

# INOSSIDABILE

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## Summary

For more detailed information please contact directly the names indicated at the end of each notification

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#### THE SAFE CAR: A STAINLESS STEEL "NEST" (L'auto sicura: un "nido" di acciaio inox)

In the plans for the prototype of the two-seater "NIDO" (NEST) car there is a concentration of design ability of the technicians at Pininfarina di Cambiano (Turin) who have looked closely at every detail amongst which even the use of innovative structural materials such as stainless steel to reach the objective of "safety".

The NIDO project is studying new solutions which involve both the structural aspect as well as the design element with the objective of increasing both the internal safety of the occupants but also the external safety, to limit the damage to pedestrians in case of accidents.

The principle that is normally applied to protect the occupants, in the event of a head-on collision, is that of guaranteeing vital space and absorbing the impact energy through the deformation of the anterior part of the structure, then transferring the remaining loads to the rear part of the structure. Active retention systems (seatbelts and airbags) are also used.

Applying this principle to a compact car is more critical with respect to a larger car as the deformation spaces are much more reduced.

NIDO offers a new principle. The car is made of three main elements:

- a chassis consisting of a deformable front section and rigid cell surrounding the occupants;
- a shell for the occupants, which behaves like a sled that moves horizontally along a central runner within the rigid cell;
- the rigid cell and the sled are connected in normal conditions by a third element, made of two energy dissipating absorbers with controlled rigidity.

In the event of a head-on collision, the car absorbs part of the energy in the deformable front section of the chassis, constructed of two sheet-metal struts, with two internal plastic foam absorbers, which dissipate the energy over the cellular sheet-metal firewall, which in turn transfers the energy along the central tunnel and the side members. The remaining energy, deriving from the dummies and the sled, shifts the sled itself forward and compresses the two honeycomb absorbers positioned between the rigid cell and the dashboard of the sled shell, allowing a controlled and gradual deceleration of the dummies. The sled can have even more absorbers, which are smaller and fitted between the rear of the sled and the rigid cell, so as to protect the occupants even in the case of a rear impact.

The application of this principle can be extended to a mid-engined two-seater sports car.

The choice of stainless steel for the structure is linked to the properties of this material, which has elevated energy absorbing capacity in the event of a collision and an increase of mechanical strength in relation to the degree of deformation speed (strain hardening).

Stainless steel makes the industrial process more flexible as it doesn't require anti-corrosion surface treatments and therefore allows us to avoid the cathoresis step: a new concept of chassis has been developed, replacing the traditional floor tray, tunnel and firewall configurations with a structure made from cellular stainless steel sheet. The advantage of this technology is the excellent shock absorption capacity and the superb performance in terms of torsional stiffness, apart from the fact that it allows a very light, linear structure.

The cellular sheet-metal technology foresees a sandwich made up of four or more stainless steel sheets of reduced thickness on top of each other: flat sheets are used for outside sections, whereas for internal parts two or more ribbed stainless-steel sheets are assembled with opposing corrugations.

Lastly it is important to remember the important ecologic

nature of the NIDO project: stainless steel is a completely recyclable material and the use of coloured plastics for the external body panels allows us to avoid painting steps.

The cellular sheet was joined with roughly 400 laser welding points, of the overlapping joint type, thus avoiding the problems of corner joints.

The last step of the project will consist in industrial feasibility study regarding the hypothesis of producing from 100-120 cars per day for a total of 20,000 units per year for 5 years. Pininfarina has applied for patents for the innovative safety features developed as part of the NIDO project.

*We would like to thank ThyssenKrupp Acciai Speciali Terni, Ilta Inox, Acciaierie Valbruna for having supplied the stainless steel and the Centro Sviluppo Materiali for the additional data regarding simulations on stainless steel.*

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#### FROM OUR MEMBERS COGNE ACCIAI SPECIALI (Dalle Associate, Cogne Acciai Speciali)

Cogne Acciai Speciali has been specialized in the production of stainless steel long products for about a century now, becoming a real multinational company. Its product range includes all types of stainless steel: austenitic, molybdenum-austenitic, duplex, super duplex, ferritic, martensitic, superalloys, precipitation hardening. The stainless steel products which are included in the production programme are semi-finished products, wire rods, bars, corrugated round bars for reinforced concrete and steels for valves in endothermic engines.

As far as Italy is concerned, the marketing and distribution activity of stainless steel bars is carried out by its associate "Cogne Distribuzione Italia Srl". This society operates through two warehouses in Cornaredo (Milano) and Padua. The Padua warehouse aims to develop sales to the clients in the Nord-East of Italy (especially in the Veneto and Friuli Venezia Giulia areas); Cornaredo works in the rest of Italy and is particularly active in the hot and cold rolled steels sectors.

