

# Fire and smoke protection for the future





## People come first

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**Hence, there is only one true measure of good indoor ventilation and air conditioning – people.** People come first. Their well-being, their vitality and ability must be promoted. And their safety is the primary objective in case of danger, such as fire.

**Ventilation ductwork penetrates our buildings like road networks our cities** thus ensuring that all parts of the building are supplied with the elixir fresh air. However, if a fire breaks out, they can assist the spread of fire and smoke. This must be prevented. Modern buildings are divided into separate fire compartments. These can be closed off in case of fire, preventing fire and smoke from spreading and keeping evacuation and rescue routes free from smoke. People in the danger zone can evacuate the burning building safely and without injury.

## The tasks of fire protection for building service plant

For optimum protection of people in case of fire, it is important to understand the development of fire. Most casualties of a fire die from inhalation of poisonous smoke gases. In order to save lives, fire and smoke protection at TROX is based on three areas:

### 1. Fire and smoke detection

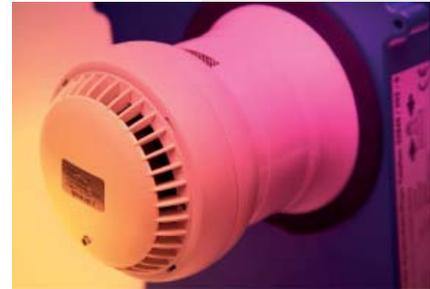
The earlier a fire or its toxic gases can be detected the earlier the fire can be fought and the building evacuated. Carefully planned, professionally installed and well maintained fire and smoke alarm systems provide this safety.

### 2. Fire and smoke protection

Fire dampers prevent the spread of smoke and separate the individual fire compartments. Their resistance to high temperatures and their reliable operation are decisive factors in saving lives.

### 3. Smoke extract

Well designed smoke extract systems remove smoke quickly and keep escape routes clear of toxic gases. The planning and design of extract systems requires a high degree of expertise and care.



*Smoke detector*



*Fire damper*



*Smoke extract damper*

*Main Railway Station, Berlin, Germany*



## Product history

For more than 55 years the **TROX name** has stood for high-quality components and systems for ventilation and air conditioning technology. Extensive research and sustainable development have made the TROX GROUP a world leader in this area of technology.

After the introduction of the universal requirement for product certification in Germany in 1974, TROX was the first company to receive a certificate mark (PA-X 100) from the Institute for Building Technology in Berlin for this type of fire dampers and with it approval for use throughout Germany. This started the great success story of the development of the Type FK-K 90 fire damper.



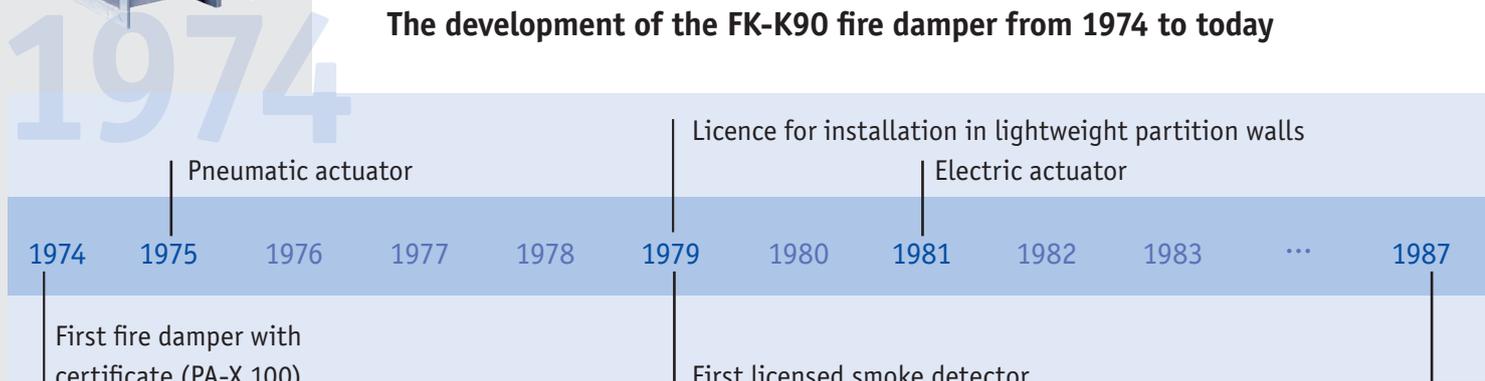
TROX Headquarters, Neukirchen-Vluyn, Germany

