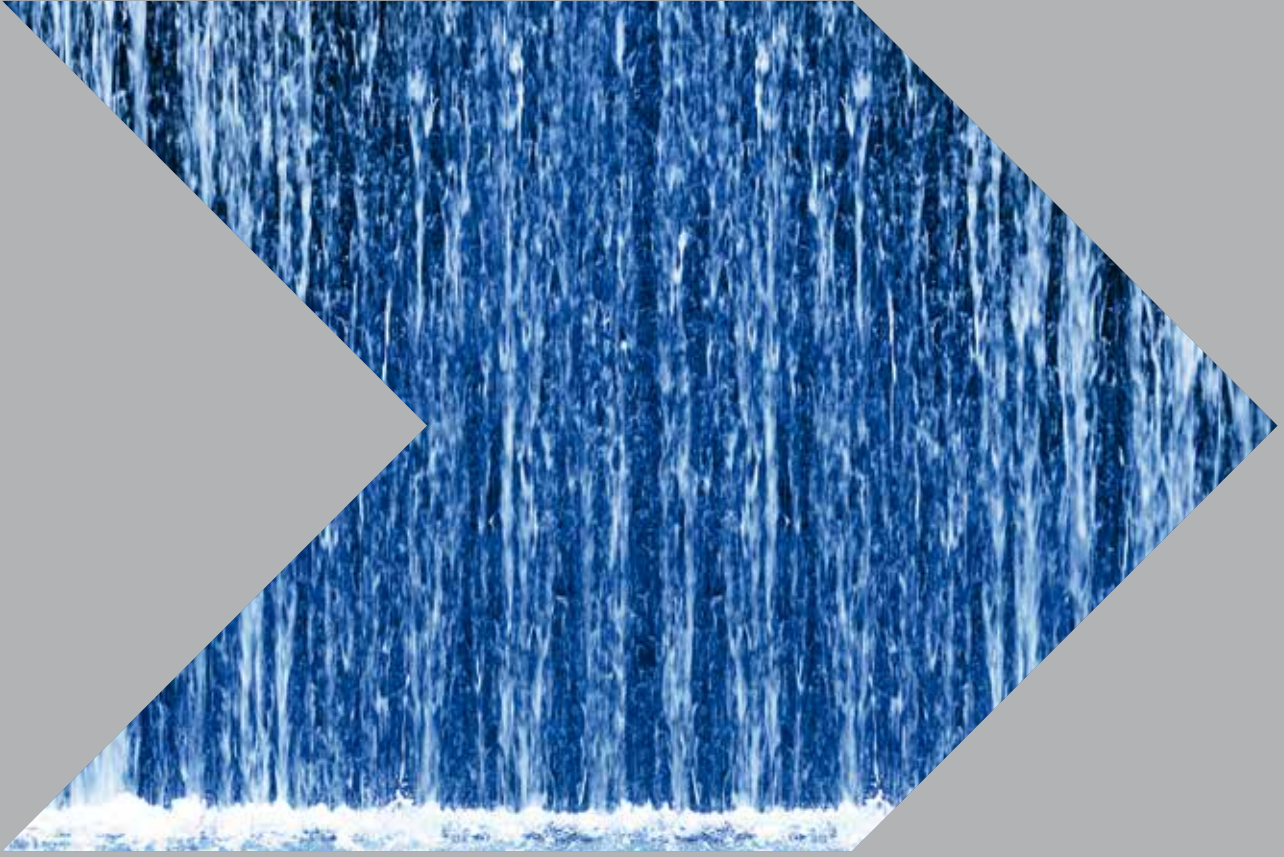


PACO FILTRENERGY

The Boost in Performance
and Profit





Because the need
for clarity increases
– qualitatively and quantitatively

Filtration and separation – rooted in nature

To better understand the process of filtration and separation it is worth taking a look at nature around us. Even more insight can be gained by investigating the natural sciences of biology, physics and chemistry. Take, for example, the spider. In principle, this filters from the air the insects that it wants to feed on. Or our ground water: the force of gravity causes precipitation to flow through various layers of soil to emerge crystal clear from a spring or other source. With osmosis, the separation process is even finer, where molecules from a solvent such as water move through a semi-permeable membrane into a region of higher solute concentration. In a number of areas, technology has closely examined and benefited from the filtering and separation processes that occur in nature.

From technology to a multidisciplinary approach

Techniques emanating from a truly multidisciplinary approach make an extremely valuable contribution to advances in research, development and engineering. Filtration and separation are without doubt one of the key technological capabilities used across a wide range of industries. The removal of unwanted elements from fluids and gases or the prevention of ingress of the former into the latter is an integral part of most production cycles and processes. The requirement for clarity is on the increase from a qualitative aspect as well as in an ever increasing number of applications. Our familiarity with filtering procedures in our everyday lives – from filter coffee through to the oil filter for the car – tends to cloud our view of the extreme technical complexity of filtration and separation processes. But there is absolutely no reason for our underestimation – in fact, quite the opposite is the case!

