



life

magazine no. 18

TRIO



Country air, city air.

Urbanisation and
the consequences.



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Urbanisation requires new approaches.

Cities are ever expanding, the volume of traffic is increasing and particulate matter pollution is getting worse. These changes also affect ventilation and air conditioning, and in particular air filtering. We have to respond by finding effective and efficient solutions to meet increasingly critical requirements. Filter technology is, hence, one of the main topics in this edition of *TROX life*.

A very unusual project concerns trains. TROX has developed bespoke filter units and filter elements for the intercity trains (IC) of Deutsche Bahn (German Railways), perfectly adapted to the various types of IC coaches. Not only will they help to cut the time required for filter changes by almost 80%, they will also provide better ventilation of the compartments.

Our interview is related to filters, too: We talked to our very own filter expert Thomas Klamp, and in the same context we introduce our new filter manufacturing facility in the Czech Republic.

Did you know that people spend 90% of their time indoors? That's a rather high figure, and it should make us think. It clearly shows the importance of good indoor air quality and sufficient ventilation. Hence our mission: 'TROX Technik for indoor life quality.' There is no mistaking the positive effects of good indoor air quality. Healthy air increases our personal comfort, improves our performance and causes fewer infections and allergic reactions to airborne germs and particles. Feeling comfortable means enjoying your work more, and it results in fewer sick days. And this is why we have dedicated many pages of this *TROX life* edition to air quality. Is good air, then, the be-all and end-all? We have some of the latest facts and figures from the world of science to show you why clean and fresh air equals better quality of life.

Megacities and the reduction of green space in cities have given rise to creative ideas. Take urban farming. Some of the most unlikely areas have been converted to urban farms that can provide entire cities with locally grown fresh produce. Tiny houses are another innovation and a creative way to combat the lack of living space that comes with urbanisation. Manufacturers promise comfort in the smallest of spaces. Read on and see for yourself.

High-rise buildings in cities have to meet more and more stringent safety requirements, especially with regard to fire and smoke protection. In order to even better meet such requirements, TROX X-FANS has recently acquired Dr. Ermer GmbH, a supplier of complete pressure differential systems with active electronic control. This is yet another strategic and logical step for TROX in becoming a systems and solutions supplier.

I can promise you an exciting read.



Yours
 Udo Jung
 TROX Board of Management



The increasing urbanisation has a huge effect on the environment. More traffic, more traffic jams and longer distances invariably lead to more particulate matter pollution.

Urbanisation means more pollution.



Filter technology vs increasing air pollution.

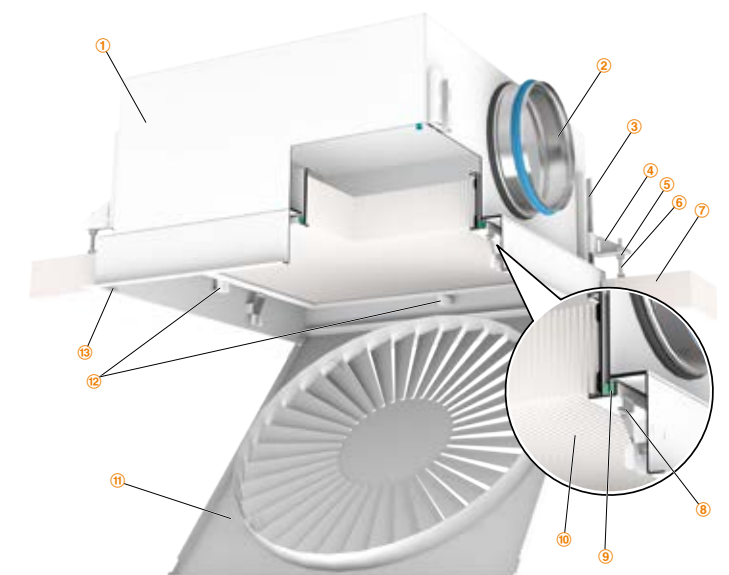
The higher the particulate matter pollution, the more effective and efficient filters have to be. Both the industry and legislation are working on solutions.

Energy class certification helps reduce energy costs.

Energy costs make up the major part of the total cost of filters. So much so that 51% can be saved when energy-efficient glass fibre filters are used instead of melt blown pocket filters (see also *TROX life* no. 16).

While filters themselves don't actually consume energy, they pose an obstacle to the airflow; this obstacle can only be overcome with more fan power. To calculate and evaluate the energy consumption caused by a filter and hence to see if it is cost-effective, Eurovent Certification in a joint effort with leading air filter manufacturers has developed an energy efficiency classification system.

Ceiling diffuser with plenum box and integral filter element.



- | | |
|----------------------------------|--------------------------------|
| 1 Casing | 7 Suspended ceiling |
| 2 Removable spigot with lip seal | 8 Spring (2x) |
| 3 C rail | 9 Fluid seal (downstream side) |
| 4 Support angle | 10 Filter |
| 5 Lock nut | 11 Diffuser face |
| 6 Screw | 12 Turn clip (4x) |
| | 13 Magnet (2x) |

When the European filter standard EN 779 was replaced with the international ISO 16890 standard a few years ago, a new test procedure for filter efficiency was introduced that takes the prevalent particle fraction in a location into account.

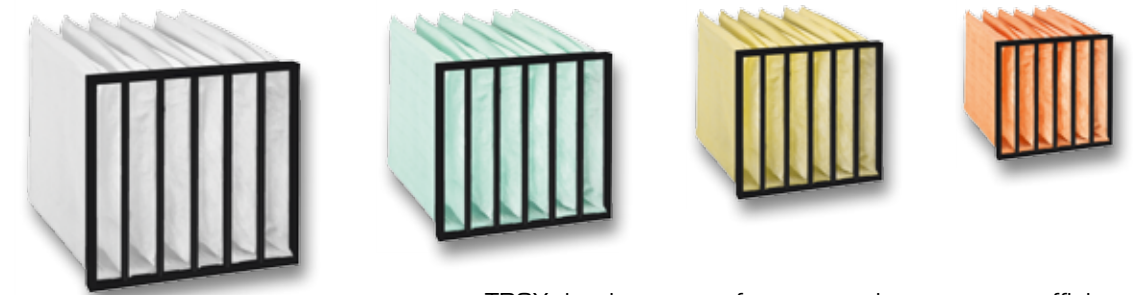
Testing is now based on different particle sizes, namely ePM10, ePM2.5 and ePM1 (see table on the opposite page), and the new energy efficiency classification scheme for filters takes the filter class into account.