### TROX in figures

- 3,000 employees worldwide
- 380 million euros turnover in 2008
- 25 subsidiaries worldwide
- 14 production plants in 12 countries
- 12 research and development centres worldwide
- More than 25 sales offices and more than 50 representatives and importers across the globe
- Total plant area: 425,000 m<sup>2</sup>
- Total production area 156,000 m<sup>2</sup>



### The development of the FK-K90 fire damper from 1974 to today





### Fire and smoke protection products

- Fire dampers, rectangular/circular
- Explosion-protected fire dampers
- Ceiling diffuser plenum boxes with integrated fire damper
- Fire protection valves
- Smoke extract dampers
- Tunnel dampers
- Smoke detectors
- Communication system TROXNETCOM

### Comprehensive range of products for fire and smoke protection

One of the world's most comprehensive ranges of components and systems for all aspects of fire and smoke protection arose from these small beginnings. The TROX range of products for fire and smoke protection covers all kinds of applications. For instance, TROX uses international standards such as LON and the AS interface to control fire protection systems in building automation.

Furthermore TROX develops practical specialised solutions for both new buildings and existing buildings and is opening up new markets and sustainable sales opportunities with new and innovative products. Tunnel dampers and wall penetration solutions for all of Europe are impressive examples.



2009

Integration into the centralised building management system with TROXNETCOM

Construction with lip seal

... 1993 ...

1999

2000

2001

...

2005

2006

...

2009

Licence for installation outside solid walls and ceiling slabs



New FK-K90 with Ex-certificate

Licence as air transfer unit

## Trusted in world markets

**Where the safety of people is concerned**, the numbers of regulations are considerable, not only in Germany and Europe. When planning and installing fire protection systems, a wide range of requirements and regulations must be observed depending on the location, size and purpose of the project.

**As an expert in fire protection**, TROX is a sought-after partner for complex projects in Germany and abroad because TROX is familiar with the requirements of regulators and technical standards throughout the world.

**TROX is a company with international experience** and is in demand to provide advice to domestic and international bodies in the development of new fire protection standards.



Warszawa, 10.04



Hydropower station Itaipu, Iguacu, Brazil

DIBt



11.09.2008

„Bird's Nest“ national stadium, Beijing, China



Moses Mabhida Stadium, Durban, South Africa



AFITI LICOF

Centro de Ensayos e Investigación del Fuego



Telefónica, Madrid, Spain



## TROX is a member of the following national and international organisations:

- DIBt (German Institute for Building Technology) as expert member
- VDMA (German Machine And Mechanical Engineering Association), Smoke Exhaust Workgroup (FV AL)
- DIN Standards Committee (German Institute for Standardisation)
- CEN (European Committee for Standards) Technical Committee 127
- BS (British Standard) Committee FSH 22/4
- IG-BSK (Workgroup Fire Protection, Switzerland)
- ON (Austrian Standards Institute) committee ON-K 141 (ventilation technology) and Workgroup ON-AG 141-22 (ventilation systems – fire protection)
- Malaysian Standard MS 555 for „Fire Dampers; Part 1“
- AENOR (Spanish Association for Standardisation and Certification) Fire Protection Committee 23

## Fire and smoke protection for the future

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The International Center Fire Protection is the new driver for innovation in the TROX GROUP in the area of fire and smoke protection. It is the most modern center for testing, research and development in Europe.

Furthermore it conducts basic research and materials testing and works closely with universities and research establishments throughout the world. In this way TROX can respond faster to specific customer requirements and technical challenges. TROX customers gain new competitive advantages.



*West view of the International Center Fire Protection, Neukirchen-Vluyn, Germany*

### **More space for knowledge transfer**

The International Center Fire Protection includes a seminar room for 60 people. It is used for certified training courses and workshops for employees, customers and partners of TROX. Furthermore, the Rhineland-Westphalian University of Applied Sciences (RWTH) in Aachen offers seminars on the premises of the new Center.