PACO: the (P)Alpha to the (C)Omega of filtration

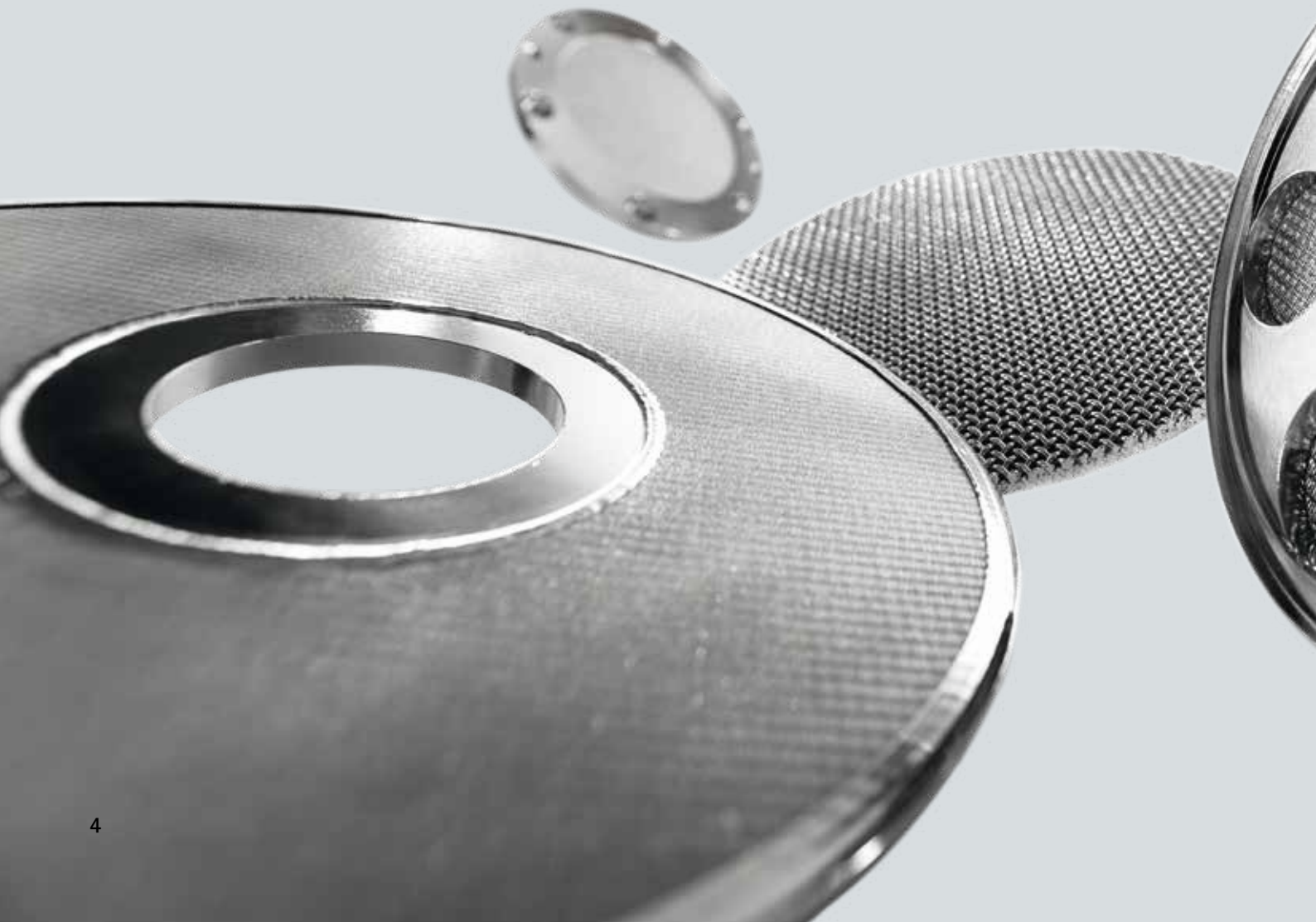
In the same way that some people were seemingly born to do a specific job, PACO was meant to be the specialist for filtration and separation. This, of course, is first and foremost down to the people that have established and developed the company. And their total commitment to finding out and providing all that is needed for success in their chosen field. In the case of PACO, this is filtration and separation and the inherently needed insight into material usage, engineering ability, process expertise, optimization of experience and constant investment in research and development. This is the only way of maintaining its position as a leading specialist – from Alpha to Omega as well as from PA to CO.

Our filter cake is know how.
Superior solutions are the filtrate



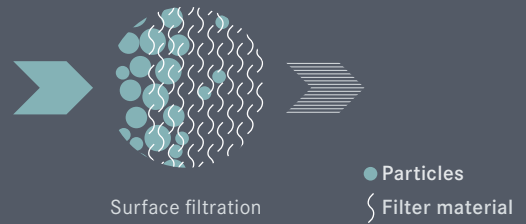
One principle – many options

In principle, it always works the same way: the fluid or gas has to pass through a permeable solid – the filter. But the players involved couldn't be more different. On one hand, the fluids or gases have completely different properties. And on the other hand, extremely different demands are placed on the results of the filtration or separation process. On top of this, various approaches can be chosen, such as surface or depth filtration as well as application-specific filter media.



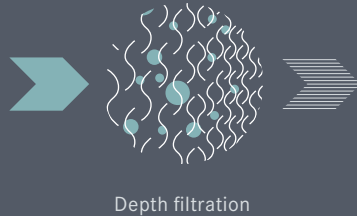
Surface filtration

Retention of particles on the surface of the filter medium. The separated particles are larger than the pores of the filter cloth so that they gradually form the filter cake. This can be used as an additional filter element for the filtering out of particles with a diameter that is smaller than the pore size. The filter cake can be removed in the course of a filter regeneration.



Depth filtration

Depth filtration is a process that uses multilayer filter media (e.g. PACOPLATE, PACOFIL®). The gas or fluid that is being filtered flows indirectly through the filter material, whereby the solid particles are trapped in all of the openings in the various layers of the filter cloth right down to the lower lying layers. Regeneration occurs through backwashing.



Ideal basis for first-class solutions

For decades, PACO has been one of the global leaders in the metal wire cloth market. Throughout all the industries that we serve, there is a strong demand for the outstanding high quality of PACO products – from high-grade materials through unequalled precision to systematically assured quality. With these features as basis, the cloths are then upgraded through leading-edge filter production techniques.