During its expansion in the stainless steel bars market Cogne Acciai Speciali has taken over the majority interest of Novacciai Srl, a company located near Novara. Novacciai operates in the market cold working steel bars, with a specialization in machining and sizes to Customer's specifications. Thanks to an adequate stock of stainless steel semi-finished products it is able to supply "just in time" the principal steel qualities with the standard diameters requested. Novacciai has a particular know-how in realizing special surfaces and tolerances.

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■ Cogne Distribuzione Italia Srl - Via Pitagora 5 - I-20010 Cornaredo MI - phone +39 02 9348101, fax +39 02 93566126

■ Novacciai Srl - Via Verdi 26 - I-28060 San Pietro Mosezzo NO - phone +39 0321 530611, fax +39 0321 530627, www.novacciai.it

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#### PICKLING AND PASSIVATION (Decapaggio e passivazione)

Amongst the factors that must be taken into account to ensure the resistance to corrosion of stainless steel, the state of the surface is fundamental as in most cases it is only the intrinsic characteristics of self-passivating materials that make them resistant to attacks from the surrounding environment, maintaining their aspect and their

"functionality" unchanged.

Pickling and passivation are, therefore, of a primary importance for a stainless steel component because they place that material in the best conditions to encourage the mechanism of self-passivation which is at the root of stainlessness.

Stainless steels, thanks to the chrome element in the alloy (at least 10.5%), are spontaneously covered by a compact and invisible layer of very thin oxides called the "passivity film", which protects them from corrosive phenomenon. This film is dynamically stable. This means that, if the film was to be damaged, it is capable of self-repairing, provided that the surrounding environment has sufficient oxidising power (the atmosphere and water are sufficient sources of oxygen) (Fig. 1).

Other elements, such as molybdenum, nitrogen, nickel, titanium, etc., influence the anchorage, the thickness, the speed of reconstruction and the possibility that such film is created and consequently the resistance to corrosion of the steel. There are therefore stainless steels with different levels of nobility, that can guarantee a very high resistance to corrosion even in extremely aggressive environments.

Figure 2, for example, shows the trend of depassivation pH for a stainless steel containing levels of chrome between 17 and 18% in relation to the content of molybdenum in the alloy, in a solution 2M of NaCl.

However, so that the mechanism of self-passivation can take place and be considered stable, it is also necessary that the surface of the steel be free of whatever element may impede or delay the trigger, such as welding oxides (Fig. 3) or contaminating substances such as carbon steel or dirtiness due to thermal alterations.

**Pickling** - In general, the real procedure is aimed at removing the scales of resistant oxides, formed following heating at high temperatures (hot rolling, forging, heat treatment, welding, etc.) with the presence of atmospheric oxygen.

Pickling can be either mechanical or chemical.

The first is done with siliceous sand, corundum, glass or stainless steel spheres, stainless steel brushes or inert materials, always using instruments that have never been used before on other metallic materials to avoid contamination.

Mechanical pickling can precede the chemical method, above all when the layer of oxide to be removed is very thick.

Chemical pickling, is made with acid baths (in general based on sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) or nitric acid (HNO<sub>3</sub>) with hydrofluoric acid (HF), at temperatures that are higher than room temperature.

Every pickling bath requires the necessary equipment and safety systems, because of the toxicity and aggressive nature of the chemicals used. Today there are also "ecological" solutions, which allow an easier disposal of the final product, based on the use of hydrogen peroxide to which suitable stabilisers are added.

Moreover, so as not to damage the objects, it is necessary to avoid prolonged stays in the pickling baths. Normally, after the bath, the treated element must be rapidly cooled and rinsed in water. When a bath treatment is not possible because of the dimensions of the component or if the pickling is required on only a part of the component, it is necessary to use "pickling pastes" which are used frequently for weld beads (Fig. 4).

**Passivation** - This treatment, on the other hand, is ideal above all to quickly restore the natural passive layer of stainless steel and eliminate the traces of metals that can have contaminated the surface. This treatment is in fact more correctly called "decontamination" and generally it follows the pickling process.

The presence of more anodic metals on the surface of stainless steel, such as for example carbon steel, can create the conditions for the beginnings of a superficial staining (a consequence of the rapid oxidation of the contaminant) or



become an obstacle to the phenomenon of self-passivation and thus create a trigger zone for corrosion. Passivation, normally carried out in baths, requires less aggressive liquids from a chemical point of view (it is generally based on nitric acid, HNO<sub>3</sub>), but disposal systems and adequate safety conditions are anyway necessary. Even for the decontamination, as well as for the pickling, a paste can be used for localised treatment of component parts. The pickling and the passivation by chemical methods require special care which it is possible to sum up in these fundamental aspects:

- The more the stainless steel is alloyed and thus resistant to corrosion, the more the substances used must have greater pickling power (high concentration and temperature);
- The thicker the layer of oxide, the longer the action time of the pickling solution must be, given equal materials treated.