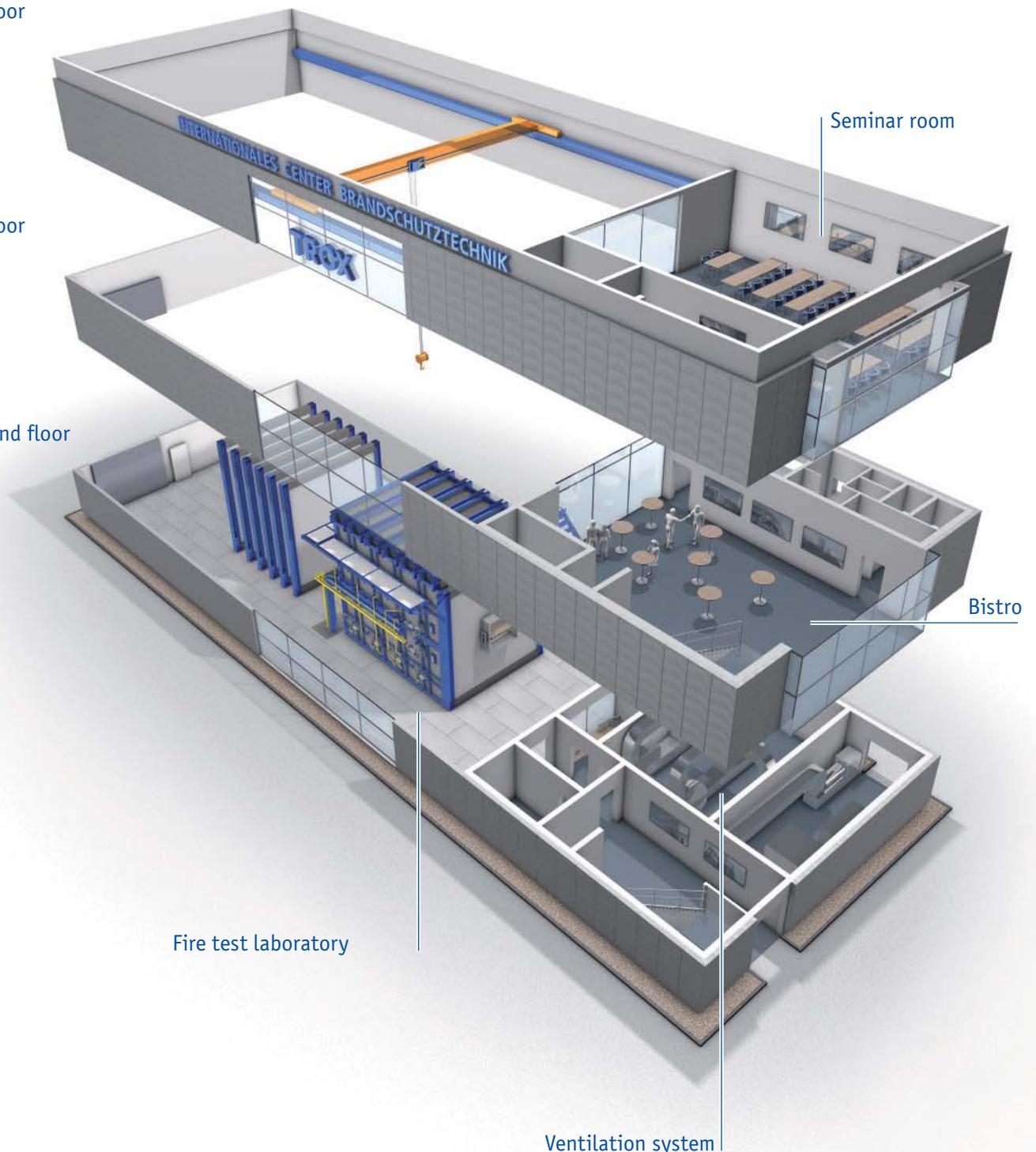
## The International Center Fire Protection in figures

Building total floor area: 612 m<sup>2</sup>  
Building dimensions: 14.3 m x 42.8 m  
Building height: 11.62 m  
Volume: 7,112 m<sup>3</sup>  
Fire test laboratory floor area: 400 m<sup>2</sup>  
Total area of technical, exhibition  
and seminar rooms: 820 m<sup>2</sup>  
Flue: height 16 m, diameter 1.60 m

2. Floor

1. Floor

Ground floor



The International Center Fire Protection

INTERNATIONALES CENTE

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## Research for improved safety

The heart of the new International Center Fire Protection is a furnace measuring 4 x 5 x 5 metres. It is big enough to test even the largest tunnel dampers that are used for extracting smoke from underground transport systems.

In Europe's most modern fire test laboratory, TROX conducts fire testing primarily for fire protection classification of building products for ventilation and air conditioning in accordance with national and international standards.

Scientific experiments can also be carried out outside the requirements of the standards to investigate specific fire protection problems. The technical instrumentation in the Fire Protection Center is also suitable for expert testing and reporting.