To remain in the picture

When filtering, a lot of material gets collected. With surface filtration, this is known as filter cake. In the case of PACO we call this know how. And the result of this process is the filtrate – whether it be the clearly advantageous solution for a specific application or a ground-breaking innovation. Being a pioneer, doesn't mean looking at your success in the past, but is rather the capability to keep on performing now and on into the future.

From application to success story through extra commitment

PACO Filtration and Separation: all down to more energy!

When the best compete for customer orders, there is always the question of what makes the difference: what gives one supplier the upper hand over another supplier? Often there is the impression that everything is very much of a muchness so that price alone decides who gets the business. But it is not really that easy. Something that we totally agree with. After all, our customers confirm to us that, beyond all rational comparisons, it is our identification with their application needs that impresses them. And this is what gives us the edge: the extra energy that we put into the development and implementation of our solutions.

The PACO difference gives the extra energy that we put into the development and implementation of our solutions.





Experience plus creativity plus technical support

Energy has to be directed into the right channels to provide the best possible solution. This means that each request automatically triggers a screening of our previous cases to see if we have already gained experience under similar circumstances. The probability of coming up with something useful is extremely high. Decades of competition at the highest level means that we have already penetrated into nearly every industry and process for filtration and separation. When the problem has been clearly recognized, experience will help us to quickly find the ideal solution. To ensure that this gives our customer the edge by bringing savings and other benefits, the creativity of our engineers and technicians comes into play. Where necessary, test runs in our technology centre or at the user's site are also included. Our technical support completes our energy output – far beyond the completion of the order.

Filtrenergy: full steam ahead for our customers!

Where does the capability of giving that extra bit of commitment to our customers, their problems and their needs come from? This is definitely a question of our mentality and corporate identity. As a family company going back a number of generations, PACO knows a lot about the need for solidarity and partnership. This is not something that management consultants have had to tell us about, because it has been an essential part of the character of our company since it was founded over 60 years ago. And the fact that our customers particularly emphasize our commitment is the best proof of this.

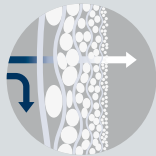
The everywhere and every time filtering solution

Filtration and separation – worlds in their own right

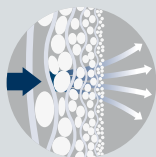
The process-related and economic importance of filtration and separation procedures cannot be overestimated. They are an integral part of most industrial processes. On top of this they play an essential part in areas which are vital for people and the environment. Without, for example, their cleansing, purifying, quality assuring, separating and protective capabilities, it would be impossible for us to have the quality of life and work that we completely take for granted now. If filtration and separation is of such great importance, isn't it logical that its implementation and further development should be carried out with an extremely high level of quality. This is the PACO way of thinking. That is why PACO filtration and separation solutions fulfil extremely high demands respecting functionality, safety and economic efficiency.



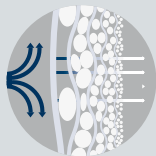
Functional variety – just as needed



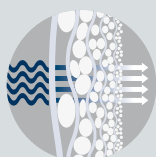
Filtering and separating



Distribution

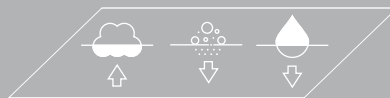


Reducing and checking



Calming





All that is involved

The PACO range of metal wire cloths, laminates, filter elements from candles through baskets to spin packs, as well as filter systems and complete solutions up to fully automated systems is as extensive as the variety of demands and applications in filtration and separation itself. This comprehensive range of products that is now available has been built up on the basis of the entrepreneurial vision of the company founders, our own research and development and the variety of tasks that have been assigned to PACO. Today a tremendous wealth of experience and a universal store of specialist knowledge ensure that a top level capability of providing solutions is available to give PACO customers the certainty of knowing that they have found the right partner.

Advantageous filtration and separation solutions through everything that is involved: perfect metal wire cloths and modules, extensive experience and the continuously renewable energy for innovations.