American standards are certainly a valid reference; there are two documents that treat the subjects we are looking at: ASTM A-380 (see the example regarding pickling in the table) and ASTM A-967.

These standards list formulas, temperatures, times and practises to be observed for pickling and passivation of the various types of stainless steel; as an example an extract of the tables contained in ASTM-380 regarding pickling is shown.

Photo: courtesy of Delmet - Via Bergamo 6 - I-20064 Gorgonzola MI - phone +39 02 9517504, fax +39 02 9513276, info@delmet.it, www.delmet.it

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### A NEW FILTERING PLANT FOR A SWISS AQUEDUCT (Nuovo impianto di filtrazione per un acquedotto svizzero)

The village of Lodrino, in the Ticino canton, draws the water for its water system from a torrent close by which, because it is in the mountains, also carries solid elements (leaves, branches, etc.). It is thus necessary that the water be purified from foreign bodies.

The pre-existing treatment plant in carbon steel, which was very run-down, has been rebuilt using stainless steel EN 1.4301 (AISI 304) and EN 1.4307 (AISI 304L). The filtering plant is made up of a stainless steel plate, which supports the weight of the sand while it is being washed through the injection of both air and water together.

After the washing, 500 special valves enable the passage of water underneath, while sand remains at the top.

Realization: Della Cagnoletta Srl - Via Gerone 4 - I-23030 Albosaggia SO - phone +39 0342510190 fax +39 0342511501, info@dellacagnoletta.com, www.dellacagnoletta.com

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### A "STAINLESS" DRINKS PLANT (Uno stabilimento per bevande "inossidabili")

The town of Novi Ligure (Alessandria) is placed in the centre of an extremely good communication system and is in a region, Piedmont, with a well-known oenological tradition. For these reasons it has been chosen as the place to build a new plant which produces and processes sparkling white wines and vermouth.

After two years of construction works the plant is now running, and includes the use of a large amount of stainless steel.

For many years stainless steel has been used in the oenological industry to make tanks and in this plant it is also used for different kinds of accessories. Its hygienic features make it in fact the best material for the food and beverage industries.

More than 220 stainless steel tanks with a capacity between 15 and 2000 hl were installed in this plant, as well as all the accessories linked to them. For their production, EN 1.4301 (AISI 304) and EN 1.4401 (AISI 316) stainless steels were used, with thicknesses between 2 and 5 mm, always with a 2B finish.

Where required, the insulation of different elements was done with preformed or foamed polyurethane. Coated with a sheet made of EN 1.4301 with a 2B finish and a thickness of between 0.6 and 0.8 mm, for tanks and autoclaves. Pipe were covered with polystyrene or mineral wool and with polyurethane foam, then coated externally with a stainless steel sheet of the EN 1.4301 type, with a BA finish and a

thickness of 0.6 mm. The seal of the coverings is done with rivets made of EN 1.4301 with a EN 1.4541 (AISI 321) shank or with screws, always made of EN 1.4301.

Stainless steel was also used in structures which complete the plant, such as winding staircases, ladders and gangways. In this way it was possible to exploit the ease of cleaning, the low bacterial retention and the resistance to corrosion of stainless steel in order to have an easily cleanable and totally hygienic environment.

Client: Gruppo Campari - Via Filippo Turati 27 - I-20121 Milano MI - phone +39 02 62251, fax +39 02 6225232, davide.campari@campari.com, www.campari.com

Tanks: Azzini Spa - Via IV Novembre 58 - I-26015 Soresina CR - phone +39 0374 343952, fax +39 0374 343505, info@azzini.it, www.azzini.net (figures 1 and 2) / Di Zio Costruzioni Meccaniche Spa - Via Maiella 73 - I-65010 Spoltore PE - phone +39 085 497521, fax +39 085 4971713, info@dizio.it, www.dizio.it (figures 3 and 4)

Insulation of tanks, autoclaves and pipes: Coifer Srl - Via L. da Vinci - I-24043 Caravaggio BG - phone +39 0363 51597, fax +39 0363 53011, info@coifer.it, www.coifer.it (Pages 5 and 6)

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### STAINLESS STEEL AS A PROTECTIVE ELEMENT

(L'acciaio inossidabile come elemento di protezione)

Strip is amongst the forms that stainless steel semi-products can assume. It is a cold-rolled flat product which, immediately after the last passage, is coiled. The lack of a protective packaging and the reduced thicknesses endangers the integrity of the raw material in correspondence with corners, especially during the transport and storage phases.

Especially to prevent damage, proper stainless steel corner-protections are made, which permit the product to avoid contamination or galvanic corrosion phenomena deriving from the contact with less noble materials.

