



# Cutting-edge Technology

Innovation as the Key to Success

# All About Know-How



## Increasing Knowledge

Being the European market leader in the field of sanitary technology is a distinction, an honour and an obligation all at once. To be able to offer our customers innovative quality products year after year, we have to keep on investing in new developments and continually optimise our existing systems. To this end, Geberit has been highly active in research and development for decades.

## Sources of Inspiration

Much of our inspiration comes directly from our customers. We make sure we are always aware of our customers' needs and expectations, and of any issues they might be experiencing. This two-way communication is a lucrative source of new ideas. Our marketing experts and product managers also observe and analyse market developments. Technology scouts track down

the latest trends, evaluate them and formulate new project proposals whenever they meet viable ideas. This thorough research procedure makes us what we are – one of the most innovative sanitary companies in Europe.

## Integrated Know-How

Our leading position has been achieved thanks to a unique combination of core competences, professional project

management, interdisciplinary teams and state-of-the-art lab and testing facilities. The comprehensive knowledge and capability of our specialists is implemented into every single product, every

conceivable attribute of which is inspected in our labs. This means we not only guarantee security for our planners but we also optimise the simplicity of assembly for the installers, the design for the archi-

itects and the functionality for the end-user – or we integrate our knowledge into groundbreaking new developments. That's what we mean by Know-How Installed.

## Sources of Inspiration for Innovative Products and Systems





# The Innovation Factory

## At the Top

Geberit is a future-oriented, innovative sanitary company, which not only perceives and takes on challenges, but also goes out looking for them. To maintain our innovative strength at a consistently high level, we have established our very own "Innovation Factory". This factory consists of development departments, competency centres and labs, which all work together to produce trend-setting new developments and product optimisations. The Innovation Factory consists of the following units:

- Fluid Mechanics
- Process Engineering
- Future Technology
- Sanitary Technology/Labs
- Materials Technology/Labs
- Acoustics/Construction Labs
- Constructional Fire Protection
- Electronics
- Drinking Water Hygiene
- Standards/Patents/Approvals
- Design/Applications Technology
- Prototype Construction
- Product Management
- Marketing and Sales