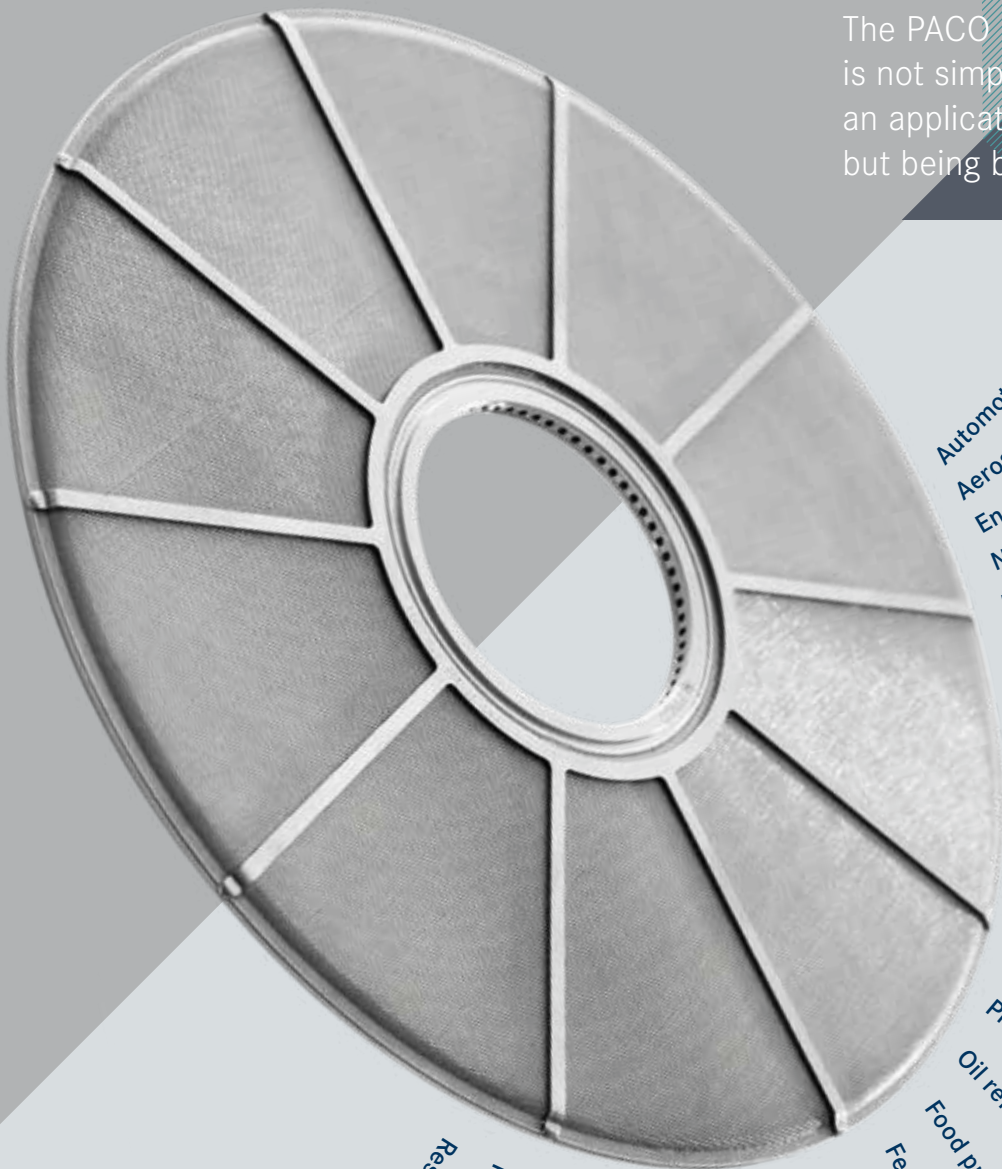
The future as a separator

As a specialist for filtration and separation, we know a lot about the filtering and separating needs of the future. This is where you will only find those suppliers that are capable of mastering the selection criteria of their markets and users. PACO most definitely ticks all the boxes here: identification with the customer's problem, the capability of product innovation, top-class engineering, high production quality and readiness for delivery, a systematic and certified quality management, and forward looking user support with the aim of a long-term working relationship. This means that we not only provide our customers with our products and services, but successfully pave the way for applying filtration and separation in the future.



Our specialist fields filtration & separation: the areas that we know best

The PACO principle is not simply being up to an application task but being beyond it.



- Automotive industry
- Aerospace
- Energy generation
- Nuclear engineering
- Equipment and mechanical engineering
- Heating, ventilation, climate control
- Biotechnology
- Medicine and dentistry
- Chemical industry
- Pharmaceuticals
- Mining
- Oil and gas production
- Process engineering and technology
- Oil refining / distillation
- Food production
- Feed industry
- Beverages industry
- Agriculture and forestry
- Building industry
- Environmental protection
- Water purification / recycling
- Waste management
- Printing and paper industry
- Research, science



Experience is good – expertise is better

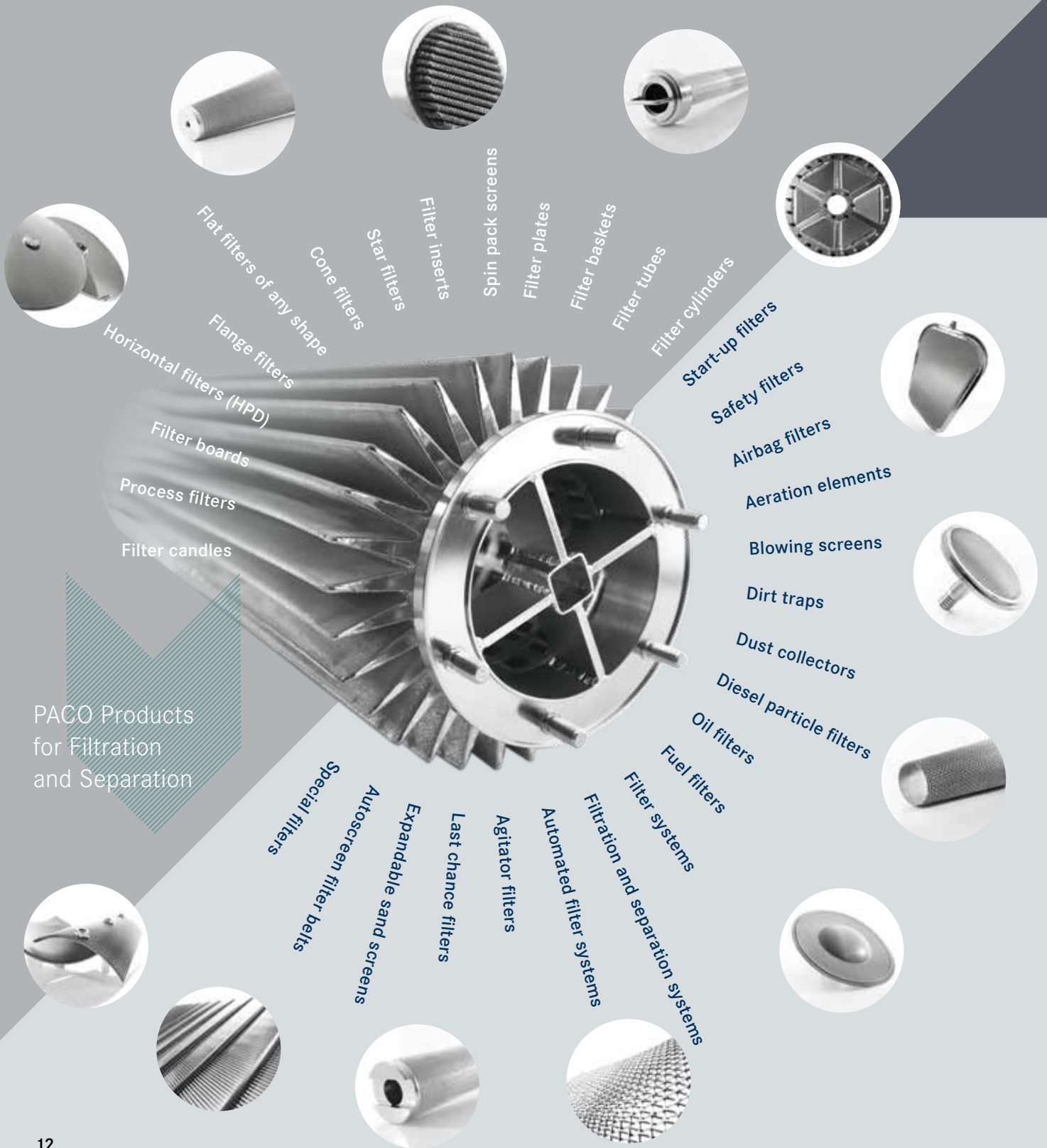
To give the user the sense of security that they need, it is not enough to simply provide a technical solution. Filtration and separation is often accompanied by high temperatures, enormous pressures or extreme physical or chemical loads. This is where an important PACO principle particularly applies: we don't want to simply be up to an application problem, we want to be way beyond it. That is why we collate all of the experience that we have gained through training, research and development as well as close cooperation with our customers and users as our expertise. Something that we can prove through the positive results of the auditing and certification procedures in sensitive areas such as nuclear technology or the automotive industry.