To calculate its energy efficiency, a filter is exposed to the new ISO-A2 fine dust. As the filter becomes more and more contaminated, the pressure drop increases. This pressure drop is being measured.

The quantity of dust being fed depends on the filter class: ePM1 filters are fed with 200 g of dust, ePM2.5 filters are fed with 250 g of dust, and ePM10 filters are fed with 400 g of dust.



TROX high-efficiency filters. Made in Germany.



TROX develops, manufactures and tests energy-efficient filters and high-efficiency filters on advanced manufacturing and test equipment in Germany. All TROX fine dust filters are certified by Eurovent. The filters are characterised by excellent efficiency values, a low pressure drop and a long filter life. And not to forget: They help to reduce life cycle costs.

New Eurovent energy efficiency classification according to ISO 16890.

AEC in kWh/a for ePM1

	A+	A	B	C	D	E
50 – 55%	800	900	1050	1400	2000	> 2000
60 – 65%	850	950	1100	1450	2050	> 2050
70 – 75%	950	1100	1250	1550	2150	> 2150
80 – 85%	1050	1250	1450	1800	2400	> 2400
> 90%	1200	1400	1550	1900	2500	> 2500

AEC in kWh/a for ePM2.5

	A+	A	B	C	D	E
50 – 55%	700	800	950	1300	1900	> 1900
60 – 65%	750	850	1000	1350	1950	> 1950
70 – 75%	800	900	1050	1400	2000	> 2000
80 – 85%	900	1000	1200	1500	2100	> 2100
> 90%	1000	1100	1300	1600	2200	> 2200

AEC in kWh/a for ePM10

	A+	A	B	C	D	E
50 – 55%	450	550	650	750	1100	> 1100
60 – 65%	500	600	700	850	1200	> 1200
70 – 75%	600	700	800	900	1300	> 1300
80 – 85%	700	800	900	1000	1400	> 1400
> 90%	800	900	1050	1400	1500	> 1500

Reducing energy costs.

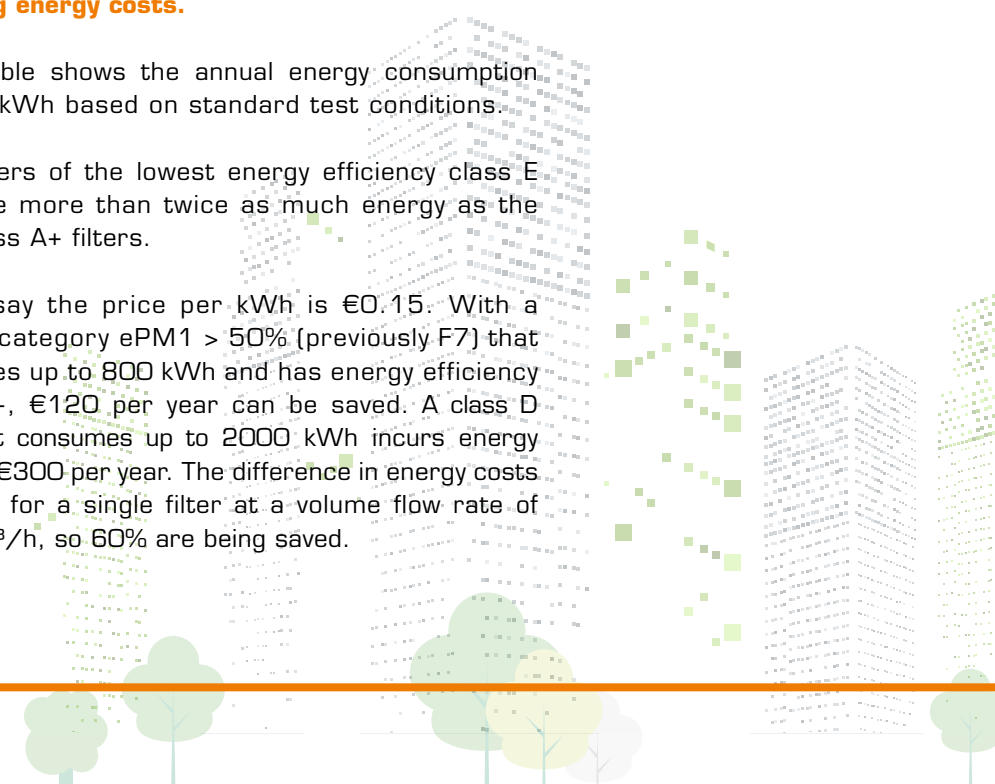
The table shows the annual energy consumption (AEC) in kWh based on standard test conditions.

Air filters of the lowest energy efficiency class E consume more than twice as much energy as the best class A+ filters.

Let's say the price per kWh is €0.15. With a filter of category ePM1 > 50% (previously F7) that consumes up to 800 kWh and has energy efficiency class A+, €120 per year can be saved. A class D filter that consumes up to 2000 kWh incurs energy costs of €300 per year. The difference in energy costs is €180 for a single filter at a volume flow rate of 3400 m³/h, so 60% are being saved.



TROX NanoWave® pocket filters of classes 1 and 2 reduce the energy consumption considerably.





Manufacturing facility of
TROX KS Filter.



The original Board of Management has remained in place, i.e. Jan Berger (Chairman) has remained responsible for sales, Petr Hrubý for technology, and Miloš Veselý for finance. As a new member of the Board of Management, Thomas Klamp, who is in charge of the filter business of TROX GmbH, has joined the Board of Management of the Czech subsidiary.

It is our goal to increase the TROX Group's filter expertise, to optimise production synergies, and to strengthen and expand our Czech location. By acquiring KS Klima-Service we have also strengthened our presence in the whole of Eastern Europe.



Thomas Mosbacher
and Udo Jung of the
TROX Board of Management
signing the contract.

TROX expands its filter business.

A few months ago TROX acquired the leading Czech air filter manufacturer KS Klima-Service, which is now TROX KS Filter. The Czech filter company was founded in 1993 and has a manufacturing facility in Příbram, near Prague. The company's main activities include the development, manufacture and sale of air filters for the HVAC industry as well as special filter equipment for industrial filtration applications.



The staff of
TROX KS Filter.

The meteoric rise of the megacity.

In 1950, not even a third of the world's population was living in cities. In 2007, the proportion broke the 50 per cent mark. According to UN predictions, this will rise even further to two thirds by 2050.

Serious consequences of urbanisation.

The rise in urbanisation is causing slums to grow, particularly in megacities in developing and emerging countries. Land is becoming more expensive and so is living space, which is becoming increasingly scarce.

