



[self-cleaning air duct solution]

Bductal *careplus*
easy cleaning high hygiene duct[al] system

[air ducts]



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A photograph of a man in a grey t-shirt and blue jeans carrying a young child on his shoulders. The child is wearing a pink long-sleeved shirt and red pants, with their arms outstretched. They are standing in a vast, green, rolling field under a bright blue sky with scattered white clouds. The text 'Duct cleaning is a necessity from a technical and standards point of view' is overlaid in white on the lower half of the image.

Duct cleaning is a necessity from a technical and standards point of view

Better air quality for a higher and safer environmental comfort: this is one of the principal aims of modern day air-distribution systems design. This is also the same goal of most recent standards which are now putting at the centre of attention the air-distribution ducts cleanliness.

Modern day residential, commercial and professional buildings do not pay attention only to architectural aspects and the functionality of the building, but also to the high comfort standards granted to the occupants. Comfort which is granted non only by the thermal conditions, but also by the quality of the supply air.

Considering the significant impact of the air quality on people's health, also the technical and legislative norms, that regulate the sector, have become in recent years more and more strict and the standards required for air conditioning systems as a whole, including the air-distribution ducts, have also become

stricter. The attention given to these issues have therefore become a central aspect for purchasers, consultants and contractors, who now have to expand their parameters of evaluation, including also issues such as cleanliness, maintenance and more in general, health of the air.

There are three reference standards for this specific area of application:

- Health Ministry Guidelines for the definition of the predictive maintenance technical protocols of air conditioning systems;
- UNI EN 15780 Ventilation for buildings - Ductwork - Cleanliness of ventilation systems.

- > Nadca Standard for assessment, cleaning and restoration of HVAC systems.

After the great success obtained thanks to the P3ductal care solution with antibacterial treatment, P3 finds itself once again in the position to anticipate the evolution of the air ducting world. In order to guarantee the highest level of air quality,

the laboratories of the Padua based company have developed a new solution of air ducts capable of offering the highest performance from a cleanliness point of view.

This is how P3ductal care^{plus} was born, the new P3 pre-insulated aluminium panel which unites the antimicrobial effect of P3ductal care together with an innovative self-cleaning effect.

The activities performed inside a building produce volatile compounds, bacteria, fungi.



Sick Building Syndrome

- breathing apparatus problems
- allergies
- eye irritation
- migraines

Therefore, the duct cleaning may no longer be underestimated.
It does not have to be seen as a cost but as a necessity.



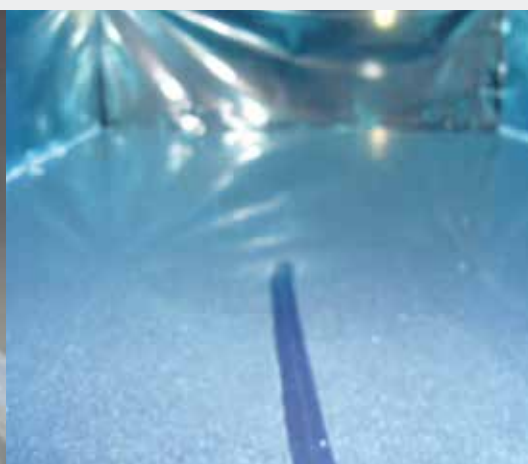
Health ministry - G. U.3 November 2006 – “Guidelines for the definition of the predictive maintenance technical protocols in air conditioning systems”.

Overview	
use	all systems
reference standard	designing, manufacturing and installation according to the EN 12097
first check	during the initial start up
initial cleanliness level	0,075 g/sm
inspection intervals	every 12 months and if necessary have to be cleaned
running cleaning level	1 g/sm

UNI EN 15780 Ventilation for buildings - Ductwork -Cleanliness of ventilation systems standard

Cleanliness classes introduced by the standard	
low	areas which are not always occupied (archives, technical rooms)
medium	offices, hotels, restaurants, schools, theatres, houses, commercial areas, exhibitions and sport buildings, industries and hospital common areas.
high	laboratories, clean rooms, pharmaceutical and food industries, hospital sterile areas

Timetable and cleaning levels foreseen by the standard					
	inspection intervals	cleanliness levels of ducts in operation		cleanliness levels of intervals new ducts	
	months	supply	circulation	supply	extraction
low	48	≤ 4,5 g/mq	≤ 6,0 g/mq	≤ 0,9 g/mq	≤ 1,8 g/mq
medium	24	≤ 3,0 g/mq	≤ 4,5 g/mq	≤ 0,6 g/mq	≤ 1,8 g/mq
high	12	≤ 0,6 g/mq	≤ 3,0 g/mq	≤ 0,3 g/mq	≤ 0,9 g/mq





Evolution takes place thanks to the “lotus effect”

Thanks to the special structure of its leaves, the lotus plant is able to perform a natural self-cleaning action. Today, thanks to the special nano-structured coating, P3ductal care*plus* reproduces this phenomenon re-creating the same self-cleaning effect inside the duct.

Traditional products which are able to offer a “barrier” against dust or more generally against dirt or solid particles, use solutions based on two technological principles:

- solutions with antistatic effect;
- solutions with hydrophobic effect (thanks to the effect of some compounds such as fluorine based or Teflon polymers, etc.).

These treatments are not suitable to the special requirements of air-distribution ducts.

For the development of the new self-cleaning P3ductal care*plus* solution, P3 decided to take an innovative and revolutionary road: the creation of a nano-structured coating with lotus effect structure.

Taking advantage of the most recent innovations developed by nano-technology it is now possible to reproduce the lotus effect applying a special coating on various types of surfaces, including metals. This solution is able to offer a very high efficiency, as, using the lotus effect principles, minimizes the contact area between the dust particles and the internal surface of the duct, making it easier, at the same time, to remove the same thanks to the air-flow.

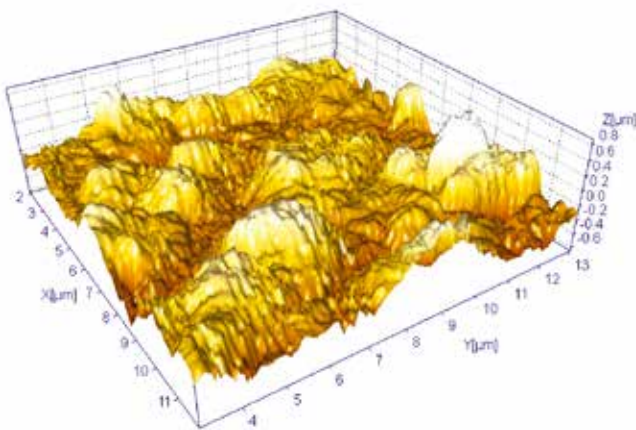
The analysis performed under the AFM – Atomic Force Microscope, have allowed to underline the biomimetic action performed by the special coating used.

The standard coating treatment has been modified

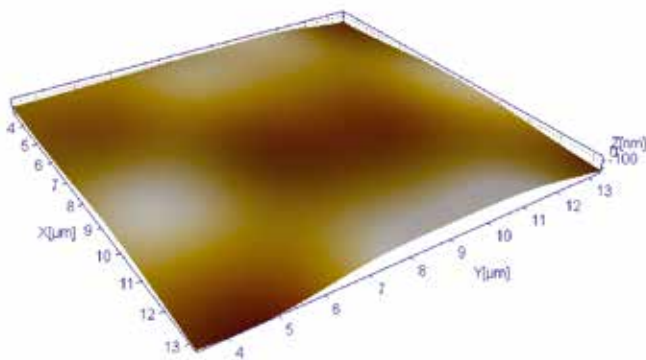
on purpose in order to recreate, on a nanometric scale, a grade of roughness that reproduces the same complex structure of lotus leaves, thus obtaining a surface that reduces considerably the adhesion of dust and solid particles.

On the other hand, the average dimension of the topography thus created, is in any case comprehended within a few nanometres, and therefore does not modify the coefficients considered in the calculation of the friction loss, giving back a perfectly smooth surface.

Atomic Force Microscope (AFM) analysis



the three-dimensional AFM measurement reconstruction of a P3ductal careplus surface on a 10x10 μm range with the z axis amplified 2 times



the three-dimensional AFM measurement reconstruction of a standard P3ductal surface on a 10x10 μm range with the z axis amplified 2 times



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Alta cortese attenzione di
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Systems
Via Don G. Cortese, 3
Ronchi e Villaneta - 35010
Padova

Legnaro, 21 marzo 2013

OGGETTO: Relazione tecnica

La presente relazione tecnica fa riferimento ai risultati di analisi effettuate mediante tecniche di microscopia a forza atomica su tre serie di campioni costituiti da foglietti di alluminio liscio spessore 80 μm con finitura superficiale standard e alluminio liscio di analogo spessore con trattamento superficiale Careplus, fornite P3 Srl - Preinsulated Panels Systems.

Ogni campione fornito da P3 Srl è stato analizzato su un range di 10x10 μm e di 30x30 μm , al fine di valutare l'omogeneità e la qualità del rivestimento superficiale. In aggiunta nella seconda e nella terza serie di misure è stata eseguita su ogni campione una misura su un range di 2x2 μm , con lo scopo di valutare nello specifico la nanorugosità su un range minore.

Tutte le misure sono state eseguite con un campionamento di 512x512 punti.

Le misure sono state realizzate mediante AFM Nt-Mt Solver e analizzate per mezzo del software SFRP di Image Metrology, producendo:

- parametri di rugosità tridimensionale
- rendering 2D e 3D per una rappresentazione qualitativa delle superfici stesse.