PACO expertise is also based on growth

In the same way that we as a company heavily invest in hardware ranging from new machines to production facilities; a large amount of commitment, ambition, and thirst for knowledge as well as technical and scientific work flows into the optimization of our expertise. That is why the large number of fields of expertise for filtration and separation that we have listed is by no

means complete. We are continually investigating ways of expanding or entering into new specialist fields that may open up in areas such as cleantech or alternative energies, biotechnology or space travel. This is primarily stimulated by the requests, application needs and challenges of our customers and other interested parties.

**Our instruments and products:
What we do to give our best**



PACO Products
for Filtration
and Separation



Countless unique solutions

It is in the nature of filtration and separation that the required solutions are always a bit more different and a bit more special if they are to provide optimum results. Each medium behaves differently, each process has different requirements, something completely different is expected from each filtrate. This means that we as a manufacturer of filter elements and separation solutions have to offer a broad portfolio of products for a great variety of needs. Our experience shows however that this is never enough, as new applications and specifications continually have to be added.



More comes from more

A wide range is the best possible proof that more is always possible. Particularly when you are called PACO. First of all there is such an accumulation of know how that this is sure to provide leads for further application wishes. And secondly much more is feasible for the developers, engineers and process technicians. With the result that technically innovative solutions, improved performance characteristics and optimum efficiency are provided. That is why it is always a recipe for success when PACO specialists start talking to experts from users or other interested parties. The determination to solve a problem on one side matches the commitment to continuously increase expertise on the other side.

The best solution is to always recognize that it is ideally suited to a specific application.

Hightech filtration for mobility in all dimensions

Since the invention of motorized mobility, the necessities and advantages of filtering, for example, fuel and exhaust gases have dynamically grown. PACO has gained extensive experience in the design and production of specialist filter elements and modules for use in all types of vehicles, powered by a multitude of technologies.

PACO for aerospace:

- > Kerosene filters
- Hydraulic filters
- > Gas retention devices
- > Special filters



PACO for motor vehicles

- > Fuel filters
- > Oil filters
- > Filter elements for parking heaters
- > Carburettor filters
- > Components for fuel injection systems
- > Air filters
- > Particle filters
- > Components for catalytic converters
- > Hydraulic filters



PACO for shipping:

- > Oil filters
- > Air filters
- > Particle filters
- > Hydraulic filters
- > Ventilation systems
- > Fire protection
- > Ballast water filtration
- > On-board sewage treatment plants



PACO for trams and trains:

- > Oil filters
- > Hydraulic filters
- > Diesel soot filters
- > Air filters and air conditioning



A key qualification for all filtration and separation solutions is that they command all necessary connection technologies. All PACO elements

can be easily integrated into existing systems – regardless of whether they use standardized or individually configured connections.

With power for efficient energy management

Demanding filtration and separation solutions are essential to the safe and efficient utilization of energy resources and generation of energy. Particularly high pressures, extreme temperatures and in many cases aggressive chemical as well as physical loads are characteristic of applications in these fields.



PACO for oil and gas production

- > Expandable sand screens
- > Seawater strainers for heat exchangers
- > Crude oil filters (SKF range)



PACO for refineries and cracking

- > Recycle gas filters
- > Candle filter systems
- > PACO Highflow twilled weaves with increased dirt absorption capacity and increased flow performance



PACO for renewable energy

- > Hot gas filter elements
- > Bag filters



PACO for power stations

- > Basket strainers
- > Candle filter systems
- > Start-up filters



PACO for pipelines and pumping stations

- > Y-type and T-type strainers
- > Basket strainers
- > HSA self-cleaning automatic filter



PACO for nuclear technology

- > Gas mixers
- > Delay beds
- > Gel dryers
- > Flame arresters

A safe and cost-effective energy supply is a fundamental requirement for economic strength and social wellbeing. The contribution towards

productivity, safety and environmental protection that is made through filtration and separation technology is correspondingly high.