The increase in concrete areas likewise increases the risk of flooding and overheating. Rivers are forced out of their original beds because there is a lack of natural flood defences such as woods and fields. Elsewhere, though, there is a lack of water. In many large cities, there is only enough drinking

water for 60% of the population. Groundwater is overused, meaning that salt water gets into the pipelines. According to the UN's second World Water Development Report, two thirds of city dwellers have no access to clean and safe drinking water.

Traffic comes to a standstill and, on some days, people can only leave the house if they use breathing protection because of the smog. According to the World Health Organisation (WHO), up to 30% of all lung and respiratory illnesses in Delhi, Beijing and Jakarta can be linked back to fine dust and other air pollutants generated by urbanisation.

The largest cities in the world.

1.	Tokyo/Yokohama	38,001,018	Japan
2.	Delhi	25,703,168	India
3.	Shanghai	23,740,778	People's Republic of China
4.	São Paulo	21,066,245	Brazil
5.	Mumbai	21,042,538	India
6.	Mexico City	20,998,543	Mexico
7.	Beijing	20,383,994	People's Republic of China
8.	Osaka/Kobe	20,237,645	Japan
9.	Cairo/Giza	18,771,769	Egypt
10.	New York/Newark	18,593,220	United States
11.	Dhaka	17,598,228	Bangladesh
12.	Karachi	16,617,644	Pakistan
13.	Buenos Aires	15,180,176	Argentina
14.	Kolkata	14,864,919	India
15.	Istanbul	14,804,116	Turkey
16.	Chongqing	13,331,579	People's Republic of China
17.	Lagos	13,122,829	Nigeria
18.	Manila	12,946,263	Philippines
19.	Rio de Janeiro	12,902,306	Brazil
20.	Guangzhou	12,458,130	People's Republic of China

Source: UN World Urbanization Prospects, 2015. This is a list of the world's biggest cities. In this case, cities are defined as urban agglomerations including the city centre, surrounding urban areas and, in some cases, cities that have merged (such as Tokyo and Yokohama).

Long food supply routes.

The distances between food producers and consumers are becoming greater and greater. This results in higher CO₂ emissions. Due to temporary storage of food, more food is being destroyed and the amount of plastic waste is rising.

Urbanisation rates worldwide.

It comes as no surprise that, in places such as Singapore, Monaco and Hong Kong, 100% of the population are city dwellers. The figure also stands close to 100% in the United Arab Emirates and in Qatar. However, there are still a few surprises in the list of urbanisation rates.

Global rankings for the rate of urbanisation across the entire population.

10	Belgium	97.9%
15	Iceland	94.2%
17	Japan	93.9%
21	Netherlands	91.0%
28	Denmark	87.8%
40	United Kingdom	82.8%
43	United States	81.8%
45	Spain	79.8%
47	France	79.7%
59	Germany	75.5%
64	Switzerland	74.0%
91	Ireland	63.5%
106	China	56.8%
189	Uganda	16.4%
191	Burundi	12.4%

Source: World Bank 2016.



Innovative filter technology for German intercity trains.

With the increasing urbanisation and the problems related to vehicle traffic, trains are set to play a more important role than ever: as a direct and reliable way of travel between cities, environmentally friendly and resource-saving. Deutsche Bahn is a future-oriented company whose focus is on extending the rail network, but also on making trains a safe and comfortable means of travel, and a safe and comfortable place to work. TROX has now developed a new generation of filter mounting systems for the intercity fleet of DB Fernverkehr AG, the Deutsche Bahn subsidiary that actually runs the long-distance trains.



A thing of the past: cumbersome, complicated filter changes.

The ventilation systems and electrotechnical installations of train coaches are found near the underside, below the platform level. The filter elements on trains have to be changed every 50 to 60 days as part of routine maintenance; this is done in special maintenance facilities. It used to be a time-consuming procedure as the non-woven filter media had to be manually folded into the steel boxes that served as filter chambers. And there was always the risk of leakages, i.e. of unfiltered air

getting through the ventilation and air conditioning system into the compartments.

Working right on the trains.

The new filter mounting systems were actually developed in the maintenance facilities, right on the trains. The first step was 'taking stock': checking the dimensions, fixing and arrangement of the ventilation components. The job became suddenly more difficult when it turned out that several solutions had to be found for the nine types of coaches.





Stephan Vogt and Chris Hipler were in charge of the filter element development for the trains.



Cumbersome and time-consuming filter changes: The filter elements had to be manually folded into the steel boxes.

Difficult job: TROX developers were faced with different installation situations on the intercity trains.



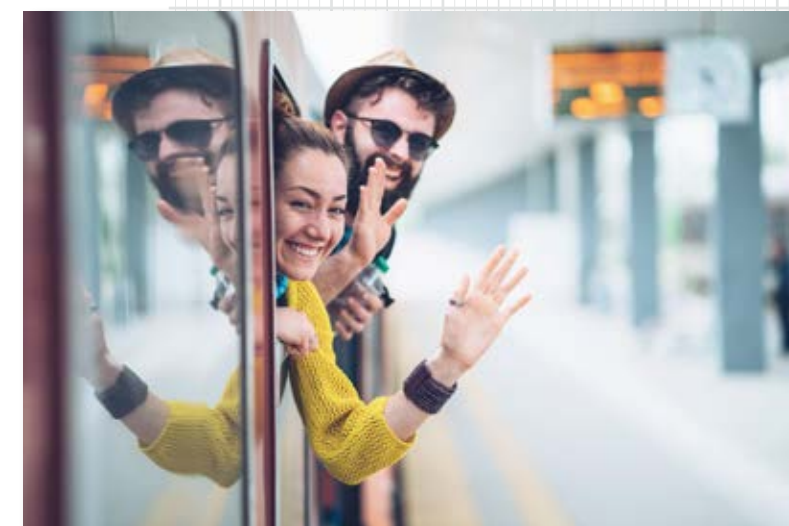
New filters: more comfort, much faster filter changes.

The goal was a smooth filter change procedure, and then in much less time than before. So TROX developed various stainless steel frames with clamping clips that allow for quick filter changes without any tools. It takes only a fraction of the time previously needed. The frames and filter elements minimise the risk of leakages as well as weather-related problems. The newer TROX filter media offer a larger filter area, while the filter element is less deep. This results in an increased dust holding capacity and extended filter life, and consequently fewer downtimes and maintenance costs. The new filter elements are also more efficient, providing 'better' air in the coaches and hence more comfort.

Difficult job due to diversity.

Working on site, the developers found that in fact various solutions were required.