Le misure di rugosità, sia su scala micrometrica che nanometrica, sono notoriamente affette da grande variabilità, essendo condizionate da fenomeni puntuali, quali la presenza di contaminazioni (visibili ad esempio nelle figure 25.3, 25.4, 25.5 e 25.6 come granuli), instabilità (visibili ad esempio come striature nelle figure 15.2, 3A.3 o 35.3) e rumore.

Le misure sono state condotte su tre livelli dimensionali (2x2 μm , 10x10 μm e 30x30 μm); questo al fine di riconoscere l'evoluzione della rugosità e della tessitura superficiale su quelle scale dimensionali che verosimilmente possono intervenire nella dinamica dei movimenti di particelle di polvere con dimensioni comprese tra le centinaia di nanometri e i pochi micron di diametro.

Nonostante la suddetta tipica variabilità da cui sono affette le misure di rugosità, nei campioni analizzati tra il 2011 e il 2013 si nota una buona stabilità e ripetibilità delle misure.

technical report following to the Atomic Force Microscope (AFM) analysis

The lotus cleanliness

Even if it lives in muddy rivers and lakes, the lotus leaves are never dirty.

For this reason, the lotus is considered, in many Oriental countries, as a symbol of pureness.

The leaves of this plant, present a peculiar surface structure, that creates a natural cleaning action.

Botanists have verified, more specifically, that thanks to the high surface tension created, lotus leaves do not retain water, that flows away (in form of water drops) and removes dirt.

Lotus leaves, if analyzed under the microscope, present a coating made of crystals of nanometric dimensions with hydrophobic effect.

Even if it looks smooth, the surface results to be “rough” instead, and it is just this roughness that allows the flowing of water drops.

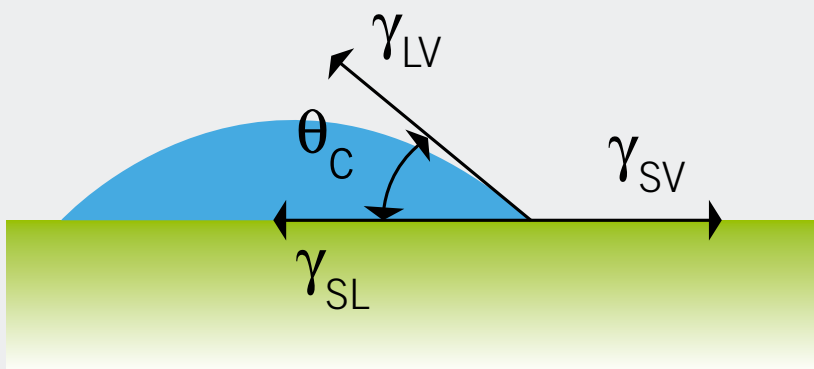
The contact area between the surface and water is approximately of the 3% of the visible one; this makes the self-cleaning action easier, as instead of just gliding away (as it would happen on a smooth surface), water drops roll around naturally, washing the dirt away.



The contact angle is the angle between the direction of the solid-liquid tension and the direction of the liquid-vapour tension, tangent to the outer surface of the drop, with the apex of three-phase liquid-solid-vapour point.

A surface is called hydrophobic if when you place a drop of water on it, the drop forms a contact angle θ_c greater than 90° .

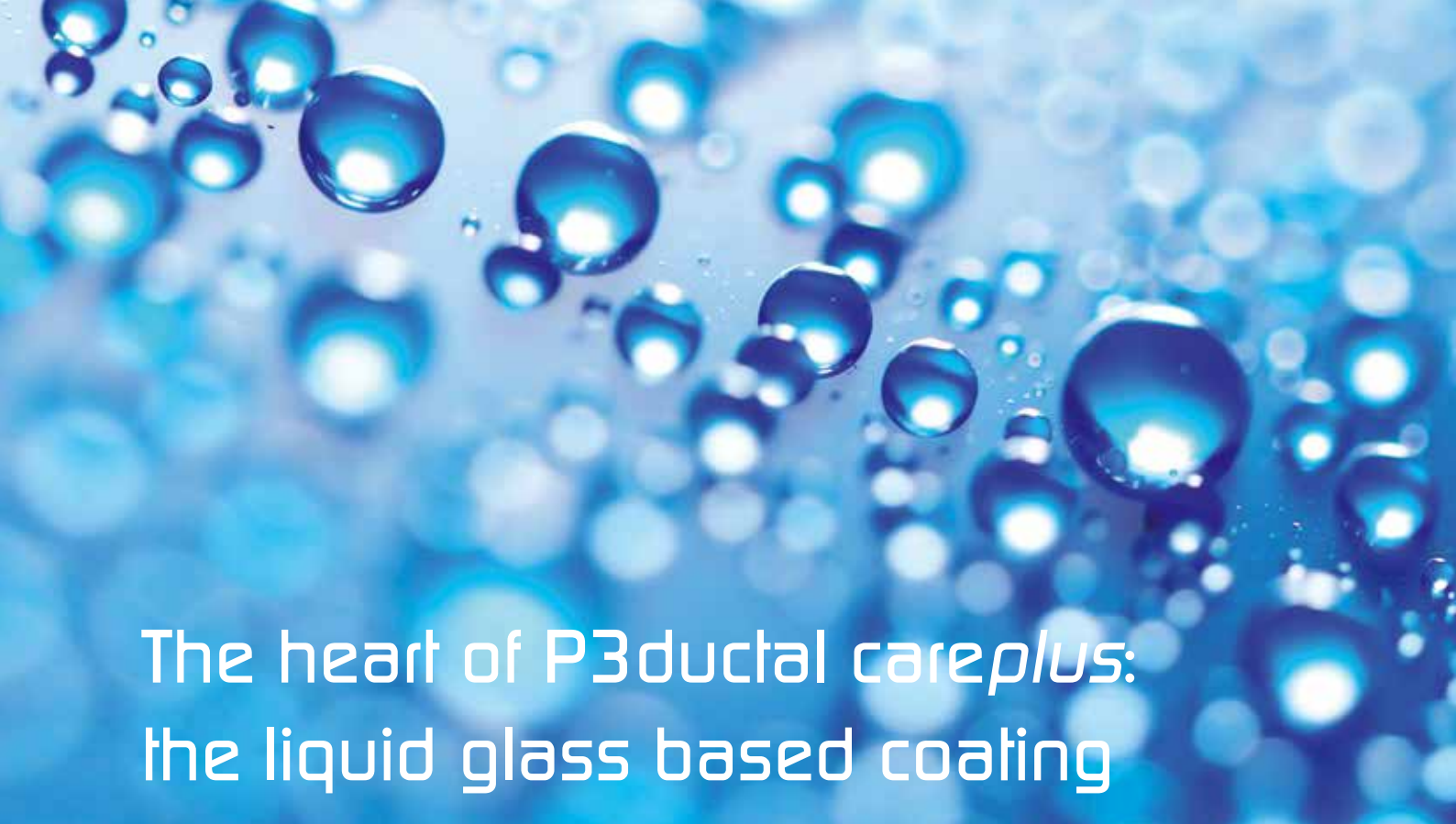
If this angle is higher than 150° the surface is called super-hydrophobic.



γ_{SV} solid-vapour interfacial tension

γ_{SL} solid-liquid interfacial tension

γ_{LV} liquid-vapour interfacial tension



The heart of P3ductal *careplus*: the liquid glass based coating

Lotus leaves use their surface conformation to keep themselves clean over time: the *careplus* technology has allowed us to recreate the same phenomenon on the aluminium surface of panels. The liquid glass is the heart of this nano-technology based innovation.

P3's intuition was to study and use the biological and biomechanical processes of nature as a source of inspiration to solve a technological problem able of considerably influencing the air quality in air distribution networks.

To reproduce the lotus leaves surface characteristics and, consequently, the capacity of keeping itself clean, the *careplus* technology led to the development of a liquid glass nano-structured coating.

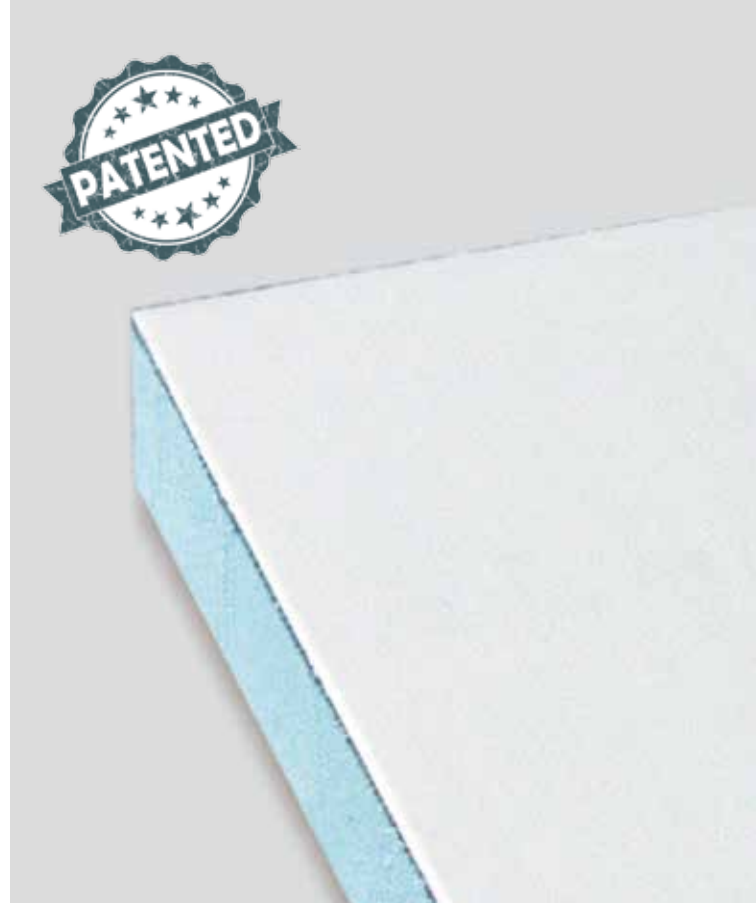
The sol-gel technology allows, in fact, the creation of semi-transparent and ultrathin protective films, that are capable of functionalizing the treated surfaces, giving them incredible characteristics: it is enough to think about the

windscreen of some cars that are able, while running, to remove rain drops without using the windscreen wipers; to the windows of some skyscrapers that keep themselves clean without requiring constant cleaning operations, to some technical fabrics that are able to resist to atmospheric agents or to the anti-graffiti paints of some historical buildings.

