions League final to the Estadio Wanda Metropolitano. Atlético Madrid will therefore host the final of the continent's top club competition on June 1, 2019 – an event that last took place in Spain at the Santiago Bernabéu stadium of local rivals Real Madrid in 2010. The spectators at the Champions League final will then enjoy a fitting welcome from the imposing MEDIAMESH® screen from GKD.

Environment:	urban
Material:	316 stainless steel
Manufacturer:	GKD Mediamesh
Photographs:	GKD
More information:	gkd-group.com

Sports stadia: indoor



Stainless steel underneath the seats

The steel underneath the seats in a stadium can be hard to reach. Corrosion can be a problem in this case. It is therefore wise to make the scaffolding underneath in stainless steel. If you choose the correct grade, it will ensure ongoing visitor safety and be maintenance free.

Turnstiles

Full Height Type Turnstiles are durable products that can be used indoors and outdoors. They provide access and access control in areas requiring high levels of security.

Turnstiles made from stainless steels are corrosion resistant, strong and easy to keep clean and hygienic. When calculating the life cycle cost it will often be the least expensive choice.

Security Cameras

In this day and age Closed Circuit Television systems (CCTV) seem to have become part of daily life in many shops, parking garages, industrial sites and indeed cities around the world. In the longstanding debate over whether privacy should prevail over security, it seems that for the time being security has become a priority. The Axis Dome Network Camera system is encased in nitrogen-pressurized stainless steel casings and is ideally suited for surveillance and remote monitoring applications in a wide range of outdoor facilities. These cameras are capable of resisting the corrosive effect of sea water and cleaning chemicals, and can also withstand high-pressure steam cleaning.

Pressurized nitrogen prevents internal condensation. Axis has three outdoor-ready, marine-grade stainless steel cameras that enable 360° coverage of

wide areas in resolutions up to HDTV 1080p and great zoomed-in detail with up to 36 x optical zoom. These cameras provide excellent video surveillance and high durability for reliable performance in demanding indoor and outdoor environments. Manufactured from austenitic grade 316L stainless steel, with a nylon clear dome cover, they can operate in a temperature range from -30 °C to 50 °C and they offer protection against dust, rain, high pressure steam-jet cleaning, snow, ice and salt fog. Stainless steel mounting accessories are also available. This is a good example of applications where the life of the relatively high cost internal equipment of a unit can be prolonged by using the more robust external protection provided by the strength and corrosion resistance of a stainless steel casing.

Picture courtesy of Axis Communications



Waste Bins

Stainless steel waste bins are elegant and sturdy, corrosion-resistant, fire-resistant, require minimal maintenance and easy to clean.



Urinals

Stainless steel urinals are sleek with both classic and modern touches. Luckily, the metal is not just beautiful, but highly functional too. Stainless steel urinals are durable, hard wearing and vandal resistant.

The robust structure, which should be mounted with stainless steel fixings, enables maximum usage with minimal maintenance, cleaning with water and soap is enough. Stainless steel is one of the most hygienic materials and does not support the growth of bacteria and other pathogens.

Stainless steel is very tough, and even lightweight stainless steel won't buckle under great weight, making it one of the most durable metals on the market. It can endure weight, hot and cold temperatures as well as weather extremes.

Stadium kitchen and foodservice equipment

Australia's leading stainless-steel fabrication specialists, Stoddart was heavily involved in the fit-out of the stainless-steel kitchen and equipment utilised in the Bankwest Stadium. This world-class stadium has five levels of premium, corporate, and general-purpose function spaces and are expected to house more than 30,000 spectators during every major event.

To ensure that this stainless-steel kitchen fit-out was designed and installed as per the desired construction requirements, Stoddard proudly worked hand-in-hand with the selected builders and contractors. Some of the equipment supplied and installed included;

- Halton ventilation exhaust hoods.
- Electrolux Professional combi ovens.
- Culinaire vertical and standard hot cupboards, bain maries, hot food slides, and cold food displays.
- Adande drawer systems.
- Anets fryers.
- Stoddart Plumbing washbasins.
- Custom fabricated workbenches, counters, and shelves.
- Custom fabricated wall sheeting and spine walls.

Text and pictures courtesy of Stoddart.



Stadium Cups

Selling food and drinks is big business at events. When disposable cups are used, they bring about a massive amount of waste. Stainless steel stadium cups can solve this problem. They can be used for serving drinks, avoiding waste and at the same time are sturdy and unbreakable, whilst offering a unique event souvenir.

These cups are easy to clean and dishwasher safe.



About worldstainless

worldstainless is a not-for-profit research and development association which was founded in 1996 as the International Stainless Steel Forum.

Its primary roles are to undertake stainless steel industry beneficial tasks that are better coordinated centrally in the fields of

- Promoting industry and material sustainability benefits
- Conserving resources and promoting the circular economy
- Providing economic and industry-leading statistics
- Support industry health & safety needs and developments
- Outlining market development and expansion opportunities
- Maintaining brand reputational positioning
- Materials education

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