*The fire test furnace is the heart of the International Center Fire Protection*



*20 gas-operated burners provide a total capacity of 9 megawatt*



*One of the burners just before reaching the test temperature*



*Eight inspection ports offer a view into the furnace*



## The combination furnace for wall and ceiling tests in figures

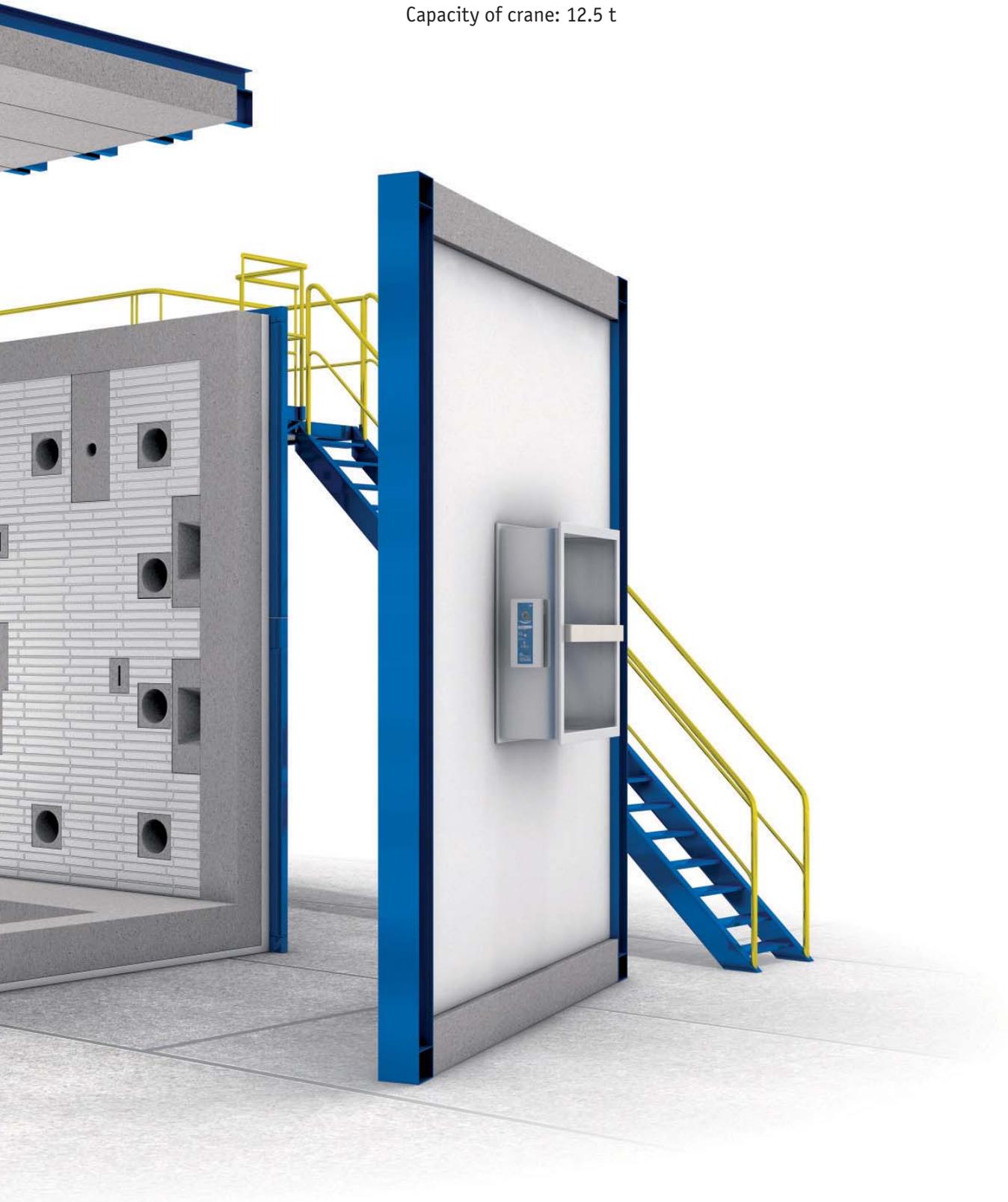
Exterior dimensions:  $W = 4 \text{ m}$ ,  $L = 5 \text{ m}$ ,  $H = 5 \text{ m}$

Combustion chamber dimensions:  $W = 3 \text{ m}$ ,  $L = 4 \text{ m}$ ,  $H = 4 \text{ m}$

Installed output of the 20 gas-operated burners: 9 MW

Max. temperature: 1,200 °C

Capacity of crane: 12.5 t





Two video cameras record the complete test procedure simultaneously to the measured test data



Pivoting temperature sensors are mounted in the wall duct



128 measuring points record the temperatures of the samples and 28 measuring points the temperature in the furnace



Test data and video recordings are collected simultaneously and visualised on monitors on the test trolley and in the control room