The life-span of these treatments were however too limited in time. This was not acceptable for the characteristics that P3 needed to give to its system in order to remove solid particles from the internal sides of air-distribution ducts.

For these reasons, the research which started quite a few years ago, in co-operation with our

technological partners, led to the development of a hybrid coating that maintained the functionality of liquid glass but over time thanks to the introduction of polymeric binders which allow a strong adhesion to the support through a process which is easily industrialized and checked thanks to defined parameters. The innovative and inventive technology applied to the P3ductal careplus solution was recognized by the granting of the patent.



Innovation is in the dna of P3

P3 has always placed at the centre of its own way of doing business the technical development of solutions in order to respond concretely and efficiently to the needs of the market.

Our goal, however, is not only to provide answers and solutions.

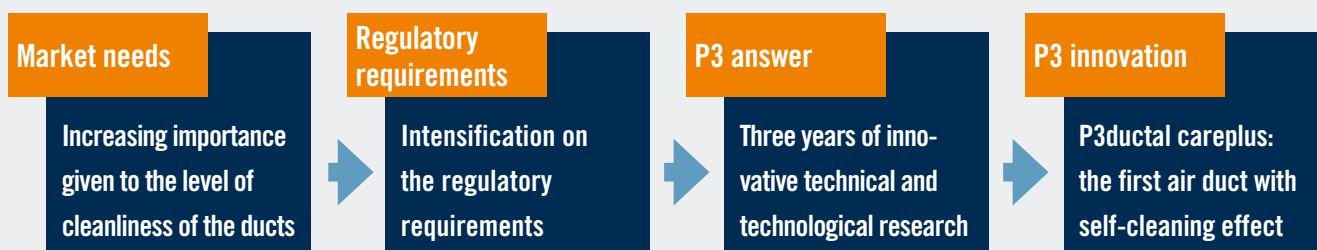
In a world which is becoming always faster and faster it is fundamental not to react only to the stimuli of the customers, but to anticipate the market creating products that can be “distinguishable”.

In order to anticipate the times you must be able to interpret first of all, the needs of the single individual players and the technological and regulatory developments.

It becomes therefore indispensable to have the ability to understand all the dynamics, to have the presence and sensitivity of listening to the market, the availability to collaborate and share information, the authority and credibility in order to participate to all the main technical tables (Aicarr, Anpe, CTI).

All these aspects represent the foundations on which all product innovations and process have been developed in the past years by P3.

Innovations which became reality, initially, in the laboratory but which are born from a continuous comparison with the outer world and find space in the competitive environment in which the company moves.





P3ductal *careplus*: the laboratory tests

The laboratory tests have highlighted the efficacy of the “self-cleaning” treatment used for the P3ductal *careplus* solution. The application of a nanotechnology coating with a lotus effect guarantees a cleaning level which is superior to the standard solutions.

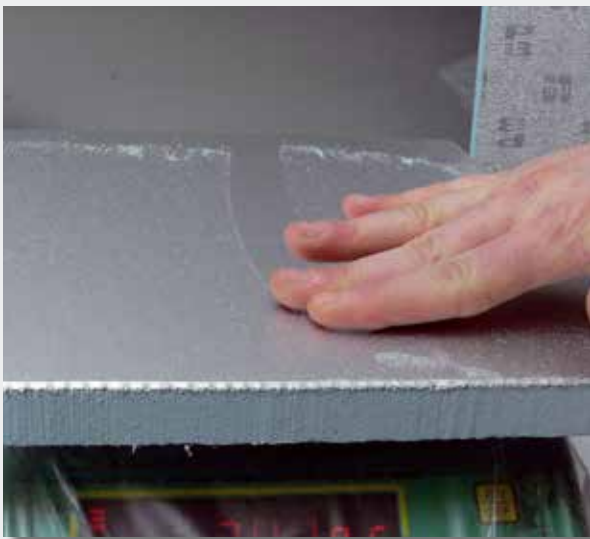
The preliminary laboratory tests, on a small scale, have allowed the identification of the optimal solution and to program the following phases.

The first tests have been conducted comparing the performance of a standard aluminium sheet with one treated with nanotechnology coatings of various types, set horizontally and both contaminated with generic dust.

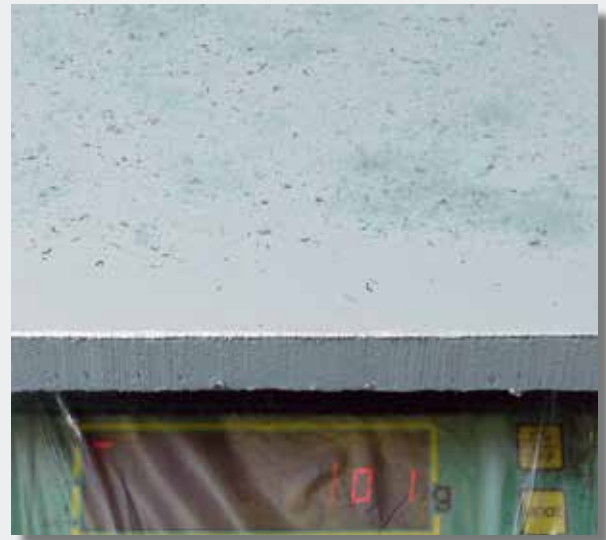
With the simple manual rotation of the sheet of 90° we went to verify the capacity of the coatings to retain more or less the solid particles of dust/dirt.

P3ductal *careplus* highlights, even with a simple visual analysis (sequence 2), an inferior quantity of particle retention and therefore a higher level of cleaning compared to the standard aluminium (sequence 1).

The second step of the tests consisted in a simulation of a real scale scenario.



sequence 1 the standard aluminium panel tends to maintain part of the dirt even after the manual rotation.



sequence 2 the P3ductal careplus panel highlights its self-cleaning effect. After the rotating action the particles were eliminated nearly completely.

Gravimetric measuring analysis

The air flow has been recreated by using a three speed table fan, positioned at a distance of 50 cm from the panel sample which is positioned horizontally on a precision scale.

Thanks to the use of a digital anemometer the velocity of the air on the surface of the sample has been recorded for all the various speeds of the fan.

We then proceeded by “dirtying” the panel samples using various types of powder (polyurethane foam, finely grinded, results the most difficult to remove completely) and a gravimetric analysis has been performed on the particles deposited initially and the residue after having activated the fan and leaving it on with the air flow over the sample for 2 minutes.

Due to the empirical nature of this test, the measurements have been performed at least 3 times for each type of sample.

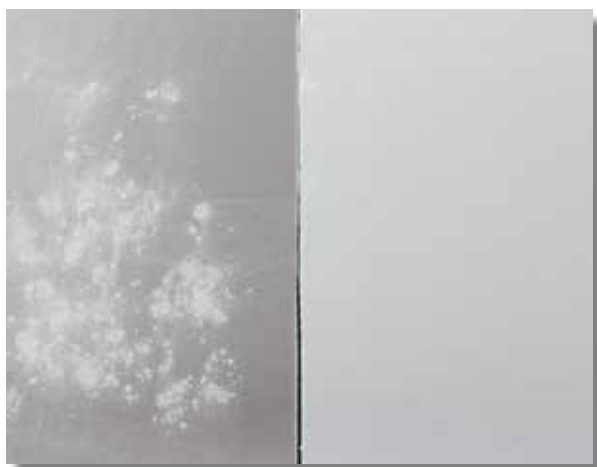
The results obtained have highlighted how the use of a nanostructure coating with a lotus ef-

fect enables the P3ductal careplus panel to obtain an increased removal of dust thanks to the action of the air flow, reaching percentages of nearly 90%. Even the observation of the residual particles magnifying the images has confirmed the same positive results.

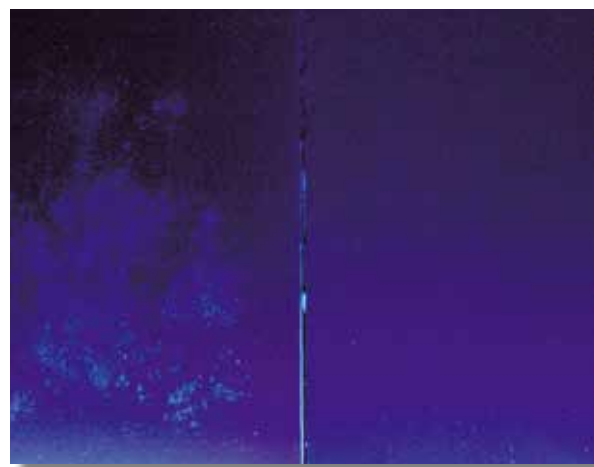
The sequences 3 and 4 highlight how the treated surface offers an increased “self-cleaning” effect.