In one type of coach, for example, the filter frame was fixed with rivets and could not be removed. For this case the developers had to find a solution where the existing drilled holes could be used. In another type of coach the fan unit was part of the ventilation system and could not be replaced, yet for maintenance it had to be replaceable. The solution was a stainless steel frame with a fixing system that allowed for replacement at any time. The developers then created installation instructions with pictures for every solution so that the railway people could make an informed decision.



38 → **8 mins.**

Conclusion.

Filter changes have become a smooth and quick affair thanks to the new filter elements. A filter change is now complete in a mere 8 minutes, down from previously 38 minutes. Thanks to the railway staff's support and the chance to carry out analyses and tests locally, in the maintenance facilities, the development effort posed no great problems.

The new filters reduce leakages and consequently improve the air quality in the compartments of intercity trains. As the new filters have a larger filter area, they can hold more dust and can remain in place longer, which reduces train downtime.

And the life cycle costs?

It's not the purchase price of a filter that accounts for the bulk of the cost; what is more important is the filter life. This is why TROX has developed a tool for calculating the life cycle cost of filters, which is available on www.trox.de/lcc. The tool allows customers to enter usage data and then select the best filter for their application with regard to energy efficiency and filter life.



Changing the urban climate for the better thanks to urban farming.

Over seven billion people live on planet Earth and half of them live in towns and cities. And the global population is increasing every day. By 2050, it is predicted to rise to 9.5 billion.



Bee colonies high above Frankfurt.



Andreas Wolf keeps bees on the roof of the luxury Jumeirah hotel in the MyZeil Frankfurt building complex, which has been fitted with TROX technology.

In order to supply enough food for the global population, the current amount of agricultural land needs to increase by 850 million hectares. However, there is not enough space available, which is why we need to exploit the potential of other spaces and develop new ways to cultivate food. Urban farming – utilising urban areas to grow food – is one such alternative. Not only does this mean that food can be harvested in cities, it also helps to change the cities' microclimate for the better.

Urban farming in Frankfurt: Skyline honey from the 28th storey of the Jumeirah hotel.

The air is full of buzzing and humming on the 28th storey of the Jumeirah hotel in Frankfurt. While business people and tourists occupy the lower storeys, the guests up above are particularly special – two beehives on the roof of the luxury hotel house around 20,000 bees. Every day, the bees fly off to visit the flowers in the city's parks, on the banks of the river Main and, of course, on the countless balconies in the city centre.

'The bees are in paradise here', says Andreas Wolf, who looks after the bees together with his colleague Florian Haas as part of the projects run by the 'gruppe finger' group of artists. And he continues: 'You wouldn't expect that in the centre of a big city such as Frankfurt. In actual fact, there is an abundant food supply here – and none of it has been sprayed with harmful chemicals.' The bees are thriving in their urban home, as demonstrated by the high honey yield. 'Here, on the roof of the hotel, we are collecting 40 to 50 kilos of honey per year. That's more than some honey farms in the surrounding countryside can manage.'

Incredible, but true: Bees feel right at home in the city and do find enough food.

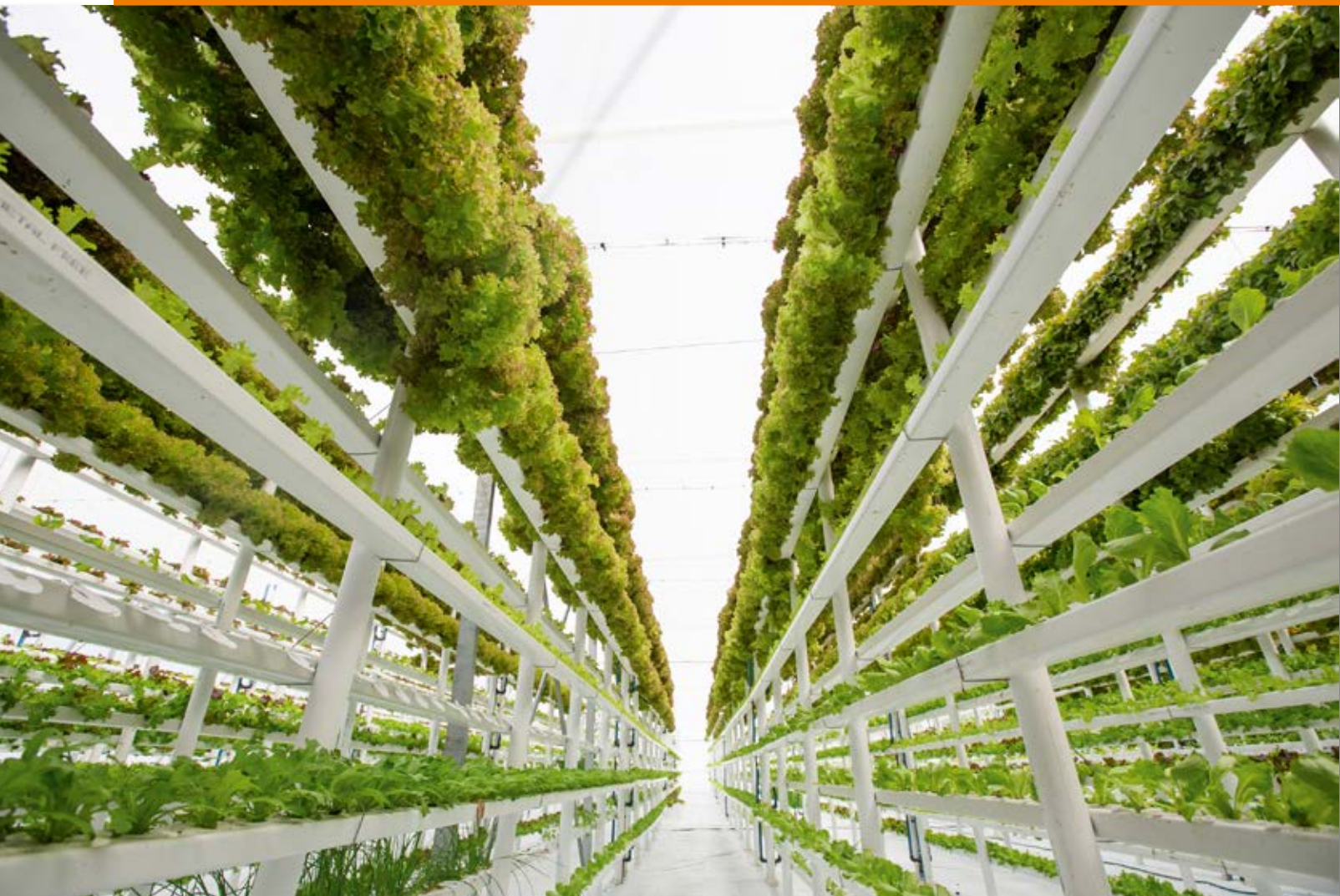
Although the idea of beekeeping in big cities may seem strange nowadays, it is actually nothing new. 'People were keeping bees near settlements over 2000 years ago. But in those days it was for a purely practical reason: people didn't want to walk far', explains Wolf. His work with bees isn't limited to Frankfurt, though; it forms part of a large-scale international art project for which he has also set up bee colonies in Moscow. He adds: 'To me, the way we manage bees represents the wider issue of how

we intend to coexist with animals more generally in future.' It is not just the bees that are benefiting from the urban farming project in Frankfurt – the hotel guests do, too. The Skyline honey is used in many areas of the luxury Jumeirah hotel – as part of the unique Skyline honey treatment in the Talise Spa, as a special honey-flavoured cocktail in the Ember Bar & Lounge and as a firm fixture on the breakfast menu at the Max on One restaurant.