## Use – flexible options

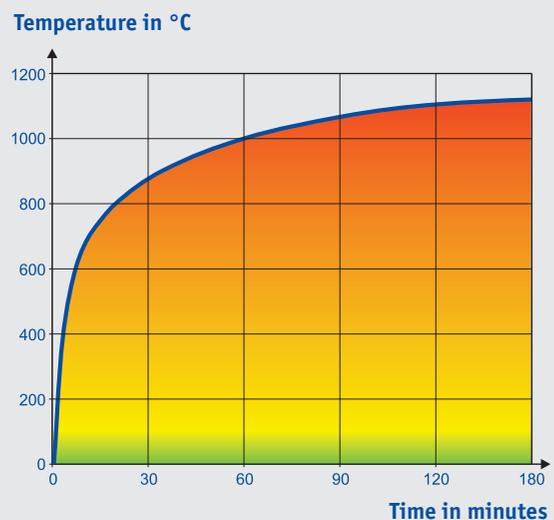
The fire test furnace consists of four solid boundaries as well as a removable wall and ceiling section for fitting the samples.

This construction of the combination furnace allows flexible test options: fire tests of building products in walls, ceilings and false ceilings as well as ventilation ducting installed through the furnace. The state-of-the-art controls allow fully automatic operation.

Four monitors in the control room show the control of the furnace for test procedure and the results of the fire testing, such as pressure curves, time-temperature curves, sample temperatures and real time camera images.

## Fire testing according to Eurocode

In accordance with the 1999 European test standard EN 1366-2, fire dampers with the maximum size of the type in question must be correctly installed in a test frame and exposed to heating in accordance with the test time-temperature curve (EN 1363-1).



Test time-temperature curve (EN 1363-1)

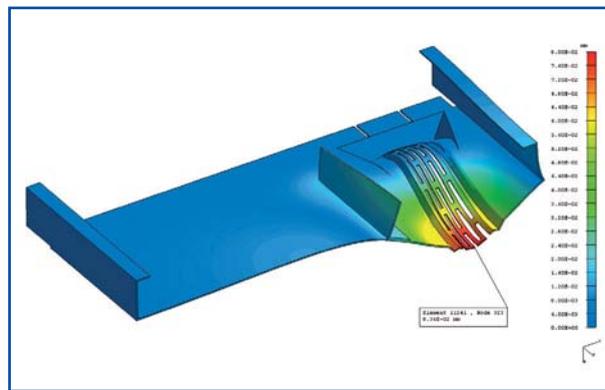
R BRANDSCHUTZTECHNIK

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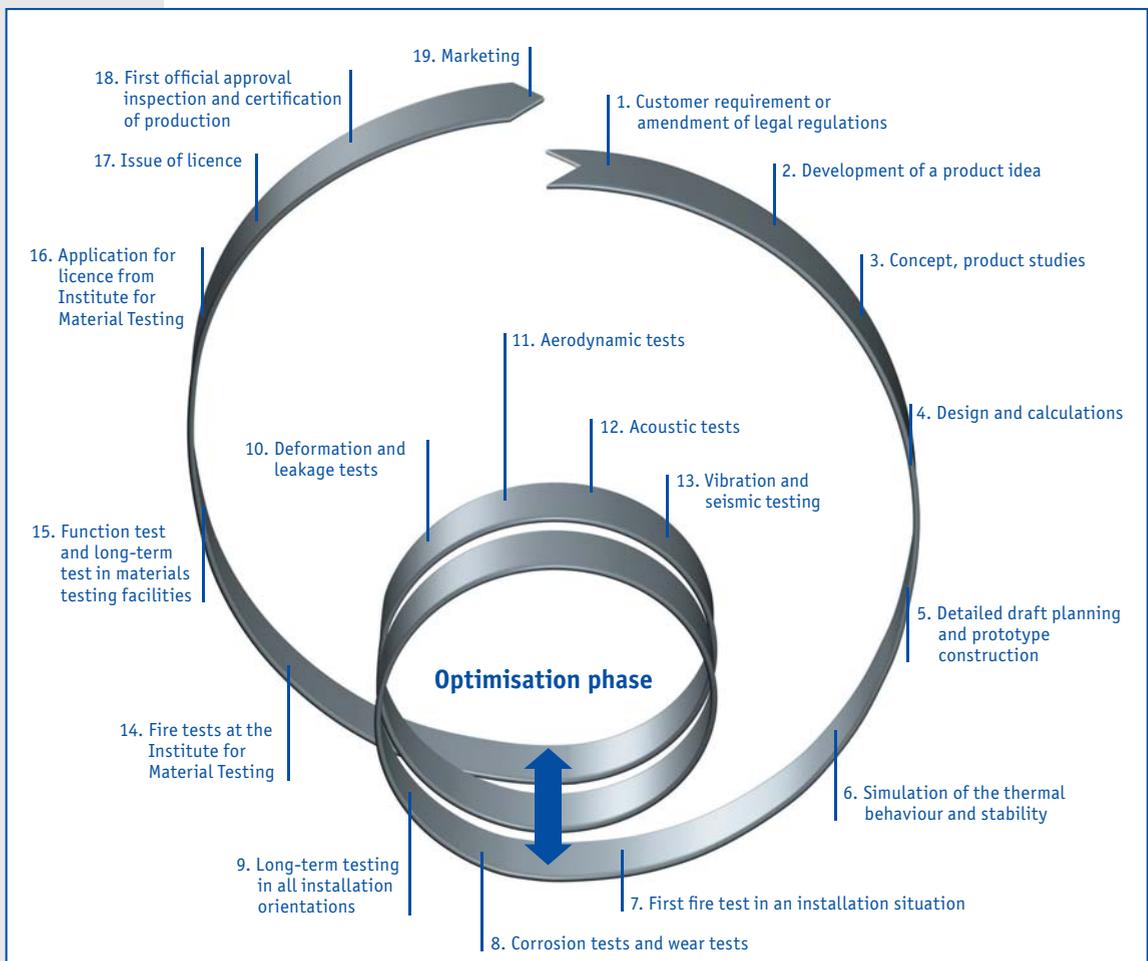
## From the idea to marketing