The results obtained from sequence 3 and 4 are confirmed from a visual comparison of the to samples. In order to highlight even further the advantages generated from the self-cleaning effect of the P3ductal careplus panel, the two samples have been analyzed under the light emitted by a Wood lamp.

This special light generated by electromagnetic radiations principally in the ultraviolet gamma, generates a fluorescent and phosphorescent effect which makes the particle residue deposited on the samples stand out.



visual comparison between the P3ductal standard panel and the P3ductal careplus panel under daylight.



visual comparison between the P3ductal standard panel and the P3ductal careplus panel under the Wood lamp.



gravimetric measuring analysis



sequence 3 after the “dirtying” action, the standard sample is put through an air flow generated by a fan for 2 minutes on speed 1 and for 2 minutes at speed 2. At the end of the test the sample shows wide evidence of residual dust.



sequence 4 after the “dirtying” action, the P3ductal careplus sample is put through an air flow generated by a fan for 2 minutes on speed 1 and for 2 minutes at speed 2. At the end of the test the sample results practically clean.

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P3ductal care*plus*: the large scale tests



Thanks to the use of an experimental air ducting system, the comparison between air ducts manufactured using the P3ductal care*plus* technology and traditional ducting systems, has highlighted the advantages of the self-cleaning technology, based on the methods described in standard UNI EN 15780.

Various technical methods exist in order to evaluate the particle deposit on the surface of air ducts.

The simples are based on a visual analysis, possibly coupled with technical instruments, while the most sophisticated supply information on the basis of the deposits on the surfaces thanks to equipment specifically studied for those applications.

A part from the techniques used for the analysis, it is in any case of fundamental importance that the comparison between the different types of air ducts take place in a controlled environment, in order to be able to guarantee the highest reproducibility.

For this reason to the laboratory tests performed on aluminium samples treated with a nanotechnology coating with lotus effect, P3ductal care*plus*, we have followed with a large scale experimentation performed using an air ducting system in which it is possible to perform simultaneous “dirtying” comparative tests of two different horizontal sections of ducts with the same quantity of air.

The requirements for a testing system needed for the comparative evaluation of the deposited particles are:

- possibility to simulate different working conditions and perform variable cycles;

- capability to simulate, for a sufficiently long section of duct, the changes in direction and section which are typical in an air duct;
- possibility to guarantee the same end conditions for the two horizontal test ducts and in particular, to be able to divide perfectly the air in the two final section of ducts;
- easy access to the final sections in order to perform the instrumental surveys.

The experimental system manufactured in this way has been used in order to perform two series

of tests: taking as reference the duct manufactured using the P3ductal *careplus* technology, we first of all performed a comparison with a standard P3ductal duct and then with a sheet metals duct.

The testing procedure was developed in order to maintain the highest level of reproducibility and was put on trial thanks to a series of preliminary tests.

In each testing phase, the velocity of the air at the exit was measured, in order to verify if the symmetrical air flow distribution. The time of each

The testing air duct system

The test air ducting system comprises a straight section of ventilating duct with a damper in order to regulate the air flow, an entry section intended for the entry for the entrance of the loading and dispersion of the dust particles, a section of the system (rising, horizontal, descending) with 90 degrees bends in order to simulate the air distribution and a two way diverging junction which divides the air flow in two equal horizontal test air ducts with open ends. The tests are performed simultaneously on both types of duct with the same section and length. A constant quantity of polyure-

thane powder is introduced at the base of the ventilating section and conveyed inside the air ducting system which thanks to the changes in direction, which generate turbulences in the air flow, helps the uniform distribution. At the end of the dust loading and ventilation the visual analysis at the exit of the duct is performed together with the removal of a sample with an adhesive pad and the suction of the dust particles deposited in the entrance and exit of the test duct along the bottom surface, thanks to the use of a vacuum pump with filter (NADCA Vacuum Test).





large scale test, insertion of the dust particles in the system.

phase is registered and maintained constant as also the quantity of dust particles used to dirty the ducts.

The air distribution system undergoes extensive cleaning after each test in order to avoid an excessive deposit of dust due to previous tests.

The test procedure consists in loading the circuit with a well defined quantity of polyurethane powder in a well define time.

Afterwards a working cycle is performed, characterized by a superior air flow to the one used during the dust loading but of the same time length. At the end of the cycle we wait for the dust still in suspension deposits on the surface of the ducts and then go and perform the analysis according to the UNI EN 15780 standard. For this phase of the experiment on the ducts manufactured using the P3ductal care^{plus} three tests for each analysis were performed in the following order:

1. Visual quality analysis (without a reference scale) of the internal surface of the duct high-

lighting the particle deposit thanks to the use of an ultraviolet light (Wood lamp);

2. Visual quantitative analysis (with a reference scale) of the internal surface of the duct performed thanks to the use of a adhesive pad, high definition photographic reproduction of the same and count, thanks to the use of a graphic analysis software, of the particle deposits on the surface.

3. Dust collected from the template positioned on the duct thanks to the use of a vacuum pump and subsequently filtered and evaluated thanks to a differential weighing scale.

These methods are characterized by different levels of accuracy and reliability.

The test results may vary according to the different testing methods which depend on the sample collection method and analysis.



large scale test, insertion of the dust particles in the system

Nevertheless, even if they have different levels of reliability, they are capable of providing an indication of the level of dirt which may be easily expressed in terms of percentage in the case of a comparative tests.

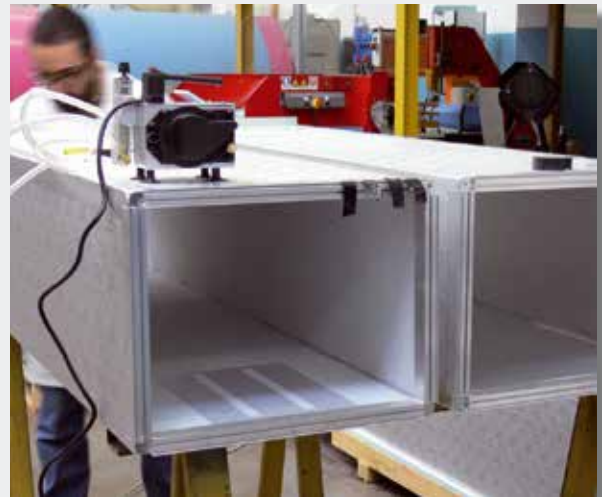
The analysis performed in the experimental air ducting system, performed according to the UNI

EN 15780 standard, used for the visual tests with reference scale, have demonstrated that the ducts manufactured using the P3ductal care^{plus} technology have a reduced deposit of particles on the surfaces of roughly 50% compared to a P3ductal standard duct and over 90% compared to that of a sheet metal duct.

NADCA Vacuum Test Phases



The sampling is performed according to the NADCA Vacuum Test



phase 1 duct section analysis after the “dirtying” phase



phase 2 particle sample taken of the deposit of dust inside the duct according to the NADCA Vacuum Test



phase 3 detail of the residual dirt taken from inside the sample of sheet metal duct



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Rapporto Tecnico DI01COMM12/01

Valutazione comparativa dei livelli di particolato solido all'interno di canali d'aria in conformità al metodo NADCA/HVCA (campionamento mediante aspirazione su filtro) della norma UNI EN 15780-2011, Appendice H

1. Premessa

Il presente rapporto tecnico riporta i risultati sperimentali relativi all'analisi comparativa dei depositi superficiali di particolato solido all'interno di canali d'aria, mediante prelievo di campioni con aspirazione su filtro, effettuati parallelamente all'interno di un circuito aeraulico di prova, su un tratto rettilineo di canale di riferimento (in pannelli sandwich costituiti da un componente isolante in poliuretano espanso rigido rivestito su entrambi i lati con lamine di alluminio, P3ductal indoor) e su un tratto rettilineo di un canale di comparazione (in pannelli sandwich costituiti da un componente isolante in poliuretano espanso rigido rivestito su entrambi i lati con lamine di alluminio e con rivestimento nanostrutturato a base di vetro liquido applicato sulle facce interne, P3ductal careplus).

Il campionamento è avvenuto mediante aspirazione su filtro in conformità al metodo NADCA/HVCA descritto nell'Appendice H della norma UNI EN 15780-2011.

2. Identificazione della prova e del componente analizzato

Richiedente:	P3 S.r.l., Via Salvo D'Acquisto, 5 - 35010 Villafranca Padovana - Loc. Ronchi, Padova (PD).
Produttore del componente analizzato:	P3 S.r.l., Via Salvo D'Acquisto, 5 - 35010 Villafranca Padovana - Loc. Ronchi, Padova (PD).
Fornitura ed installazione del componente analizzato:	Il componente in prova è stato fornito ed installato da P3 S.r.l.
Identificazione del componente analizzato:	Canale d'aria P3ductal careplus, realizzato con pannelli sandwich costituiti da un componente isolante in poliuretano espanso rigido rivestito su entrambi i lati con lamine di alluminio e con rivestimento nanostrutturato a base di vetro liquido applicato sulle facce interne.
Data e luogo della prova:	Il campionamento è stato eseguito in data 06/02/2013 presso gli stabilimenti P3 S.r.l.