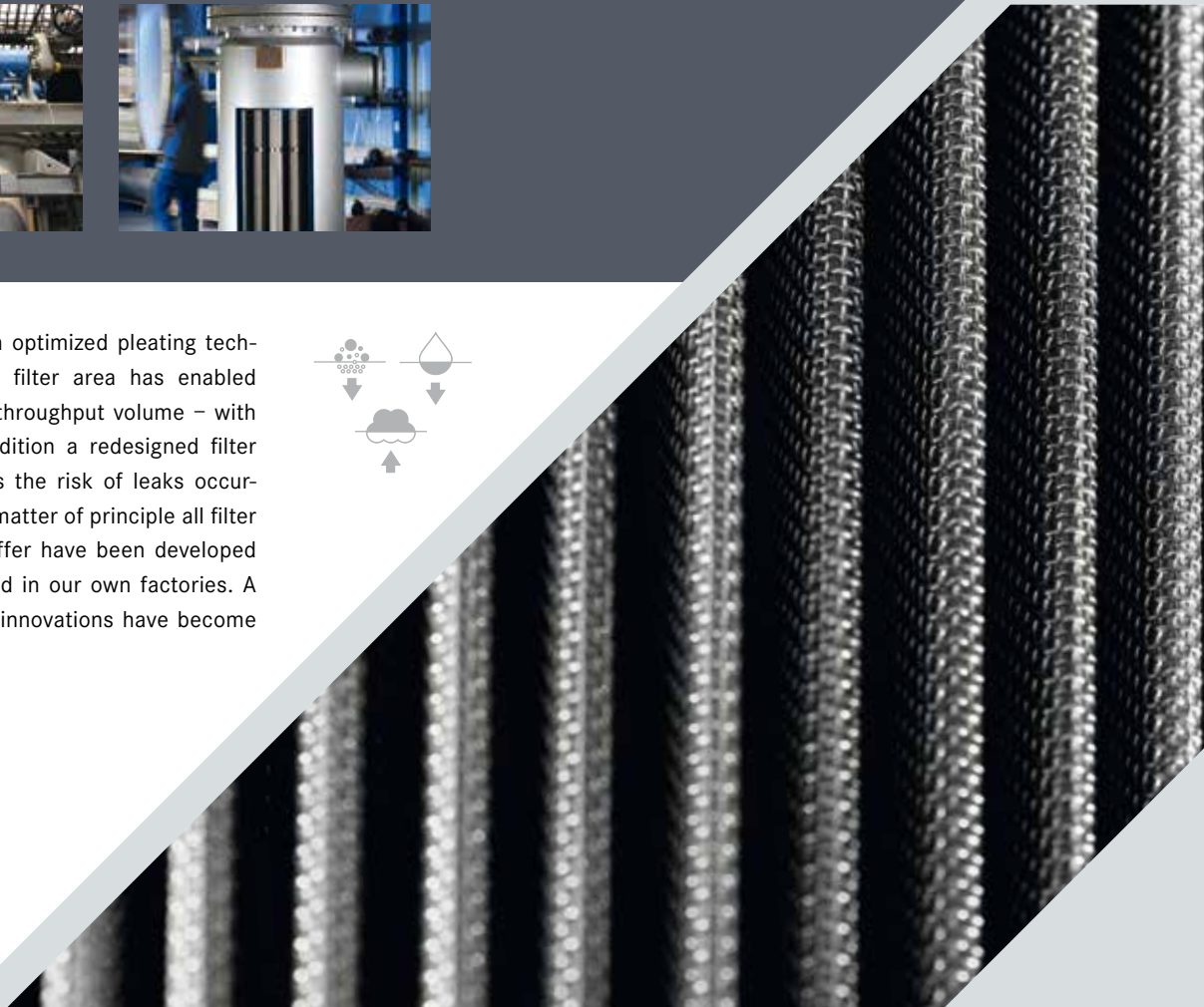


High performance for the chemical industry

Polymer filtration plays a decisive part in the quality and economic efficiency of synthetic fibre production. At the heart of this are the filter elements or, to be more precise, spin-pack filters. PACO is not only one of the leading manufacturers of specialty filtration solutions, but uses its own R&D to support the development of innovative, customer-specific solutions.



The development of an optimized pleating technique to increase the filter area has enabled PACO to increase the throughput volume – with longer lifetimes. In addition a redesigned filter edge further minimizes the risk of leaks occurring. Incidentally, as a matter of principle all filter elements that PACO offer have been developed by us and are produced in our own factories. A number of PACO filter innovations have become industry standards.



PACO for plastics production

- > Product and system solutions for the separation of solid and fluid components, homogenization of the polymer with additives, retention or shearing of gels
- > HE filter candle range 2 μ - 60 μ smooth, cylindrical, pleated
- > Product filters, media-specific for acryl to polyester
- > Pre-polymer filter candles
- > Extra-long filter elements up to 1400 mm (one-piece) for pre-polymerisation, polymerisation and melt filtration
- > Spin-pack filters
- > Sieve rings
- > Special filters for microfibers and super-microfibers
- > Autoscreen filter belts

Keeping it all pure – from active substances to drinks

All processors and consumers share a common fundamental right, the right to purity. After all, authenticity, qualitative transparency and genuine purity are the most important conditions for safety – in chemicals as well as pharmaceuticals and the beverage industry.