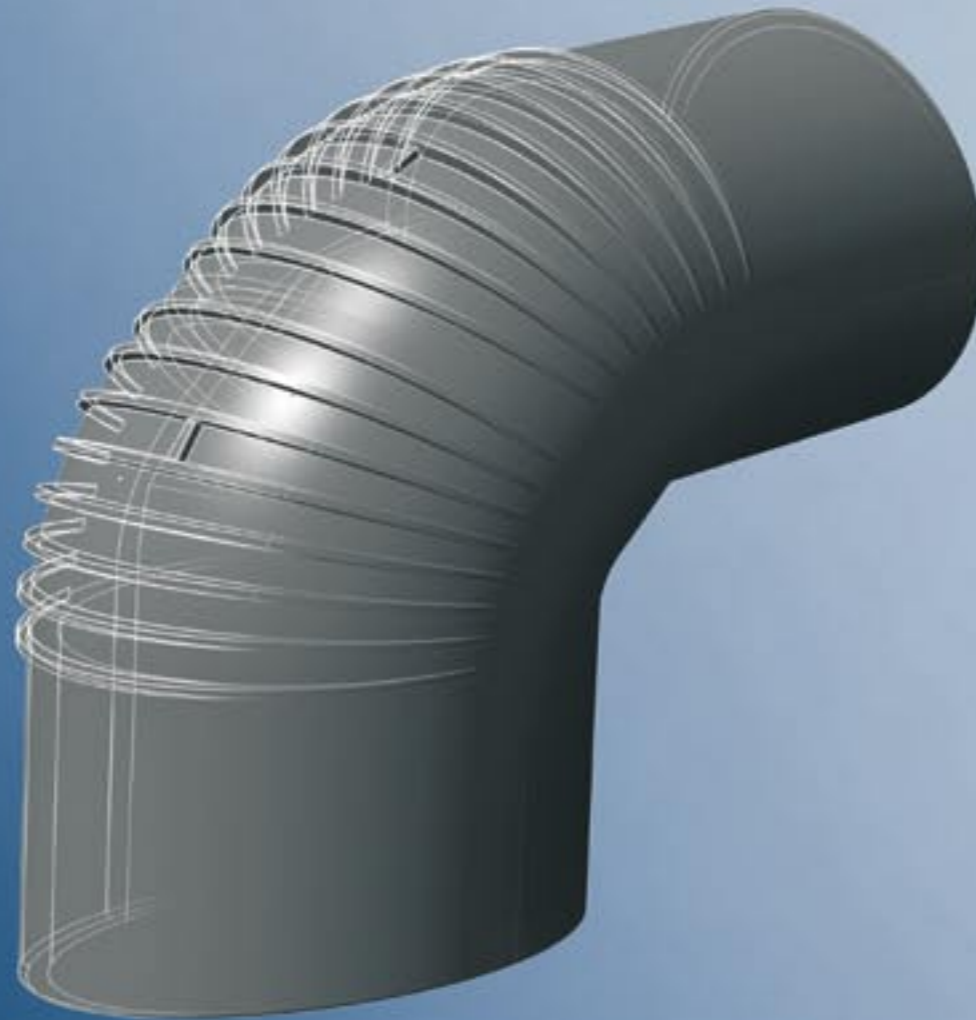
## Innovation Process Development

Innovation Process Development (IPD) is a model we use to structure and enhance many of our development and optimisation projects. The model ensures that the creative potential of our ideas is fully exploited and that developmental activities are aligned to market demands. IPD consists of six phases: ideas development, concept, development, realisation, optimisation and marketing. As part of the internationalisation process, individual competency centres were established in China and the USA for research and development in order to best meet market-specific needs.

Geberit Core Competences and Innovation Process Development (IPD)



## Wild Ideas or Promising Products?



### **Interdisciplinary Project Teams**

After the ideas have been generated and the scope of the project sketched out, project leaders establish interdisciplinary teams including engineers, technicians and designers from development and production as well as specialists from the procurement and product & quality management departments. This team pools its know-how and begins to address how to carry out the project successfully. If necessary, the development teams also exchange ideas with accredited universities, testing institutes and standard committees.

### **Development and Design**

The Design Department is responsible for the design and development of technically well-engineered sanitary products and systems. In this department, the most modern 3-D CAD systems will be used to create new products from the first idea right on up to the start of production.

### **By the Pros, for the Pros**

Application technology represents the interests of the installer in the project team. In cooperation with the product managers and development engineers, the application specialists analyse the construction techniques of various countries, discover trends and implement their knowledge into every phase of the development process.

Before the launch of each and every new Geberit product, the prototypes and pilot series parts undergo comprehensive testing. By doing this, Geberit ensures the simplicity of installation, coordinated interfaces and ensures system compatibility. Learnings from these tests are incorporated in user-friendly installation instructions.



## Everything Flows

### The Miracle of Fluid Mechanics

The flow characteristics of sanitary equipment and systems are a major factor in warranting their reliability and consistent, flawless performance. The department of sanitary technical groundwork works with fluid mechanics to optimise the flow characteristics of all of our sanitary equipment. Using the latest computer-supported simulation techniques (as used in the automotive and space travel industries), fluid processes, water pressure and distribution speed can be virtually reproduced and research carried out. The flow is calculated and optimised even in a complex filling valve before the first prototype is manufactured.

Thanks to these progressive developmental methods, Geberit can produce quiet, water-saving and unprecedented products.

With these virtual development methods, fluid technicians have contributed to a new generation of traps, which are more compact, more capable, cleaner and quieter than their predecessor models. Geberit also supports leading producers of ceramics with fluid-technical product optimisation, providing fluid mechanical enhancements across the entire bathroom solution.

### Facts

#### Optimisations to virtual models

- Simulations of flow processes via CFD (Computational Fluid Dynamics)
- Structure-mechanical analysis via FEM (Finite Elements Method)
- Consideration of fluid-induced component movements (Fluid Structure Coupling)

#### Examination using real prototypes

- Flow visualisation with high-speed cameras (up to 140 000 frames/second)
- Analysis of fluid dynamics using dynamic pressure and acoustics metrics

## Powder or Resin?

### Efficient Prototype Construction

During the developmental phase, the project team works with prototypes and analyses their behaviour. For this reason, prototypes should be constructed to resemble the project product as closely as possible. The prototype construction department forms the interface between the prototype and the serial part and works closely with the project leaders and the design department.

In addition to conventional mechanical processing procedures, the company's in-house 3-D printer ensures quick and flexible prototype allocation, which speeds up the developmental process.

Geberit also makes use of laser sintering (SLS) and stereo lithography (SLA) to create the prototypes. For all of these procedures, the prototype is designed layer by layer using cured powder or cured resin.

### Facts

- Rapid prototyping: generative manufacturing procedure for which the available CAD data is directly converted into work pieces. Geberit makes use of stereo lithography, laser sintering and 3-D printing procedures
- Rapid tooling uses generative technologies to create brand new tool designs for pilot- and low-volume production
- 3-D printing: with the company's in-house 3-D printer, prototypes are designed layer by layer and every layer (0.016 mm) is cured with UV light
- Conventional manufacturing procedures (veering, milling, silicon casting) are always used in cases where requirements on lab testing are high



## 50 Years in 3 Months

### Efficient Sanitary Lab

In the Geberit sanitary lab, new products are tested to ensure functionality, user-friendliness and conformity to a variety of global standards. The sanitary technology department works in close co-operation with product development, universities, testing institutes and standards boards.