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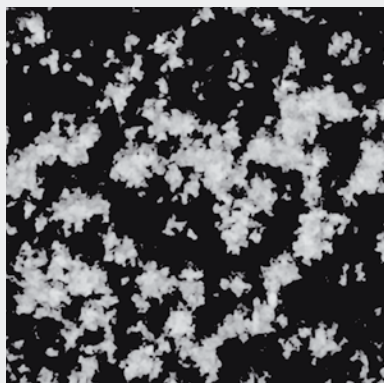
The large scale test: sheet metal, P3ductal standard, P3ductal careplus comparison

sheet metal duct

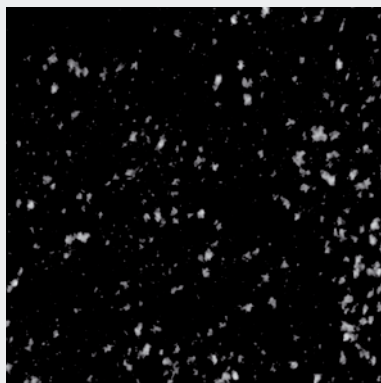
P3ductal standard duct

P3ductal careplus duct

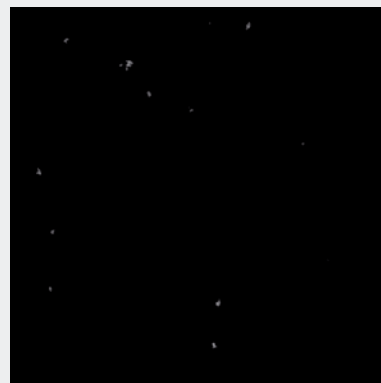
visual quantitative analysis
(taping test)



detail of the residual dirt "glued" to the tape after the taping test on the sheet metal duct



detail of the residual dirt "glued" to the tape after the taping test on the P3ductal standard duct.



detail of the residual dirt "glued" to the tape after the taping test on the P3ductal careplus duct

visual quality analysis
(Wood lamp)



detail of the residual dirt highlighted by the Wood lamp in the proximity of the corner of the sheet metal duct



detail of the residual dirt highlighted by the Wood lamp in the proximity of the corner of the P3ductal standard duct



detail of the residual dirt highlighted by the Wood lamp in the proximity of the corner of the P3ductal careplus duct


The solid particle reduction offered by the P3ductal careplus solution is of roughly

50%

compared to the P3ductal standard solution

90%

compared to the sheet metal solution



P3ductal *careplus*: life-span and safety

In order to be really effective, the self-cleaning treatment has to be granted through time, as to say has to withstand standard working conditions and maintenance of the duct. P3ductal *careplus* treatment withstand the abrasive effect of nylon brushes used for cleaning operations.

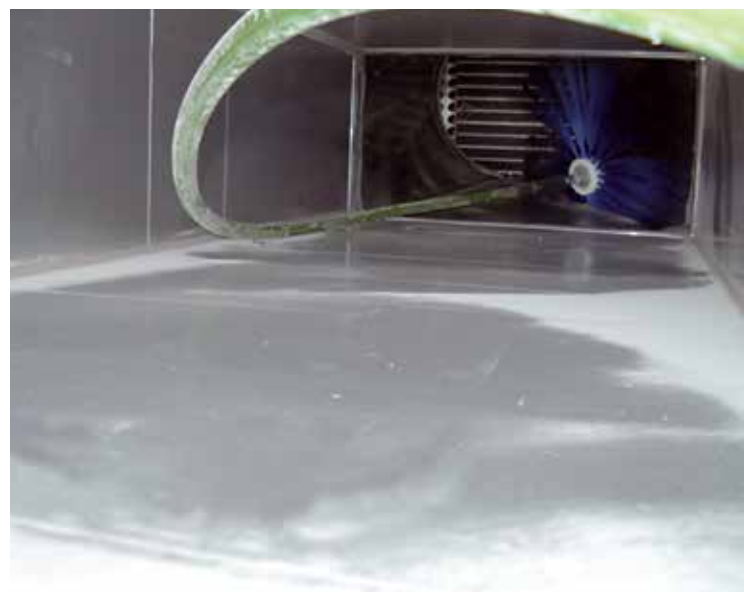
To be really effective, the “self-cleaning” treatment of P3ductal *careplus* has to guarantee its “durability”, as to say, the treatment has to be able to stick permanently to the metallic coating and grant a good resistance to normal scratching actions due to the maintenance and cleaning with brushes of the internal side of the duct.

To obtain a result able to fully satisfy these requirements, P3 started its research journey which led to the development of some hybrid formulas based on polymeric lacquers modified on a nanometric scale, in order to obtain a micro-texture surface able to recreate the “self-cleaning” behaviour and, at the same time, to grant a permanent adhesion to the support, and consequently,

the resistance to wearing of time.

From a safety point of view, the first thing which has to be evaluated is that the self-cleaning treatment is not harmful.

From this point of view, total reassurance arrives from the scientific literature available on the



subject, which identifies the silica gel, the basic component of the coating used for the solution P3ductal careplus, as a secure and biocompatible component, to the point that it is often used as a supplement and food additive in fruit juices. In addition, the P3ductalcareplus panel has been tested for food contact suitability.

Laboratory tests, conducted by measuring the global release and migration during contact with testing liquids, have given absolutely positive results.

Always from a safety point of view, we can not but consider also the normal fire evaluation parameters.

P3ductal careplus ducts maintain the high safety standards typical of the P3ductal product range. Also panels belonging to the P3ductal careplus solution ensure a low level of participation to fire, do not have any dropping effect and grant a reduced opacity and toxicity of fumes.

The safety of these ducts is confirmed by the excellent results obtained according to the strictest International standards. P3ductal panels have not only been tested according to the UNI 8457 (trigger flame) and UNI 9174 (flame and radiating panel) required by the Italian market (reaching the fire reaction class of 0-1, that makes them compliant to the requirements of the Ministerial Decree 31-3-2003), but also to the strict ISO 9705 – room corner test.

This test, which is the only one capable of reproducing a generalized fire of big dimensions, highlights the P3ductal char-

acteristics, which do not allow the propagation of fire, circumscribing the combustion only to the area which is directly hit by the flames and limiting the propagation of fumes and harmful gases in the duct.

P3ductal panels guarantee the Euro Class B according to the EN 13501-1 standard.

In consideration of the fact that the majority of injuries and casualties in the event of a fire are due to the propagation of combustion fumes, consultants have duly considered also this issue.

P3ductal ducts have been tested according to the big-scale test defined by the norm prEN 50399-2-1/1 and according to the AFNOR NF F 16-101 standard, obtaining the prestigious F1 class.

CHELAB	
RAPPORTO DI PROVA 12/000410981	
data di emissione 12/12/2012	
Codice intestatario	0010508
Spett.le P3 PREINSULATED PANELS SYSTEMS SRL VIA DON G. CORTESE, 5 - RONCHI 35010 VILLAFRANCA PADOVANA (PD) IT	
Dati campione	
Numero di accettazione	12.049470.0001
Consegnato da	GLS General Logistics Systems il 12/10/2012
Data ricevimento	12/10/2012
Proveniente da	P3 PREINSULATED PANELS SYSTEMS SRL VIA DON G. CORTESE, 5 - RONCHI 35010 VILLAFRANCA PADOVANA (PD) IT
Descrizione campione	P3DUCTAL CAREPLUS
Dati campionamento	
Campionato da	Cliente
Pareri ed interpretazioni	
Riga (12.25.37): gli esiti analitici risultano CONFORMI ai riferimenti indicati. Il giudizio di idoneità alimentare del campione è subordinato alla validazione dell'esito di tutte le prove condotte a questo scopo. Pertanto è possibile ritenere che il materiale, nelle condizioni testate, sia idoneo a venire a contatto con gli alimenti simulati dai liquidi di creazione per i quali sia le prove di migrazione globale che specifiche, eventualmente condotte, hanno dato esito conforme. Si sottolinea che l'idoneità alimentare è da considerarsi valida purché i materiali, gli additivi ed i coadiuvanti tecnologici impiegati siano ammessi dalla legislazione vigente, gli eventuali limiti di migrazione globale e specifica siano rispettati e siano ottemperati i requisiti stabiliti dai Regolamenti CE 1925/2004 e CE 2023/2006.	
Modello: T10/50 rev. 4	
Documento con firma digitale avanzata ai sensi della normativa vigente.	
I risultati contenuti nel presente Rapporto di prova si riferiscono esclusivamente al campione oggetto di analisi. Il presente Rapporto di prova non può essere riprodotto parzialmente, senza autorizzazione scritta di Chelab.	
Sede legale ed amministrativa: 37123 Reseghetti - Via Fratte 25 - Tel. 0423.71177 (5 linee r.a.) - Fax 0423.711090 - codice fiscale e p.iva e reg. imprese n. 01505803209 i.a.s. iscritta n. 158079 - capitale sociale € 123.482,00 interamente versato - R&D: Irene Chelab - e-mail: info@chelab.it	

Test report food approval P3ductal panel careplus

A photograph of surgeons in an operating room, wearing blue scrubs, masks, and hairnets. One surgeon in the foreground is wearing a head-mounted display. The background shows medical equipment and other staff.

P3ductal *careplus*: a self-cleaning and antimicrobial panel

To ensure the maximum air quality, the “self-cleaning” solution is not enough. The optimal result is obtained by combining the efficiency of this new solution with the positive effects of the P3ductal care solution with antimicrobial treatment.