This production of these protective elements is done by pressing, using progressive dies with a 120 mm pitch, operating on thicknesses between 0.5 and 1.2 mm, with widths between 150 and 400 mm.

In this way it is possible to protect the stainless steel, preserving the product quality and allowing an optimal use of the material, reducing the waste of damaged parts during transport.

Production: I.S.A. Industria Stampaggi Ambrosiana Srl - Viale Luraghi - I-20020 Arese MI - phone +39 02 9345491, fax +39 02 93454912, info@isastampi.it

### STAINLESS STEEL SMALL COMPONENTS MAKE THE WORLD MOVE

(Minuterie metalliche inox: fanno muovere il mondo)

Small metallic items are used in the production of electric equipment for motor vehicles and in components for lighting equipments, electricity panels in industrial plants and onboard merchants and military ships and also in household appliances.

For the production of small metallic items Arinox S.p.A. supplies the stainless steel precision strips to Poimec S.r.l., an Italian firm leader in this sector, which plans and realizes metallic components for high-technology systems.

Small stainless steel precision items are generally made using AISI 301 with medium-high work hardening and typical thickness between 0.15 and 0.50 mm, in order to enable the correct shaping of the detail and to give strength when being used. Sometimes the AISI 304 alloy is used, always work hardened, and also the AISI 316 one but in an annealed state.

Arinox uses the most advanced productive technologies, in order to supply high quality and precision strips, as far as mechanical, dimensional and surface features are concerned, including the high quality of edges.

Stainless steel precision strips: Arinox S.p.A. - Gruppo ARVEDI - Via Gramsci 41/A - I-16039 Sestri Levante GE - phone +39 0185 3661, fax +39 0185 366320 - Sales Manager: Ing. Massimiliano Sacco - Sales Manager Assistant: Ing. Alberto Bagna - Marketing: Dott. Luigi Ricci - sales@arinox.it - www.arinox.it

Metallic small components: Poimec S.r.l. - Via Vitteva di Piazza Fontana 17/19 - I-10024 Moncalieri TO - phone +39 011 6474449, fax: +39 011 6896181 - Sales Manager: Mr. Franco Vercelli - direzione@poimec.it, www.poimec.com

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From the Arcelor convention, 29<sup>th</sup> October 2004

### STEEL CONSTRUCTIONS FOR A BETTER WORLD

(Costruzioni in acciaio per un mondo migliore)

Arcelor Building & Construction Support (Support unit for the development of steel construction solutions) organised the Arcelor convention for the first time in Italy, which was dedicated to construction and which took place at the new Rho/Pero exhibition centre (that will only be opened to the public on the 25<sup>th</sup> April 2005), with more than 200 participants.

130,000 tons of steel, carbon and stainless steel, make this building-site a true "case history" for metallic construction and, once finished, it will be the biggest exhibition centre in Europe with 530,000 m<sup>2</sup> of covered surfaces.

After a welcome by Pierre Bourrier, Senior vice President Construction of the Arcelor group, Prof. Eng. Massimo Majowiecki showed how steel is the ideal material in the evolution of construction. Then Eng. Mario Maddaloni, NPF Group-Astaldi, talked about how steel is a flexible tool for the General Contractor.

The guests then visited the imposing twin-levelled pavilions, produced exclusively with Arcelor steel and also the central pedestrian corridor which is 1,300 metres long, seeing all that steel can offer in terms of architecture, building techniques, speed, cleanliness and respect of the environment. Of particular effect is the reflecting façade, made from stainless steel panels, which cover the pavilions that face the central axis.

For further information: Arcelor BCS - Via Lucania 2 - I-20090 Buccinasco MI - phone +39 02 48862402, fax +39 02 48862403, arcelor.bcs@arcelor.com, www.arcelor.info, www.constructionitalia.com

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### A MAGIC FOUNTAIN FROM SCRAPS

(Dagli scarti di lavorazione una magica fontana)

For the second successive year Luciano and Ernesto Dellavia (Delinox, Lodi Vecchio LO) have given their contribution to the San Fermo fair in Lodi Vecchio, near Lodi, with a very particular modular fountain.

It is made of scraps from 3,0 mm thick sheets of EN 1.4301 (AISI 304) stainless steel. In the fountain there are, in total, 420 kg of entirely recycled materials, combined together to form a construction that is 5.50 m high and with a maximum diameter of about 2.80 m.

The fountain, which ends at its summit with an element made from scraps of punched sheet metal, is composed of two overlapping cylinders of different diameter, which are shaped like a grid. The cylinders have bigger meshes at the base, where circular laser cut medallions representing the signs of the zodiac are hung. Junctions have been made with micro plasma jet welding.

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