The honey produced by the bees – on the roof of the luxury Jumeirah hotel, right next to where the TROX X-FANS are installed – is used in various ways in the hotel, including in the Skyline honey treatments in the spa.





Salad cultivation in a modern, hydroponic vertical farm – this method consumes only 1% of the water required for a standard, ground-based farm. Vegetables are thriving on multiple levels here, as substrates supply the plants with nutrients.

A lack of space is the mother of invention. Enter vertical agricultural spaces and roof farms.

In many cities, it is rare to find undeveloped land, and any wasteland is already being utilised – for example, by a residents’ initiative in the centre of Berlin. As a result, agriculture is now looking upwards – farms are being set up on roofs and going vertical in existing buildings, while bee colonies are being kept on top of skyscrapers.

In densely populated metropolises such as New York, Paris, Berlin or Milan, vegetables are being grown at lofty heights. As roof structures are not generally cut out for heavy loads, roots are planted

in beds of mineral wool or clay pellets (used in hydroponics). As a result, the plants require less water and the yield is even higher than in conventional farming. Filtered drain water from the skyscrapers can sustain fruit and vegetables, while wind and solar power modules and the use of waste heat can also reduce CO₂ emissions.

Buildings such as former factory halls can also be repurposed for agriculture. Suspended ceilings are brought in so that produce can be planted on several levels, making the best use of the space. The optimum climate for plants is similar to the one humans prefer – plants require temperatures of between 20 and 26 °C, but they also need a higher level of

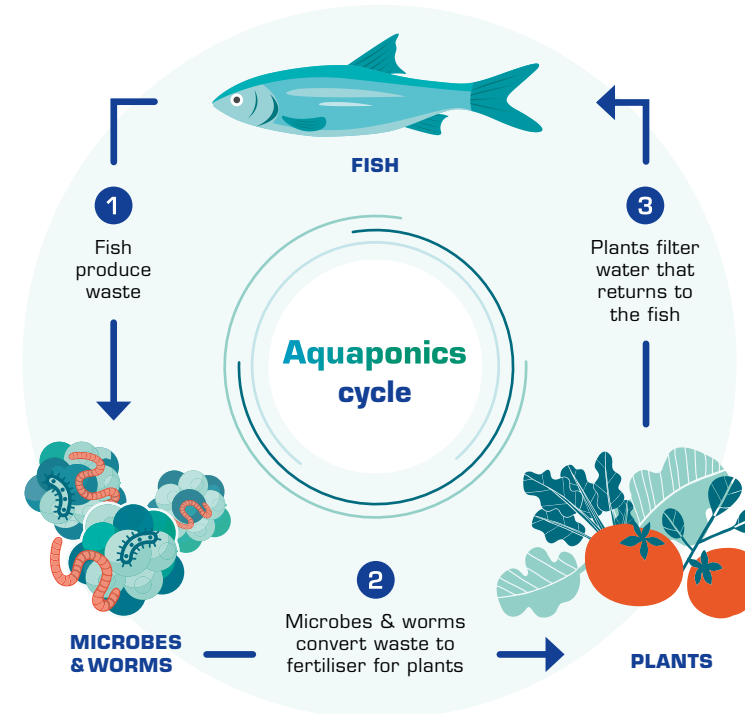
relative humidity compared to humans (75 to 95%) as well as a low airflow velocity. Instead of oxygen, plants ‘breathe in’ CO₂, which is converted into oxygen during photosynthesis.

Aquaponics. Aquaculture and agriculture in perfect symbiosis.

Between the buildings of an old Berlin malt factory, fish and vegetable farming are efficiently linked together. On top of a 1000-litre aquarium housed in an overseas container, there sits a 1800 m² greenhouse featuring all kinds of plants. The water containing the fish excrement flows into separate containers, is treated in a bio filter and is then channelled back into the aquarium and greenhouse. This process reduces the amount of water required by 50%.

The carbon dioxide (CO₂) released by the fish farm is absorbed by the plants. The fish excrement is turned into plant food that nourishes the beds that have been created, allowing plants such as cucumbers, tomatoes and herbs to flourish and grow.

How does the aquaponics cycle work?



Urban farming: Montreal, Canada.



Urban farming: Bangkok, Thailand.

Urban farming frees up land and is eco-friendly.

Not only does urban farming increase the amount of agricultural space available, it also has major ecological potential. Short transport routes and the use of existing resources, such as purified wastewater, improve the CO₂ balance, while the plants improve the urban microclimate by filtering out dust and producing oxygen through photosynthesis.

Urban farming – a fantastically efficient climate system.



Tiny houses provide the answer to the urban housing shortage.



A shortage of space and housing on the one hand, and rising property and land prices in cities on the other hand have prompted designers and others to think about how to build a proper home even in the smallest of spaces.



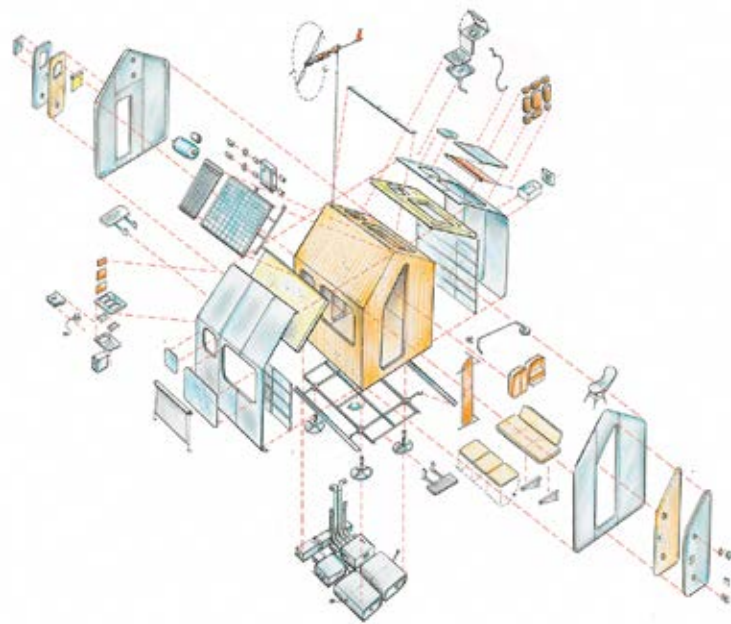
Diogene, designed by Renzo Piano and built by Vitra, is a fully furnished home with a floor area of only 2.4 x 2.4 m.