The new International Center Fire Protection with the fire test furnace facility, which is unique in Europe, is an important research and development centre on the long journey from an idea to marketing an innovative product. During the optimisation phase of a new product, numerous details must be improved step by step.

As products must be tested for all applications and in different installation situations, a number of fire tests are required.



*Simulation of the thermal behaviour and stability of a fire damper*

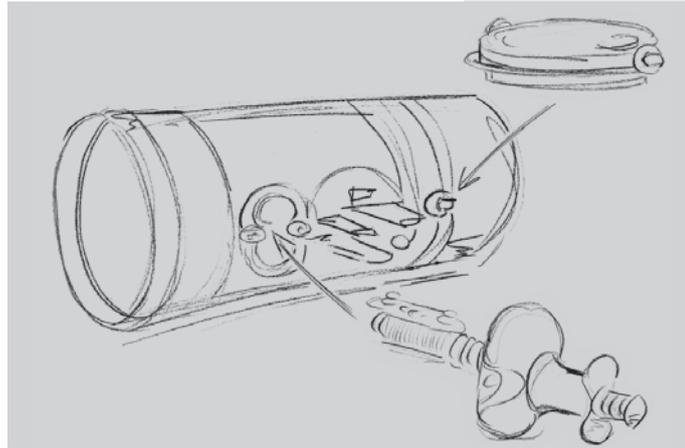


*Example of the development cycle of a fire damper with licence*

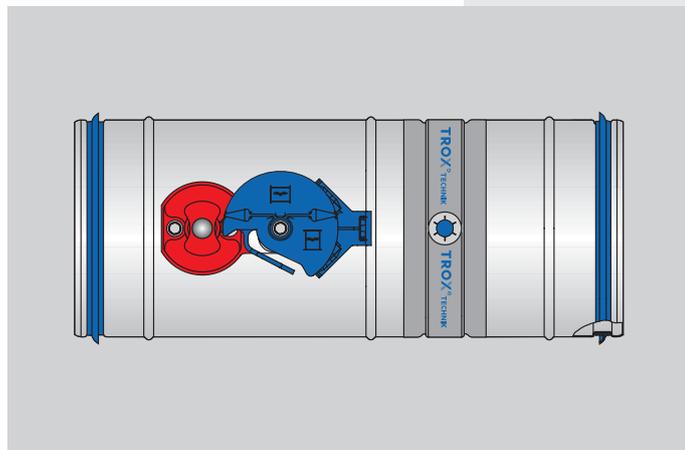
## From the idea to the product

Along the long way from the idea to the finished product, even the smallest modification is retained and filed in outline drawings, design drawings and 3D CAD graphics.

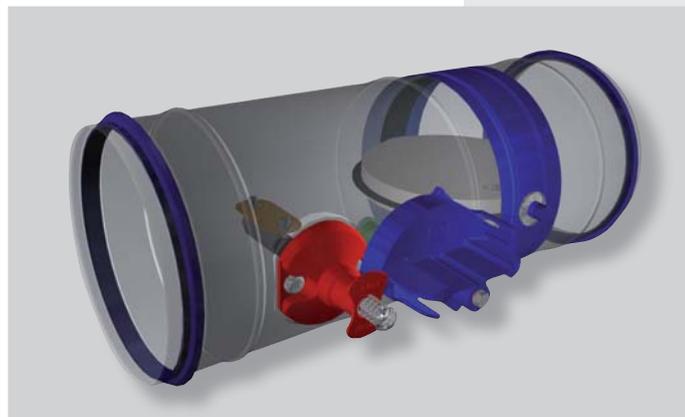
Results from test laboratories are continually implemented in the design plans until finally the finished product is ready for series production.