### High Demands

If standards are not yet established, the sanitary technology department works with the project team to conduct specific product and durability tests. The demands we have for our products are often more stringent than the standards in place in many of our markets.

### Tested a Million Times

In the endurance testing labs, cisterns, filling valves, actuator plates and taps are subjected to computer-controlled lifecycle testing. During this procedure, the data from the flushing process, for example, of up to 150 cisterns is simultaneously evaluated at a rate of at least 200 000 flushes per cistern. The results of short and long-term testing serve as a guideline for production release and country-specific approvals.

### Put to the Test

In 24 metre high testing towers – the same height as eight standard building storeys – the resilience and dependability of Geberit drainage

systems and the Pluvia roof drainage system are tested under real conditions. In addition, in specially designed labs, Mepla and Mapress pipes, taps, fittings and connection elements are not only subjected to extreme temperature fluctuations, but also to high pressures and enormous force in order to test their strength and resilience.

### Facts

- 800 square metres of laboratories including standardised test setups, multi-functional test stands with custom-made testing software, temperature cycle facilities, endurance testing equipment and special facilities for measuring the susceptibility to fouling and limescale
- Central water preparation (6 levels) for circulation water (maximum performance 2600 m<sup>3</sup> testing water/day, testing pressure 0.1-12.0 bar)
- More than 20 pumping facilities (pressure range 0.1-210 bar) for supplying the test stands
- 4 facilities for temperature change testing for long-term evidence for drinking water systems, instruments and drainage pipes (up to 5000 cold/hot water cycles 93°/20°)
- 500 testing devices (volume flow, pressure, temperature, force, paths, measurement systems), 150 of which are quality-relevant, all of which are recorded and maintained in the testing device monitoring system
- Video evaluation with handycams and high-speed cameras (up to 140 000 frames/second)
- Ceramics stock with 600 sanitary instruments from all over the world



## The Stuff Quality Products are Made of

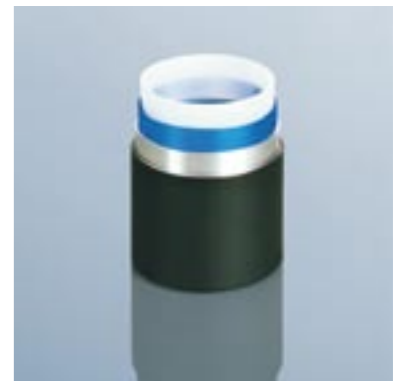
### The Right Materials

The Materials Technology department supports product development by selecting suitable materials and carrying out technical inspections of Geberit product materials before production release. In the materials lab, synthetics and other materials are tested with the latest examination methods for their chemical and technical attributes in order to compile reports on their durability, deformability and service life. Should the performance of standard materials not be sufficient, the department will develop its own. The materials lab works closely together with suppliers, external specialists, universities and testing institutes.