As a supplier of filtration and separation solutions to all industries, we know that the perfect functionality of all processes alone is not sufficient. There is also the need for advantageous maintenance and regeneration properties as well as cost effectiveness in all areas. Our completely metal components already have one inherent system advantage. To complement this, we have developed innovative regeneration processes that are particularly efficient and material friendly.

Past PACO experience shows that no list will ever be really complete. Particularly when it comes to our areas of activity.

PACO for chemistry and fine chemistry

- > PACOPLATE "S" metal cloth laminates, filter fineness from 1 μ upwards
- > Metal cloth laminates PACOPLATE "L"
- > Horizontal plate pressure filters (HPD)

PACO for pharmaceuticals

- > Pleated or smooth cylindrical filter elements
- > Re-generable filter elements for drying systems
- > Pressure filter baskets for bag filter systems
- > PACOPLATE metal cloth laminates, filter fineness from 1 μ upwards

PACO for biotechnology

- > PACOPLATE metal cloth laminates, filter fineness from 1 μ upwards

PACO for water treatment

- > Coarse and fine filters for rain water and sewage treatment plants
- > Ultra-fine sieve baskets
- > Volume filters for rain water treatment

PACO for food processing

- > PACOPERF perforated plate discs
- > PACOMESH reinforced sieves
- > PACOSCREEN filter plates
- > PACO SIMPLEX, DUPLEX and TRIPLEX filter cloths
- > Pressure filter baskets for bag filter systems

PACO for beverages

- > PACOSLOT slotted tube candles
- > Horizontal plate pressure filters (HPD)

HETA – our multiplier for complete systems and process technology

HETA Verfahrenstechnik – “High end” from the outset

As a member of our group of companies, HETA rounds off the PACO range of products and services in the plant manufacturing sector. It goes without saying that a branch such as “filtration and separation” also has a “high end”. This provides solutions for the most demanding applications, particularly those in safety-critical areas. Or in connection with media or process conditions that are particularly difficult to control. Such projects not only require specialist engineering skills but also a capability to implement that ensures high performance and utmost safety. That is why HETA shortly after starting as an engineering consultancy office, also established its own high performance production for plant and systems.



HETA Systems and Media

HETA designs and produces:

- > HSA automatic filters
- > Micro filters
- > Droplet separators
- > Edge-type filters
- > Candle filters
- > Double filter systems
- > RSA backwash filters
- > Strainers

Filtration/Separation of solids from fluids

- > Polymer melts
- > Amines, acids, alkalis
- > Solvents
- > Fuels
- > Heavy fuels
- > Lubricating oils
- > Paints and lacquers
- > Solvents for machine tools
- > Condensate in steam cycles
- > Industrial process water
- > Sea and service water
- > Cooling water in power stations

Separation of immiscible fluids

- > Water and foreign particles
from diesel oil and kerosene
- > Water and foreign particles
from chemical compounds
- > Water and dirt from heavy fuels

Separation of fluids from gases

- > Condensate
from carbon dioxide
- > Condensate from gases
- > Condensate from air
- > Contaminants from liquid gas
- > Water from liquid gas,
kerosene and gasoline

HETA plans and produces according to the principle that perfection cannot be delegated.



First the planning and then the complete package

In general, HETA only builds a system once as the next customer usually demands a solution with completely different parameters. Nevertheless each new project will bring synergies of knowledge to the fore that in each case benefit the latest in the line. This begins at the planning phase, where solutions can be identified faster and developed on a project-specific basis. Whereupon everything else follows step-for-step: the design of the plant, the conception and implementation of the control system, shipment to any corner of the world, installation on site, commissioning and testing, service support and whatever comes after that.

The HETA HSA automatic filter enables continuous operation through its self-cleaning function. Without process interruptions it eliminates solid particles from low viscosity fluids – reliably and with no breaks.

It's always about doing the whole thing

HETA projects primarily focus on fully integrated systems for the separation and filtration of fluids and gases. The complete program: filtration/separation of solids from fluids and gases. Separation of immiscible fluids. Separation of fluids from gases. In each case the protection of downstream devices such as heat exchangers, condensers, pumps and compressors plays an important part. Important applications for HETA systems include the production and pipeline transport of mineral oil and natural gas, energy generation from the power station through to the reactor and, automated solutions for chemicals, petrochemicals and pharmaceuticals. This is complemented by systems for environmental protection and water treatment – including seawater. And last but not least, specialty systems such as sophisticated one-off vessel constructions. It goes without saying that the necessary PACO filter elements and modules are automatically always an integral part of the system.



Manufacturing technology – perfection, that no one can quickly imitate



The high power EVOROLL bending and rolling machine enables HETA to pre-bend metal plates with a thickness up to 20 mm and a length of 3000 mm and roll them to e.g. produce blanks for vessels.

Why?

Because it's all down to how!

With filtration and separation, it often comes down to thousandths of a millimetre. This fineness can only be ensured through high precision manufacturing methods. In the case of PACO, this precision starts by making cloths of metal wires that in themselves have to be extremely precisely produced. The way that PACO weaves its metal wire cloths is something that very few in the world can do, as the looms are built by PACO's own mechanical engineers and are not available on the open market. This is the basis for one precision manufacturing step after another. Something that also applies for the perfectly constructed cloth laminates.