*First draft*



*Dimensional drawing*



*3D CAD graphic*



*Photo of the finished fire damper*

## Safety for 18 million passengers a year



### Early fire detection and smoke protection at Düsseldorf Airport, Germany

The tragic fire in 1996 at the Düsseldorf Airport, in which 17 people died and many others were injured, has shown that the greatest danger to life and limb in a fire is not high temperatures but the spread of poisonous combustion gases.

This is why, when rebuilding the destroyed Terminal B and the new Terminal C the airport operator placed great emphasis on early detection of fire and keeping evacuation and rescue routes free from smoke. In order to prevent the spread of combustion gases through ventilation ducts TROX fire dampers with additional smoke detectors were installed. All functions of the fire dampers and smoke detectors are linked to the building control systems by TROXNETCOM.

<i>Project:</i>	<i>airport 2000 plus</i>
<i>Owner:</i>	<i>Flughafen Düsseldorf GmbH</i>
<i>Architect:</i>	<i>J.S.K. Dipl.-Ing. Architects</i>
<i>General contractor:</i>	<i>HOCHTIEF AG, Bilfinger Berger AG, Philip Holzmann AG</i>
<i>Building services consultant:</i>	<i>IGK-IGR Ingenieur-Gesellschaft Kruck GmbH</i>
<i>HVAC contractor:</i>	<i>Arge Imtech</i>
<i>Fire protection solution:</i>	<i>Fire dampers with spring return actuators, thermoelectric release mechanism and smoke detectors</i>



*Airport Hamburg, Germany*



*Airport Bilbao, Spain*



*Airport Athens, Greece*

## Ready for emergency

### Retrofit of the Elbe Tunnel in Hamburg, Germany

After the devastating fire catastrophies in the Mont-Blanc tunnel, the Tauern tunnel and the Gotthard tunnel, the EU reacted by enacting the Directive 2004/54/EG „Road Tunnel Safety in the Trans-European Road Network“ which set new standards in regard to fire protection.

A comprehensive retrofit of the first, second and third bore of the 3,325 metre long tunnel was started in early 2009 to comply with the new directive and to improve safety in the Hamburg Elbe tunnel. TROX is supplying 410 tunnel dampers for smoke extract as part of the fire protection retrofit. The dampers are made of stainless steel and must withstand a temperature of 400 °C for 90 minutes.

TROX, with its large number of references, is the ideal partner for compliance with the strict requirements for fire protection. For example, the Mrazovka Tunnel in the Czech Republic and the Vielha Tunnel in Spain were fitted with TROX fire dampers. The ADAC (German automotive society) tunnel test in the „Ventilation“ category rated both tunnels „very good“.

*Project:* Hamburg Elbe Tunnel  
*Owner:* Free and Hanseatic City of Hamburg – LSBG  
*Specialist consultant:* RMN and HBI Planning Bureaus  
*General contractor and HVAC contractor:* Cegelec Anlagen- und Automatisierungstechnik GmbH & Co. KG  
*Fire protection:* tunnel dampers with dimensions from 2,050 mm x 1,600 mm to 500 mm x 6,250 mm



Pörzberg Tunnel, Germany



Soterramiento M-30, Madrid, Spain



Fundación Barredo, San Pedro de Anes, Spain

## Because unique items are irreplaceable

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### High-tech fire protection in the Porsche Museum, Stuttgart, Germany

The Porsche museum contains around 80 legendary sports cars like the 356, the 550, the 911 and the 917 – irreplaceable creations that have made automotive history.

Porsche expects at least 200,000 visitors a year, and therefore fire and smoke protection was given a very high priority.

The 267 actuator-driven TROX fire dampers and the 49 TROX smoke extract dampers are integrated into the centralised building management by TROXNETCOM. As system integrator TROX conducted the commissioning of this high-tech solution.

*Project: Porsche Museum, Stuttgart, Germany  
Owner: Dr. Ing. h. c. F. Porsche AG  
Architect: Delugan-Meissl ZT GmbH, Vienna  
Building services consultant: INTERPLAN GmbH  
HVAC contractors: SIEGLE+EPPLE GmbH & Co. KG, MSR, Honeywell  
Fire protection: TROXNETCOM, smoke detectors, smoke extract dampers, fire dampers*



*IKMZ University Library, Cottbus, Germany*



*Teatro di Roma, Rome, Italy*



*Museum Island, Berlin, Germany*

## Futuristic „City of Wine“ with fire protection for the future



### The „Marqués de Riscal“ in Elciego, La Rioja, Spain

For the Hotel Marqués de Riscal, in the heart of the Rioja wine-growing region, TROX delivered specially designed fire dampers. The functionality of the fire dampers was tested according to ISO graph 834 at 1,070 °C. This means that the damper conform to the rigid Spanish fire resistance class K120 with a fire resistance time of 120 minutes.