Tiny mobile homes.

The term 'tiny house' refers to mobile housing solutions that require a plot of only 5 to 20 m².

Even in the 18th century, people were intrigued by the idea of a simple, stripped-back house. The concept of a house pared down to the bare essentials has continued to fascinate architects ever since. Including Italian top architect Renzo Piano: In 2009, he published the blueprint for a wooden gabled-roof house in the Italian magazine 'Abitare'. That Diogene model had a floor area of 2.4 x 2.4 m, the roof ridge was 3.2 m high, and the house weighed 1.2 tonnes. In June 2010, Renzo Piano met with Rolf Fehlbaum of Swiss chair manufacturing company Vitra, and they agreed to continue working on the Diogene project together. After three years of development, a Diogene prototype was unveiled at the Vitra campus as part of the Art Basel 2013 art fair.



Tiny Houses by Schreinerei Diemann. Mobile home.



Diemann offer complete tiny houses on specially designed trailers that are allowed to travel on public roads and that have been inspected and certified by TÜV Germany. Tiny houses are high-quality constructions and built with eco-friendly materials. The desire of many city dwellers to live in a more sustainable way, closer to nature and using fewer resources is boosting the trend in deliberate downsizing. In this case, less is more.

Can tiny houses help to stop the spread of slums?

Slums, such as the favelas in Rio de Janeiro, generally consist of meagre shacks made of corrugated iron or wood that are crammed together in tight spaces. There is no infrastructure, no water, no sewerage system and no electricity. Could slums such as these be renovated using suitable tiny house solutions, thus helping to alleviate problems in these trouble spots? Sadly, tiny house prices are too high to make this a reality. Would it perhaps be possible to develop cheap solutions? Or is that just a pipe dream? Far from it – even today, cheap houses can be manufactured using a 3D printer, and cheap, eco-friendly components can be made out of sustainable raw materials. It's an exciting challenge for the creative designers of the future.

Tiny houses crafted by hand.

In Germany, there are around 20 suppliers of tiny houses – generally craft businesses from the woodworking industry. One of the leading manufacturers is the Diemann carpentry workshop in Hamm, Germany. Tiny houses offer all the creature comforts you need, and then in a compact living space, including a living and dining area, a cosy sleeping loft, a separate bathroom with a shower, WC and washbasin, and a fully equipped kitchen.

The clever use of space in tiny houses with their bespoke, multi-functional furnishing elements – such as staircases with integrated storage space or seating platforms with compartments for nested storage stools – make the interiors look and feel much bigger than they actually are. Electricity connections plus connections for fresh water and wastewater ensure that no one has to do without the comfort to which they are accustomed. Alternatively, photovoltaic systems that exploit solar energy, fresh water tanks, and urine diverting or composting toilets can be installed on request, so that residents can become more independent from the public power and water supply and reduce their resource consumption.



Filter expert Thomas Klamp.



Thomas Klamp is the head of filter technology at TROX. He has devoted himself to this field since his university days and brings his expertise to the various filter related committees of which he is a member.



What new developments do you expect to see in filters in the future?

It's not just about new products. Knowing about certain substances in the supply air or process air is also becoming more and more important. Outgassing from particulate filters, for example, can result in a product being rejected.

I also imagine that completely new areas of application will be found – take German railways. We developed bespoke filter products for their fleet of intercity trains that consist of a filter unit, a frame and a replaceable filter element. The time required for filter changes has been considerably reduced as a consequence (see also the project report).

The revised EN 1822-1 standard came into force in October 2019. What makes it special?

This standard is of high importance in Europe and also worldwide. The well-known filter groups EPA, HEPA and ULPA will remain important for many more years to come. The special thing about this standard is that a filter is not tested using a randomly chosen particle size; instead, testing is carried out at the filter medium's weak point (MPPS – **Most Penetrating Particle Size**).

The acquisition of KS Klima-Service, the market leader in the Czech Republic, will no doubt offer strategic opportunities, won't it?

In the Czech Republic we will manufacture products for the first and second filter stages for general room requirements and industrial filtration. These filters are mass-produced, form part of the replacement parts business and are very price-driven on the market.

High-efficiency particulate filters for the third filter stage are used together with suitable TROX filter units for various projects. The quality products mentioned last will be produced in Germany.

Filter units and filter elements can be combined with control components, sensors and displays that are integrated with the central BMS, and then you have a complete TROX filter system. Filters are a key element of intelligent systems as they ensure clean air within the overall ventilation system. They are in fact integral to the TROX vision 'for indoor life quality'.



TROX® TECHNIK
The art of handling air
for indoor life quality

Mr Klamp, your CV reveals that particulate filters fascinate you.

Yes, indeed. It was during my degree course in electrical engineering and especially while writing my dissertation in which I designed a clean room for a company in the semiconductor industry that I developed a keen interest in particulate filters.

What I find fascinating is the physical separation mechanisms of the filter medium and the interaction of the clean room components. They ensure that only very few particles in the μm particle range are left in the supply air. Without particulate filters it would be impossible to run an operating theatre.

How do you support your customers?

Service is a crucial factor alongside the products themselves. Of course, our services also include an energy costs calculator as well as design programs such as the Easy Product Finder – this is a design tool that calculates the concentration of supply air based on the concentration of outdoor air and the type of filter chosen. Our filter experts are developing bespoke filter solutions to meet every customer requirement regarding filter units and filter elements.

What impact is urbanisation having on filters?

The impact that particulate matter has on people's health – one of the consequences of the rise in urbanisation – is increasingly coming to the fore. In addition to the studies that have already been carried out on the role of particulate matter in heart and cardiovascular diseases, new studies are focusing on the development of Alzheimer's disease.