An overview of PACO manufacturing and processing technologies:

- > Metal wire weaving
- > Metal fleece production
- > Calendaring
- > Vacuum sintering
- > Pleating
- > Annealing
- > Diffusion annealing
- > Cleaning annealing
- > Smoothing
- > Cleaning (ultrasonic etc.)
- > High precision thread cutting
- > Laser cutting
- > Water jet cutting
- > Cutting-to-size
- > Punching
- > Milling
- > Forming
- > Bending
- > 3D measurement
- > Welding
 - TIG welding
 - Resistance welding
 - Plasma welding
 - Wolfram plasma welding
 - Arc welding
 - HF welding
 - Robotized welding
- > Laser marking
- > Adhesive bonding
- > Dyeing
- > Coating
- > Soldering
- > Electro-polishing
- > Covering
- > Lining
- > Refurbishing
- > Cleanroom technology



The PACO factory has an automated working centre with integral pleating machine, as well as longitudinal seam and round welding system built by our mechanical engineering team that produces folded filters with a length of up to 1400 mm.



Our location is certified quality “Made in Germany”

PACO uses the complete range of materials testing procedures. In metallography microscopic methods are frequently used.



We understand quality to be more than just standards

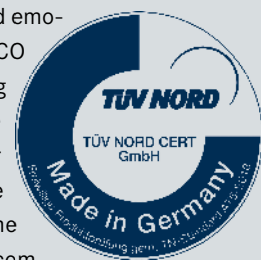
For manufacturers to guarantee compliance with certain quality characteristics is standard practice in most markets around the world. In the same way, neutral authorities carry out audits at regular intervals to confirm that such guarantees are based on provable facts and not just empty promises. With PACO, however, this goes much further than the need of ensuring that standards are complied with. We don't view quality as an obligation but as something natural that we completely voluntarily want to provide. Like breathing or our pulse.

Nevertheless it is still something that we check with the greatest attention to detail using state-of-the-art testing technology and methods:

- > *Destructive materials testing*
- > *Conditionally destructive materials testing*
- > *Non-destructive materials testing*
- > *X-ray fluorescence analysis*
- > *Metallographic methods*
- > *Microscopic methods*
- > *Porometry*
- > *Contrasting*

Guaranteed “Made in Germany”

There are certain certificates that others will never be able to attain. Something that is the envy of a lot of our competitors is our location “Germany” with all its objective and emotional advantages. This is why PACO has never considered transferring production capacity into low-wage countries. Our location is also our position: we can best supply the best possible quality from our home in Germany. To emphasize our commitment, we regularly receive the TÜV certified proof of origin “Made in Germany”. This underlines the fact that all PACO Group products and services primarily originate in Germany – with all the positive effects for our location in Germany respecting employment and the training of our future workforce.



Our certification: extensive, up-to-date and sometimes special

Starting with ISO 9001 and whatever else is needed

The basis for a demonstrable quality management is, for example, approval certification according to ISO 9001. But today this alone is not sufficient for any company. Certain customers demand special approvals to confirm compliance with their own specific requirements.

PACO and HETA certificates and accreditations (selection)

DIN EN ISO 9001:2008 Quality Management System

for PACO

Testing organization: DNV GL Business Assurance Zertifizierung und Umweltgutachter GmbH, Essen, Germany

Areas of application: Development, manufacturing and packaging of metal wire cloths

for HETA

Testing organization: BUREAU VERITAS Certification, Hamburg, Germany

Areas of application: Development, production and sales of filters, separators, pipeline strainers and special vessels

AD-2000 Data Sheet HP 0 in conjunction with DIN EN ISO 3834-2 / KTA 3211.3

Testing organization: TÜV Technische Überwachung Hessen GmbH

Areas of application: Production of pressure vessels according to the "Pressure Equipment Directive 97/23/EC"

Certified proof of origin "Made in Germany" Standard A75-S018

Testing organization: TÜV NORD CERT GmbH

Areas of application: Metal wire cloths and filters

Nuklear Standard KTA 1401 /AVDS D 100/50

Testing organization: RWE Power AG as appointed by AREVA NP GmbH

Areas of application: Planning and production of process technology components, in particular filters, separators and vessels for nuclear power stations

ASME Section VIII with U-Stamp

Testing organization: American Society of Mechanical Engineers

The National Board of Boiler & Pressure Vessel Inspectors

Areas of application: Identification and registration of boilers, pressure vessels or other pressure-resistant objects with the NB-mark.

NB Certificate of Authorization

Prüforganisation: The National Board of Boiler & Pressure Vessel Inspectors

Areas of application: Boilers, pressure vessels or other pressurized products, produced according to ASME U.

Your filtration topic? We separate the best solution for you!

From supplier to partner

When competing for customers and orders, some are prepared to make the most remarkable promises. Others try to use spectacularly low prices to make quality aspects appear unimportant. Whether this sways a decision one way or the other is something that everyone has to decide for themselves. From the outset, it was always a clear PACO policy to talk with current and potential customers in a way that was helpful and professionally credible. This is where experience and product-related research and development plays an important part. As we also try to work as closely as possible with our customers' experts, we can quickly find and implement customer-specific solutions. It is not until suppliers become partners that long-term business relationships develop.

Do what a number have already done: simply ask us!

Whoever has got to know PACO, always likes to ask us. If you would like to do this for the first time, don't hesitate. The chance that you will

benefit from contacting PACO, talking to experts and exchanging experiences and viewpoints is extremely large. We are really looking forward to getting to know you and your company.



Communication – fast, direct, interlinked

Global communications Sales and partner network – online

PACO is represented wherever PACO products and services are demanded. Our worldwide sales and service networks mean that you are never very far from the best possible PACO Mesholutions.

Find your local PACO partner:

www.paco-online.com

All contact addresses – direct

You can also reach the PACO headquarters and our specialists directly:

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Telephone: +49 (0) 66 63-97 8-0

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Filtrenergy-powered mesholutions by PACO & Group