The TROX fire dampers conform to the new standard Código Técnico de la Edificación which came into effect in 2008. This means that the fire protection in this futuristic building is ahead of its time.



<i>Project:</i>	<i>Hotel Marqués de Riscal in Elciego, Spain</i>
<i>Owner:</i>	<i>Starwood Hotels &amp; Resorts Worldwide, Inc.</i>
<i>Architect:</i>	<i>Frank O. Gehry</i>
<i>Building services consultant:</i>	<i>IDOM Consultants S.A.</i>
<i>HVAC contractor:</i>	<i>AXIMA Sistemas e Instalaciones</i>
<i>Fire protection:</i>	<i>Fire dampers</i>



*Hotel Emirates Palace, Abu Dhabi, UAE*



*Hotel Leningrad, Moscow, Russia*



*„Hohe Düne“ Hotel, Warnemünde, Germany*

## Renovation during operation

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### Smoke and fire protection in a Deutsche Telekom building in Frankfurt, Germany

Renovation work places particular demands on the fire protection products.

In summer 2006 one of the largest fire protection renovations in Germany was completed. Around 1,250 smoke extract dampers and 700 actuator-driven fire dampers supplied by TROX were installed in the Deutsche Telekom building. The dampers are actuated by TROXNETCOM with 60 controller and power units. Every command is executed in less than one second.

The renovation was conducted while the building was in use. This included very critical technical departments such as international communication and cash card accounting. A failure in any of these systems would have meant the loss of millions of euros.

The renovation was completed in a very short time to the full satisfaction of the customer thanks to the easily installed TROX products.

*Project:* Deutsche Telekom office building in Frankfurt/Main, Germany  
*Owner:* DeTeImmobilien  
*Building services consultant:* Ingenieurbüro Gernet  
*HVAC contractor:* GA-tec Gebäude- und Anlagentechnik GmbH  
*Fire protection:* TROXNETCOM, smoke detectors, smoke extract dampers, actuator-driven fire dampers



Yintai Centre, Beijing, China



Mondrian Building, Brussels, Belgium



Torre Agbar, Barcelona, Spain

## Subsidiaries and sales offices

### Argentina

TROX Argentina S.A.

### Australia

TROX Australia Pty Ltd

### Austria

TROX Austria GmbH

### Belgium

S.A. TROX Belgium N.V.

### Brazil

TROX do Brasil Ltda.

### Bulgaria

TROX Austria GmbH

### China

TROX Air Conditioning Components (Suzhou) Co., Ltd.

### Croatia

TROX Austria GmbH

### Denmark

TROX Danmark A/S

### France

TROX France Sarl

### Great Britain

TROX UK Ltd.  
TROX AITCS Ltd.

### Hong Kong

TROX Hong Kong Ltd.  
TROX AITCS Ltd.

### Hungary

TROX Austria GmbH

### India

TROX INDIA PRIVATE LIMITED

### Italia

TROX Italia S.p.A.

### Malaysia

TROX Malaysia Sdn. Bhd.

### Norge

TROX Auranor Norge AS

### Poland

TROX Austria GmbH

### Romania

TROX Austria GmbH

### Russia

000 TROX RUS

### Sweden

TROX Sverige AB

### Switzerland

TROX HESCO Schweiz AG

### Serbia

TROX Austria GmbH

### Spain

TROX España, S.A.

### South Africa

TROX South Africa (Pty) Ltd.

### Czech Republic

TROX Austria GmbH

### USA

TROX USA, Inc.  
TROX AITCS Ltd.

### United Arab Emirates

TROX Middle East (LLC)

## Foreign representatives

Abu Dhabi

Bosnia-Herzegovina

Chile

Cyprus

Egypt

Finland

Greece

Iceland

Indonesia

Iran

Ireland

Israel

Jordan

Korea

Latvia

Lebanon

Lithuania

Morocco

Mexico

Netherlands

New Zealand

Oman

Pakistan

Philippines

Portugal

Saudi Arabia

Slovakia

Slovenia

Sweden

Taiwan

Thailand

Turkey

Ukraine

Uruguay

Venezuela

Vietnam

Zimbabwe



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The art of handling air

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