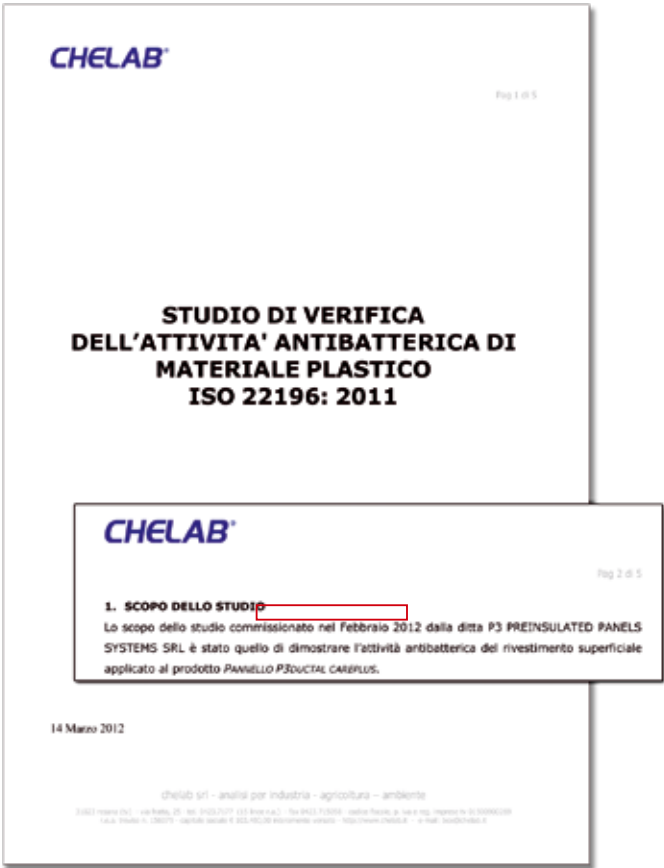
The special liquid glass nano-structured coating facilitates the removal of solid particles laying on the internal side of ducts, reducing, at the same time, the nesting of pathogen microorganisms.

The “cleanliness” of the surface is therefore an extra element able to favour the already proven efficacy of the P3ductal care solution, thus creating an environment which is certainly even more hostile to the proliferation of bacteria and other contaminant agents which are potentially harmful for the health.

Antimicrobial efficacy of the P3ductal *careplus* solution

- > Escherichia coli
- > Staphylococcus aureus
- > Legionella Pneumophyla
- > Klebsiella pneumoniae
- > Micrococcus luteus
- > Proteus vulgaris
- > Streptococcus faecalis
- > Salmonella
- > Trichophyton mentagrophytes

Laboratory tests performed on aluminium samples treated with this new coating have given very positive results, confirming a big scale antimicrobial activity, which continues also after accelerated ageing tests, performed by simulating 20 cleaning processes with nylon brushes as required by UNI EN 13403.



P3ductal careplus duct antibacterial activity study

Antibacterial Activity (incubation 24 h at 35 °C)		Untreated Sample	P3ductal careplus panel**	Brushed P3ductal careplus**
Escherichia coli ATCC 8739	UFC/surface	616600	17.4	<1
	Log UFC/surface	5.79	1.24	<1
	R	/	4.55	5.79
Staphylococcus aureus ATCC 6538P	UFC/surface	114	<1	<1
	Log UFC/surface	2.06	<1	<1
	R	/	2.06	2.06

Summary data ISO 22196:2011 “number of viral bacteria recovered from the surface after 24 hours of incubation at 35 °C and the value of R for the samples object of essay



Functional advantages

Having seen the innovative and peculiar characteristics of P3ductal careplus, the operational advantages may be summarized in a cleaning action of the treated surfaces due to the simple movement of the sections of ducts during the installation phases and during the passage of air, even in the start-up phase.

Thanks to the ground-breaking characteristics offered by P3ductal careplus, and in particular to the revolutionary nano-structured liquid glass coating which is capable of reducing in total safety, thanks to the so-called lotus effect, the possible accumulation of dust and solid particles, the following effects may be found:

- A cleaning action of the treated surface due to the simple movement of the duct sections during the installation and the passing of the air, especially during the start-up phase;
- Simple maintenance and cleaning operations;
- Increased antimicrobial efficacy.

**Self-cleaning effect
guaranteed by
P3ductal careplus**

**Removal of
particle deposits**

Movement of duct sections

Initial start-up testing

Flush-out Phase (LEED - IAQ management plant)



P3ductal careplus: the real effects on the job site

The guaranteed advantages of the P3ductal careplus ensure a prompt and innovative response to the design and operational requirements of a modern day Installation. The self-cleaning effect represents, today, one of the most important criteria in the choice of an air duct.

50% and 90% do not represent today just numbers emerged from experimental tests conducted in a scientific way in the laboratory.

The solid particles reduction offered by the P3ductal careplus solution, constitutes in the current state, one of the most appreciated technical advantages by designers, installers and duct makers.

The numerous references testify the growing appreciation towards a solution that, by itself, is able to

respond promptly and effectively to a fundamental parameter such as that of the cleanliness and hygiene of the air.

By analyzing the actual situations of real job sites (in the following pages we present some Case Studies made by analyzing the deposits of dirt and dust inside stored sections of ducts) you are able to see in a tangible and unequivocal way the operational advantage of P3ductal careplus.

Where to use P3ductal careplus

- > Operating theatres
- > Hospitals
- > Clinics
- > Laboratories
- > Clean rooms
- > Food industries
- > Environments with large crowds which require a very high quality of the air

Villa Maria Cecilia - Cotignola (Ravenna)

Type: hospital

Duct: P3ductal careplus



Detail of the dust deposited inside a galvanized sheet metal duct stored in a job site



Detail of the dust deposited inside a smooth indoor P3ductal duct stored in a job site



Detail of the dust deposited inside a careplus P3ductal duct stored in a job site

La Maddalena Oncological Institute - Palermo

Type: hospital

Duct: P3ductal careplus



Detail of the dust deposited inside a care P3ductal duct stored in a job site



Detail of the dust deposited inside a careplus P3ductal duct stored in a job site

Torre EVA - Mestre (Venezia)

Type: commercial and clinical
structure

Duct: P3ductal careplus



Detail of the dust deposited inside a care P3ductal duct stored in a job site



Detail of the dust deposited inside a careplus P3ductal duct stored in a job site

Dr Schär Food processing plant

Type: Food processing plant

Duct: P3ductal careplus



Detail of the dust deposited inside a smooth indoor P3ductal duct stored in a job site



Detail of the dust deposited inside a careplus P3ductal duct stored in a job site



Major P3ductal care*plus* references

Hospitals and health care facilities

- > Ospedale S. Carlo di Nancy - Roma
- > Presidio ospedaliero Monaldi - Napoli
- > Presidio Ospedaliero S. Martino - Oristano
- > Istituto Figlie di San Camillo - Cremona
- > Ospedale Villa Maria di Cotignola - Ravenna
- > Ospedale Busonera di Padova
- > Ospedale di Correggio - Reggio Emilia
- > Ospedale La Maddalena - Palermo
- > Presidio Ospedaliero Valdese - Torino
- > Polo Ospedaliero Oftalmico C.Sperino - Torino
- > Ospedale S. Chiara - rep. pediatria - Trento
- > Clinica S. Lucia - San Giuseppe Vesuviano - Napoli
- > Ospedali Riuniti - Foggia
- > Presidio Ospedaliero Vito Fazzi - Lecce
- > Ospedale Giovanni XXIII - Bari
- > Clinica Villa Lucia Hospital - Conversano - Bari
- > Presidio Ospedaliero Santa Maria del Carmine - Rovereto - Trento
- > Kiaat Hospital – Nelspruit - Sud Africa
- > Mthatha Hospital – Durban - Sud Africa
- > Ospedale dei Bambini, San José - Costa Rica
- > Ospedale R. A. Calderón Guardia, San José - Costa Rica
- > Ospedale Fernando Escalante Pradilla, Pérez Zeledón - Costa Rica
- > Ospedale México, San José - Costa Rica
- > Ospedale di Alajuela, Alajuela - Costa Rica

Trade, services and industry

- > Stabilimento Dr Schär - Bolzano
- > Esselunga - Trento
- > Auditorium di Foligno - Perugia
- > Torre Eva - Venezia
- > Sede Motorizzazione Civile - Pordenone
- > Laboratori Humanitas - Cascina Perseghetto di Rozzano - Milano
- > Banca Popolare - Ravenna
- > Pastificio Novella - Sori - Genova
- > Hotel Residence Oleandri - Paestum - Salerno
- > Vodafone Village Palazzina Uffici - Milano
- > Industria farmaceutica Biothera - Algeria
- > Industria farmaceutica Janis Media - Algeria
- > Caja Costarricense de Seguro Social Sede Antico, San José - Costa Rica

P3ductal careplus: product range and specification guidelines

The product range: panels



15HL21PLUS

Piral HD Hydrotec panel with self cleaning and antimicrobial treatment on the smooth aluminium side

- panel thickness 20,5 mm
- aluminium embossed/smooth 80µm/80µm



15HN21PLUS

Piral HD Hydrotec panel with self cleaning and antimicrobial treatment on the smooth aluminium side

- panel thickness 20,5 mm
- aluminium embossed/smooth 80µm/ 200µm



150L31PLUS

Piral HD Hydrotec panel with self cleaning and antimicrobial treatment on the smooth aluminium side