One of the consequences of this debate will be an increase in demand for higher supply air quality and better air filtration. The new ISO 16890 standard assesses filters based on the ePM1, ePM2.5 and ePM10 particle fractions. This means the filter classification process is taking a significant step, away from a purely lab-based test method towards a practical filter assessment. Nowadays filter units are used also in congested city centres and in streets with high levels of particulate matter pollution in order to reduce the concentration of particulate matter. This, however, is only really tackling the effects of particulate matter pollution, not the causes.

Mr Klamp, thank you for your time.

Functions and roles.

- **Head of Filter Technology at TROX GmbH**
- **Managing Director of TROX KS Filter** (responsible for business development and integrating the company into the TROX Group)
- **Chairman of the EN 1822 standardisation group on the CEN/TC 195 committee**
- **Member of the ISO 16890 standardisation group on the ISO/TC 142 committee**
- **Deputy Chairman of the German mirror committee for filter standards in DIN**
- **Member of VIP3000** (a German association of interest groups from the pharmaceutical industry)
- **Member of IUTA** (German institute for energy and environmental technology)
- **Member of the research advisory committee at IUTA**



▶ **Thomas Klamp**

The questionnaire was developed by Marcel Proust and popularised in Germany by the FAZ newspaper.

GETTING PERSONAL

Where would you most like to live?

South Tyrol.

What does real happiness mean to you?

Staying healthy and spending time with family.

What kind of mistakes are you most likely to forgive?

The ones that are made for the first time.

Your favourite fictional heroes?

--

Your favourite historical figure?

William Shakespeare.

Your favourite composer, musician or band?

Various classical ones as well as medieval music.

What's your favourite pastime?

Listening to music.

What's your favourite food?

Duck.

Which qualities do you most value in friends?

Reliability.

What's your biggest weakness?

Impatience.

Your dream of happiness?

I am already happy.

What would be the worst thing that could happen to you?

Family misfortune.

What's your favourite colour?

Blue.

And your favourite flower?

Rose.

Your favourite animals?

Songbirds and birds of prey.

Your favourite book?

The German novel 'Die Rache der Schachfigur' (literally 'the revenge of the chess piece').

What motto do you live by?

Find the guiding principle in your life and then follow it.



Higher safety requirements due to urbanisation.

As more and more people move to urban areas, the density of housing increases, and buildings are expanding upwards. The requirements on safety for building occupants rises accordingly, especially in the event of a fire. In such a case, pressure differential systems keep stairwells free from smoke and allow people to escape safely.



The new management team of Dr. Ermer GmbH (left to right): Hartmut Brandau and Christian Söllner, Managing Directors; Michael Porten, Head of Sales of Dr. Ermer GmbH; Michael Buschmann, Head of Business Development Management of TROX.



TROX X-FANS expand their portfolio.

At the beginning of December 2019, TROX X-FANS acquired the Cologne-based company Dr. Ermer GmbH, a supplier of electrically controlled pressure differential systems and ancillaries. Pressure differential systems keep stairwells free from smoke. In the event of a fire, fans blow outdoor air into stairwells from below, thereby creating a positive pressure. Even if someone on an affected floor opens a door to the stairwell in order to escape, the positive pressure in the stairwell ensures that the smoke cannot get into the stairwell; the escape route is kept free from smoke so that people can leave the building safely.

Two systems can be used to create and control the positive pressure, one passive and mechanical (TROX X-FANS) and another one active and electrical (Dr. Ermer GmbH).

Passive control means that a fan creates a constant strong airflow in the stairwell. Mechanical dampers in or near the roof are forced open as a consequence so that the pressure is relieved. The dampers are fitted with springs and weights that control the pressure.

Actively controlled pressure differential systems are fitted with a sensor that captures the changing pressure conditions in the stairwell, while a frequency

inverter is used to control the fan speed so that exactly the right air volume is led into the stairwell.

Dr. Ermer GmbH ideally complements the TROX X-FANS portfolio in the field of pressure differential systems. The combination of both types of systems – ‘the best of two worlds’ – is a clear advantage. And on top of it, Dr. Ermer’s pressure differential systems can be combined with the excellent and extensive range of TROX components.

The cooperation between Dr. Ermer GmbH and TROX X-FANS started some time ago. Joint projects have included the construction of two 19-storey tower blocks and a 6-storey block of flats with a total of 403 flats in Düsseldorf, Germany. Dr Horst Ermer, who has been one of the pioneers of pressure differential systems in Germany, and Udo Jung, Member of the Board of Management of TROX, have known each other for many years.



79 people died when a fire broke out in the Grenfell Tower in London. A pressure differential system could have saved those lives.

Safety first.

Fires in high-rise buildings such as the one in London's Grenfell Tower in 2017 show just how important effective fire and smoke protection are. At the same time, such fires pose a huge challenge to firefighters.

The Grenfell fire was probably caused by a defective fridge-freezer. Within minutes the fire raced up the exterior of the 24-storey building with 120 flats. Most people in the building were caught in their sleep and couldn't get to safety as the building had only one escape route. 79 people lost their lives. Many of us probably still remember the harrowing pictures of the disaster.



Test of the pressure differential system under real-life conditions.



For Germany, the MHHR guideline stipulates that high-rise buildings need to have either two stairwells so that one can be used as an alternative escape route, or a protected stairwell fitted with a pressure differential system. A pressure differential system would also have made the firefighters' job much easier, and the building occupants would probably have been able to get to safety.