- panel thickness 30,5 mm
- aluminium embossed/smooth 200µm/80µm



15HR31PLUS

Piral HD Hydrotec panel with self cleaning and antimicrobial treatment on the smooth aluminium side

- panel thickness 30,5 mm
- aluminium embossed/smooth 200µm/200µm

The product range: accessories



In order to guarantee the highest level of air quality a wide range of accessories are available (flanges, profiles, deflectors, disks, reinforcement bars, etc) with antimicrobial treatment

The product range: flexible hoses



In order to guarantee the highest level of air quality a wide range of flexible hoses with antimicrobial treatment are available

Pre-insulated aluminium ducts for the air thermo-ventilation and air conditioning will have to be manufactured using eco-compatible sandwich panels of the P3ductal careplus line like the **PIRAL HD HYDROTEC PANEL WITH SELF-CLEANING AND ANTIMICROBIAL TREATMENT**. This panel with the lotus effect, is capable of reducing the possible formation of dust or solid particles and to simplify, consequently, the normal maintenance and cleaning operations of the ducts as foreseen by the “guidelines draft in air conditioning systems predictive maintenance technical protocols” published by the Italian Health ministry in the Official Gazette on the 3rd of November 2006 and foreseen by the UNI EN 15780 Standard Ventilation for buildings – Ductwork – Cleanliness of Ventilation System. The panel has the following properties:

- **Panel thickness:** 20.5 mm;
- **External aluminium:** 0.08 mm thick, embossed and protected with polyester lacquer;
- **Internal aluminium:** 0.08 mm thick, smooth and with self-cleaning and antimicrobial treatment;
- **Self-cleaning treatment:** nanostructured coating based on liquid glass;
- **Efficacy of the self cleaning effect:** verified thanks to large scale testing in collaboration with a University Department;
- **Initial thermal conductivity:** 0.022 W/(m °C) at 10 °C;
- **Insulating material density:** 50-54 kg/m³;
- **Insulating material:** polyurethane which has been expanded with the use of only water and not with CFC, HCFC, HFC or HC gasses;
- **Insulation expanding agent:** ODP (ozone depletion potential) = 0 and GWP (global warming potential) = 0;
- **% closed cells:** > 95% according to ISO 4590;
- **Rigidity class:** R 200,000 according to UNI EN 13403;
- **Fire reaction class:** 0-1 according to Italian ministerial decree (D.M.) 26/06/84;
- **Fire reaction class:** B according to European Standard EN 13501-1;
- **Fire reaction class:** approved according to the ISO 9705 standard (Room corner test);
- **Smoke toxicity and opacity:** class F1 according to NF F 16-101;
- **Smoke toxicity:** FED and FEC < 0.3 according to prEN 50399-2-1/1;
- **Smoke toxicity:** below 6.7 according to the British Naval Engineering Standard NES 713;
- **Efficacy of antibacterial active principle:** verified in conformity with standard ISO 22196 by an Italian Ministry of Health accredited laboratory.

Ducts will have to be manufactured to P3ductal standards and in conformity with the UNI EN 13403 standard. The ducts will have to be manufactured using accessories with antimicrobial treatment.

FLANGING

The individual lengths of ducting will be joined together by means of special “invisible” flanges with hidden bayonet connections, providing a suitable airtight and mechanical seal to meet the requirements of standard UNI EN 13403. The maximum length of each section of duct will be 4 metres.

REINFORCEMENTS

Where necessary, the ducts will be fitted with special reinforcement bars in order to provide further mechanical strength during operation. Said reinforcements will be calculated using the manufacturer's charts. The maximum deflection of the sides of the duct must not exceed 3% or in any case 30 mm, as laid down in standard UNI EN 13403.

TURNING VANES & SPLITTERS

All rectangular elbows must be fitted with special turning vanes; the large circular elbows will be fitted with splitters in order to meet the requirements of standard UNI EN 1505.

SUPPORTS

Ducts will be supported by special brackets at intervals which should not exceed 4 metres if the widest side of the duct is less than 1 metre, and at intervals which should not exceed 2 metres if the widest side of the duct is more than 1 metre. Accessories, such as: volume dampers, fire dampers, diffusers, in-duct heating coils etc. will be supported independently so that the ducts do not have to support their weight.

INSPECTION

Ducts will be fitted with special control points for airflow sensors and doors for inspection and cleaning set at intervals along the ducts as laid down by standard EN 12097 and by the “Guidelines published in the Italian Official Gazette dated 3/11/2006 relating to ventilation system maintenance”. Doors may be made using the same type of sandwich panel used to produce the ducting, in conjunction with the relevant profiles. Doors will be fitted with seals in order to provide the required airtight seal. Alternatively, P3ductal inspection hatches may be used.

AHU CONNECTION

Connections between air handling units and ducting will be performed by means of special antivibration joints in order to isolate them from vibrations. Ducts will be supported independently in order to prevent that the weight of the ducts be transferred to the flexible fittings. Moreover, connection with the air handling unit will allow the unit to be uncoupled for system maintenance purposes. Should the antivibration joints be fitted outdoor, they will have to be waterproof.

Ducts installed outdoor will have to be manufactured using sandwich panels like the **PIRAL HD HYDROTEC PANEL WITH SELF-CLEANING AND ANTIMICROBIAL TREATMENT** with the following properties:

- **Panel thickness:** 30.5 mm;
- **External aluminium:** 0.2 mm thick, embossed and protected with polyester lacquer;
- **Internal aluminium:** 0.08 mm thick, smooth and with self-cleaning and antimicrobial treatment;
- **Self-cleaning treatment:** nanostructured coating based on liquid glass;
- **Efficacy of the self cleaning effect:** verified thanks to large scale testing in collaboration with a University Department;
- **Initial thermal conductivity:** 0.022 W/(m °C) at 10 °C;
- **Insulating material density:** 46-50 kg/m³;
- **Insulating material:** polyurethane which has been expanded with the use of only water and not with CFC, HCFC, HFC or HC gasses;
- **Insulation expanding agent:** ODP (ozone depletion potential) = 0 and GWP (global warming potential) = 0;
- **% closed cells:** > 95% according to ISO 4590;
- **Rigidity class:** R 900,000 according to UNI EN 13403;
- **Fire reaction class:** 0-1 according to Italian ministerial decree (D.M.) 26/06/84;
- **Fire reaction class:** B according to European Standard EN 13501-1;
- **Efficacy of antibacterial active principle:** verified in conformity with standard ISO 22196 by an Italian Ministry of Health accredited laboratory.

Ducts will be protected once installed with a waterproofing Gum Skin resin. Bitumen-based compounds must not be used. It is advisable to apply strengthening gauze around flanging points. Ducts will be built to P3ductal standards and in conformity with standard UNI EN 13403. The ducts will have to be manufactured using accessories with antimicrobial treatment.

FLANGING

The individual lengths of ducting will be joined together by means of special “invisible” flanges with hidden bayonet connections, providing a suitable airtight and mechanical seal to meet the requirements of standard UNI EN 13403. The maximum length of each section of duct will be 4 metres.

REINFORCEMENTS

Where necessary, the ducts will be fitted with special reinforcement bars in order to provide further mechanical strength during operation. Said reinforcements will be calculated using the manufacturer's charts. The maximum deflection of the sides of the duct must not exceed 3% or in any case 30 mm, as laid down in standard UNI EN 13403.

SUPPORTS

The ducts will have to be supported every 2 meters, lifted from the ground with appropriate fasteners and will have to have a suitable slope in the horizontal portions in order to drain any water.

SNOW/WIND LOADS

Ducts must be also sized in order to bare the snow/wind loads as stated in the manufacturer's tables.

CONSTRUCTION SOLUTIONS

Should the ducts pass through the roof, they should be fitted at the end with “gooseneck” shaped bends in order to prevent water and/or snow from getting in. All external duct openings, like the exhaust outlets, external air intakes etc. will be fitted with special bird

Pre-insulated aluminium ducts for the air thermo-ventilation and air conditioning will have to be manufactured using eco-compatible sandwich panels of the P3ductal careplus line like the **PIRAL HD HYDROTEC PANEL WITH SELF-CLEANING AND ANTIMICROBIAL TREATMENT**. This panel with the lotus effect, is capable of reducing the possible formation of dust or solid particles and to simplify, consequently, the normal maintenance and cleaning operations of the ducts as foreseen by the “guidelines draft in air conditioning systems predictive maintenance technical protocols” published by the Italian Health ministry in the Official Gazette on the 3rd of November 2006 and foreseen by the UNI EN 15780 Standard Ventilation for buildings – Ductwork – Cleanliness of Ventilation System. The panel has the following properties:

- **Panel thickness:** 20.5 mm;
- **External aluminium:** 0.08 mm thick, embossed and protected with polyester lacquer;
- **Internal aluminium:** 0.2 mm thick, smooth and with self-cleaning and antimicrobial treatment;
- **Self-cleaning treatment:** nanostructured coating based on liquid glass;
- **Efficacy of the self cleaning effect:** verified thanks to large scale testing in collaboration with a University Department;
- **Initial thermal conductivity:** 0.022 W/(m °C) at 10 °C;
- **Insulating material density:** 50-54 kg/m³;
- **Insulating material:** polyurethane which has been expanded with the use of only water and not with CFC, HCFC, HFC or HC gasses;
- **Insulation expanding agent:** ODP (ozone depletion potential) = 0 and GWP (global warming potential) = 0;
- **% closed cells:** > 95% according to ISO 4590;
- **Rigidity class:** R 200,000 according to UNI EN 13403;
- **Fire reaction class:** 0-1 according to Italian ministerial decree (D.M.) 26/06/84;
- **Fire reaction class:** B according to European Standard EN 13501-1;
- **Fire reaction class:** approved according to the ISO 9705 standard (Room corner test);
- **Smoke toxicity and opacity:** class F1 according to NF F 16-101;
- **Smoke toxicity:** FED and FEC < 0.3 according to prEN 50399-2-1/1;
- **Smoke toxicity:** below 6.7 according to the British Naval Engineering Standard NES 713;
- **Efficacy of antibacterial active principle:** verified in conformity with standard ISO 22196 by an Italian Ministry of Health accredited laboratory.

Ducts will have to be manufactured to P3ductal standards and in conformity with the UNI EN 13403 standard. The ducts will have to be manufactured using accessories with antimicrobial treatment.

FLANGING

The individual lengths of ducting will be joined together by means of special “invisible” flanges with hidden bayonet connections, providing a suitable airtight and mechanical seal to meet the requirements of standard UNI EN 13403. The maximum length of each section of duct will be 4 metres.

REINFORCEMENTS

Where necessary, the ducts will be fitted with special reinforcement bars in order to provide further mechanical strength during operation. Said reinforcements will be calculated using the manufacturer's charts. The maximum deflection of the sides of the duct must not exceed 3% or in any case 30 mm, as laid down in standard UNI EN 13403.

TURNING VANES & SPLITTERS

All rectangular elbows must be fitted with special turning vanes; the large circular elbows will be fitted with splitters in order to meet the requirements of standard UNI EN 1505.

SUPPORTS

Ducts will be supported by special brackets at intervals which should not exceed 4 metres if the widest side of the duct is less than 1 metre, and at intervals which should not exceed 2 metres if the widest side of the duct is more than 1 metre. Accessories, such as: volume dampers, fire dampers, diffusers, in-duct heating coils etc. will be supported independently so that the ducts do not have to support their weight.

INSPECTION

Ducts will be fitted with special control points for airflow sensors and doors for inspection and cleaning set at intervals along the ducts as laid down by standard EN 12097 and by the “Guidelines published in the Italian Official Gazette dated 3/11/2006 relating to ventilation system maintenance”. Doors may be made using the same type of sandwich panel used to produce the ducting, in conjunction with the relevant profiles. Doors will be fitted with seals in order to provide the required airtight seal. Alternatively, P3ductal inspection hatches may be used.

AHU CONNECTION

Connections between air handling units and ducting will be performed by means of special antivibration joints in order to isolate them from vibrations. Ducts will be supported independently in order to prevent that the weight of the ducts be transferred to the flexible fittings. Moreover, connection with the air handling unit will allow the unit to be uncoupled for system maintenance purposes. Should the antivibration joints be fitted outdoor, they will have to be waterproof.

Ducts installed outdoor will have to be manufactured using sandwich panels like the **PIRAL HD HYDROTEC PANEL WITH SELF-CLEANING AND ANTIMICROBIAL TREATMENT** with the following properties:

- **Panel thickness:** 30.5 mm;
- **External aluminium:** 0.2 mm thick, embossed and protected with polyester lacquer;
- **Internal aluminium:** 0.2 mm thick, smooth and with self-cleaning and antimicrobial treatment;
- **Self-cleaning treatment:** nanostructured coating based on liquid glass;
- **Efficacy of the self cleaning effect:** verified thanks to large scale testing in collaboration with a University Department;
- **Initial thermal conductivity:** 0.022 W/(m °C) at 10 °C;
- **Insulating material density:** 46-50 kg/m³;
- **Insulating material:** polyurethane which has been expanded with the use of only water and not with CFC, HCFC, HFC or HC gasses;
- **Insulation expanding agent:** ODP (ozone depletion potential) = 0 and GWP (global warming potential) = 0;
- **% closed cells:** > 95% according to ISO 4590;
- **Rigidity class:** R 900,000 according to UNI EN 13403;
- **Fire reaction class:** 0-1 according to Italian ministerial decree (D.M.) 26/06/84;
- **Fire reaction class:** B according to European Standard EN 13501-1;
- **Efficacy of antibacterial active principle:** verified in conformity with standard ISO 22196 by an Italian Ministry of Health accredited laboratory.

Ducts will be protected once installed with a waterproofing Gum Skin resin. Bitumen-based compounds must not be used. It is advisable to apply strengthening gauze around flanging points. Ducts will be built to P3ductal standards and in conformity with standard UNI EN 13403. The ducts will have to be manufactured using accessories with antimicrobial treatment.

FLANGING

The individual lengths of ducting will be joined together by means of special “invisible” flanges with hidden bayonet connections, providing a suitable airtight and mechanical seal to meet the requirements of standard UNI EN 13403. The maximum length of each section of duct will be 4 metres.

REINFORCEMENTS

Where necessary, the ducts will be fitted with special reinforcement bars in order to provide further mechanical strength during operation. Said reinforcements will be calculated using the manufacturer's charts. The maximum deflection of the sides of the duct must not exceed 3% or in any case 30 mm, as laid down in standard UNI EN 13403.

SUPPORTS

The ducts will have to be supported every 2 meters, lifted from the ground with appropriate fasteners and will have to have a suitable slope in the horizontal portions in order to drain any water.

SNOW/WIND LOADS

Ducts must be also sized in order to bare the snow/wind loads as stated in the manufacturer's tables.

CONSTRUCTION SOLUTIONS

Should the ducts pass through the roof, they should be fitted at the end with “gooseneck” shaped bends in order to prevent water and/or snow from getting in. All external duct openings, like the exhaust outlets, external air intakes etc. will be fitted with special bird grids.

P3ductal seven gears

 <p>P3ductal careplus easy cleaning high hygiene duct[al] system</p>	<p>very high hygiene applications with self cleaning and antimicrobial treatment</p>	
 <p>P3ductal care high hygiene applications duct[al] system</p>	<p>high hygiene applications with antimicrobial treatment</p>	
 <p>P3ductal indoor indoor applications duct[al] system</p>	<p>indoor applications</p>	
 <p>P3ductal outdoor outdoor applications duct[al] system</p>	<p>outdoor applications</p>	
 <p>P3ductal resistant aggressive applications duct[al] system</p>	<p>aggressive applications</p>	
 <p>P3ductal smart4 fast construction duct[al] system</p>	<p>low pressure applications</p>	
 <p>P3ductal smart8 fast construction duct[al] system</p>	<p>high aesthetics applications</p>	

P3ductal: one system, many advantages

» Eco-sustainability

- Water expansion of the polyurethane: patented Hydrotec technology
- LCA analysis (Life Cycle Assessment)
- EPD certification (Environmental Product Declaration)

» Maximum safety in case of fire

- Fire reaction class B according to ISO EN 13501- 1
- Positive outcome according to ISO 9705 Room Corner Test
- Class F1 according to AFNOR NF F 16-101 for the combustion fumes
- Low toxicity of the fumes (FED and FEC <0.3 according to prEN = PREN 50399-2 -1/1)

» High level of security in the event of an earthquake

- High lightness
- High flexural rigidity
- High damping value

» Excellent air seal

- Exclusive invisible flanging system
- Elimination of the longitudinal leaks and reduction of the leaks in the transverse joints
- Air seal Class "C" according to UNI EN 13403

» Thermal insulation

- Continuous and constant in all the duct
- Low thermal conductivity
- Elimination of condensation problems

» High energy saving

- The P3ductal ducts guarantee from a LCC (Life Cycle Costing) analysis an important reduction of the operational energy costs

» Hygiene and air quality

- Maximum hygiene and cleanliness
- Aluminium as inner surface of the ducts
- Solution available with self-cleaning and antimicrobial treatment

» Lightness

- Maximum Lightweight
- Reduction of the load on the supporting structure and on the bracketing points
- Reduction of the installation labour time

» Silent

- Good acoustic behaviour
- Reduction of vibrations and resonance
- Maximum environmental comfort

» Duration

- Strength, rigidity and good resistance to corrosion, erosion and deformation, even in particular applications

» Easy construction

- Possibility to build ducts in the factory or directly at the job site with a significant reduction in the transportation costs

For more than 3 generations we have been working in the air distribution ducts field.

Today P3 is part of an, **ever increasing international group, whose mission is the promotion of the P3ductal preinsulated aluminium duct with the aim of maintaining it as the most important reality in the air distribution ducts market.**

P3 has renewed the construction system of traditional galvanised sheet metal ducts, by developing the **P3ductal technology which makes use of preinsulated aluminium panels and creating the accessories, tools and machinery intended for the construction and installation of air distribution ducts.**

The P3ductal system is produced in various plants

around the world, distributed in more than 80 countries and can count on a **widespread sales network, able to give the required support to all its customers and consultants.**

P3's strong points are represented by the **constant research in order to improve the quality of its products. Thanks to the continuous commitment and innovation of its internal laboratories** which cooperate in close relationship with various University Research Centres, P3 is able to offer vanguard performances and technologically advanced materials.

Since 1996 P3 has been working under a certified management system according to the UNI EN ISO 9001, 14001, 18001, 50001, 10014 standards.





The air, for P3 a mission from over 50 years



P3 srl unipersonale

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**ISO 9001
ISO 10014
ISO 14001
OHSAS 18001
ISO 50001**