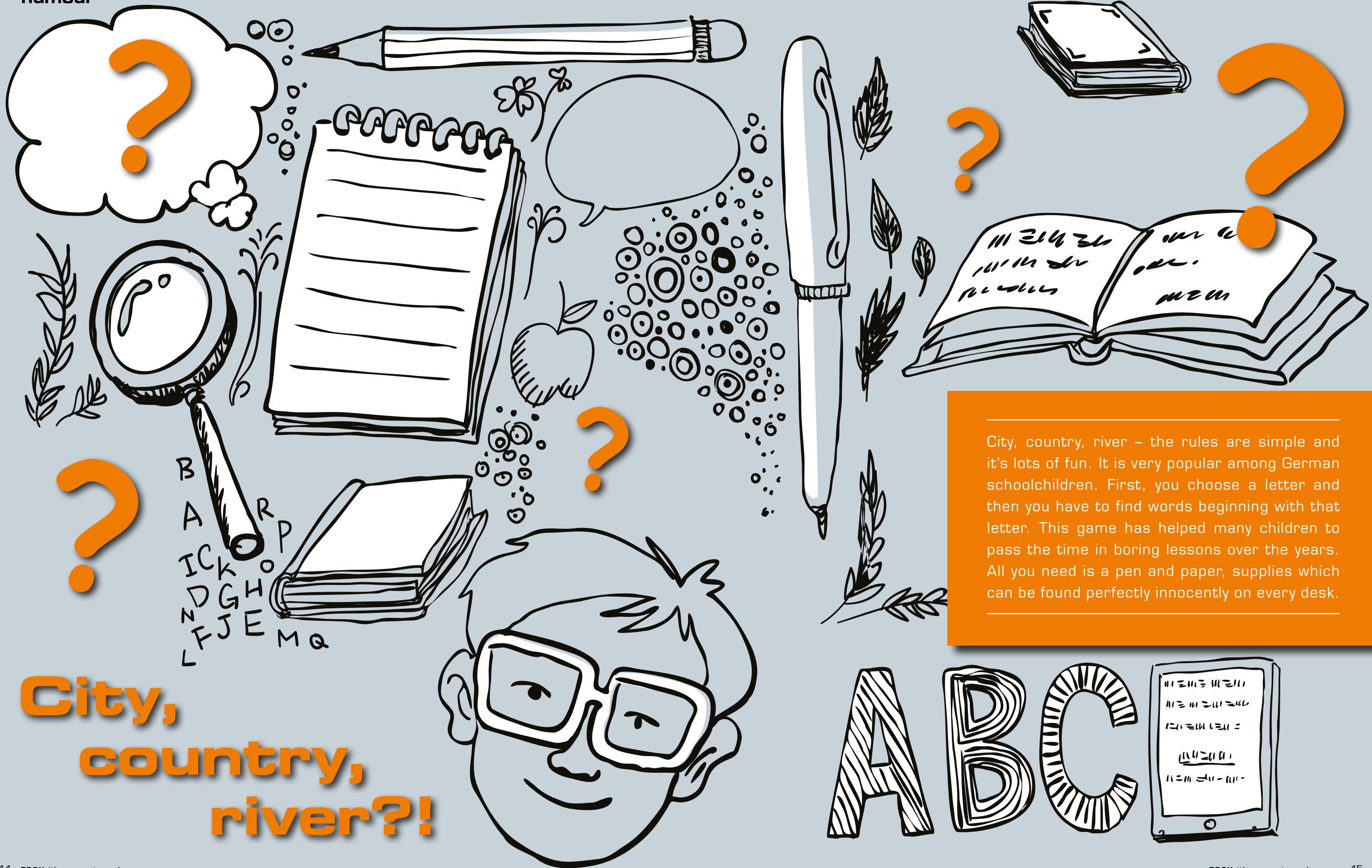
Pressure differential systems: effective and safe.

Such systems create a positive pressure in the stairwell, thereby preventing smoke on the incident floor from getting into the stairwell. So the occupants have enough time to find the emergency exits and leave the building.

Pressure differential systems are, hence, real life-savers. They are also a great help to firefighters, who can reach the source of a fire without being impaired by smoke, rescue people in danger and start firefighting effectively.

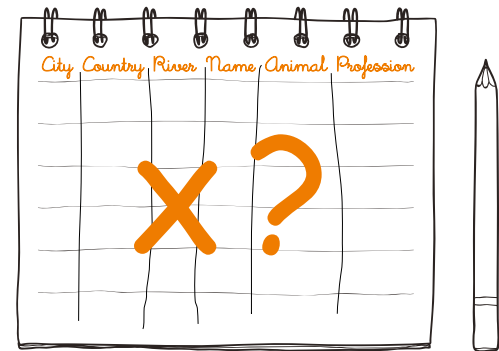
TROX X-FANS: PDS for demonstration purposes.

Pressure differential systems have been installed for demonstration purposes both in the Bad Hersfeld subsidiary and in the TROX head office in Neukirchen-Vluyn. On the occasion of the TROX X-FANS anniversary in 2016, the Bad Hersfeld system was tested under real-life conditions with participation from the Bad Hersfeld fire brigade. Successfully: 'In a real-life situation, the pressure differential system would have provided unimpaired visibility for the firefighters and allowed them to rescue people and effectively fight the fire', said the officer in charge of the fire exercise afterwards. The system was extended in 2018 to allow for simulating various fire scenarios. When TÜV Süd, a global provider of technical services including testing and certification, came to Bad Hersfeld last October for a seminar, TROX X-FANS staff took the opportunity to demonstrate the revamped system to the more than 20 experts. The demonstration was received with much appreciation.



City, country, river?!

City, country, river – the rules are simple and it's lots of fun. It is very popular among German schoolchildren. First, you choose a letter and then you have to find words beginning with that letter. This game has helped many children to pass the time in boring lessons over the years. All you need is a pen and paper, supplies which can be found perfectly innocently on every desk.



We played according to the following rules: 5 points for the same answer as someone else, 10 for a unique answer that no one else had and 20 when it was the only answer in that category. Usually, the letter is set by one player saying the alphabet in their head, and when another player says stop, they say the letter that they got to. You can add more categories if you wish. Flora and fauna, surnames and first names, lakes and seas, stars and starlets – let your imagination run wild!

The game was being played as early as the end of the 19th century. In the past, we used to leaf through atlases to find exotic solutions, but now of course we use the Internet. There are platforms where you can play online. And there you can find quirky and unusual categories: child-friendly and X-rated, poets and poems, songs and songwriters or foreign languages and dialects.

X: Xysticus audax

... is a species of spider from the crab spider (Thomisidae) family. It is a common species that is widespread in central Europe.



X: Xanten

... is a medium-sized town in the Wesel district of Germany. It is located in the Lower Rhine region of North Rhine-Westphalia.



X: Xenopus

The clawed frog genus (Xenopus) belongs to the family of tongueless frogs (Pipidae) within the batrachian order (Anura). In contrast to the African dwarf frogs, the nearly 30 species in this group have no webbing between their front toes. The most well-known species in this genus is the African clawed frog.

The letters X and Y pose a particular challenge. There are only three cities in the world that begin with X: Xanten in Germany and Xiamen and Xuzhou in China. There is only one country beginning with X: Xizang, which is the Chinese name for Tibet. And, in case you were wondering, the two rivers beginning with X are also in China: the Xar Moron and the Xiliao.

In the animals category, you have no choice but to start looking at the scientific names. The Xenopus is a type of clawed frog, Xysticus audax is a species of spider and xenocongrid is a type of Mediterranean fish. In the first names category, we found the following options: Xaver, Xerxes, Xavier, Xabi or Xherdan for boys and Xena, Xenia, Xia or Xanthippe for girls.

Just wait and see – your children are going to love city, country, river. A tried-and-tested pastime to rival Warcraft and other online fighting games.

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