### Intensive Inspection

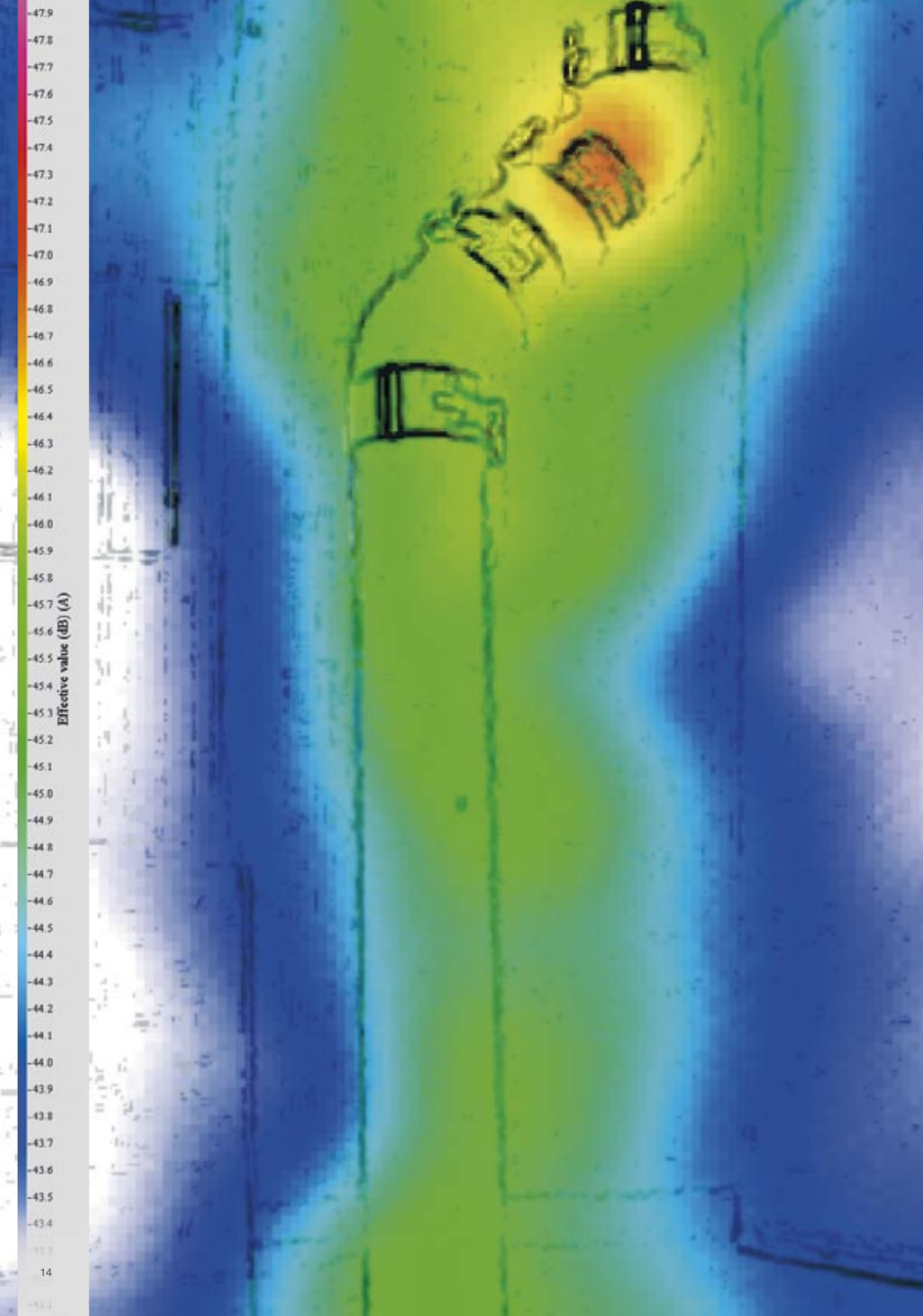
In our state-of-the-art labs, we conduct inspections such as tensile tests, decamping and pressure tests, as well as tests for chemical consistency. Our lab employees search for solutions to ensure our products retain their original functionality and aesthetics, even after many years of use. The consistency and performance of adhesives and caulks, such as those used in Mepla pipes, are also thoroughly tested.

The materials lab contributed significantly to the development of the 3-layer Mepla composite pipe as well as the Silent-db20 drainage system with acoustic insulation.



### Facts

- Compounding lab with Buss-Kokneter for proprietary development of synthetic materials
- Accelerated service life inspection of pipe materials via pressurised water autoclaves
- Long-term inner pressure inspection facility with 70 stations, pressures up to 100 bar, temperatures up to 110°C
- Thermoanalysis and spectroscopic methods such as FTIR for the characterisation of material attributes and material identification
- Complete mechanical and chemical inspection labs
- Thin-film microscopy



## Solid, Fireproof and Quiet

### Acoustics and Statics

In our construction lab, which is unique in Europe, we test both individual components and entire installation systems for their acoustic and static attributes. Highly qualified engineers and specialists apply their expert knowledge and experience to the research and the optimisation of Geberit products. In specially constructed labs, we can, for example, simulate noise transmission, as it would occur in a multi-storey apartment building. This means we can test and improve the acoustic characteristics of not only individual components, but also entire installation systems.

For the structural analysis tests in which the resilience and deformability of Geberit products are tested, we have again produced custom-made facilities and equipment. Tests conducted in special installation boxes show that Geberit prewall systems can withstand static strain of over 100 kg for urinals, over 150 kg for wash-basins and more than impressive 400 kg for wall-hung toilets.

We also test the resilience and deformability of Geberit partition walls under a weight of 20 tons with a force framework custom-made for this purpose.

### Consistent Fire Protection

The fire performance of Geberit products and systems is checked in cooperation with external inspection offices. The "Constructional Fire Protection" department determines the technical foundations of fire protection and demonstrates the efficiency of fire protection measures to development engineers and designers. It tests and evaluates prototypes and serial products. In addition, fire inspections in relation to material class and fire resistance ratings are carried out in respect to the fire protection regulations in place in various countries.



## All for Hygiene

### **Increasing Comfort and Cleanliness**

Geberit Electronics ensures the continuous improvement of hygiene in sanitary rooms, whilst also increasing comfort for Geberit customers. Even in the areas of sensors and actuator engineering, research into innovative solutions is constantly being conducted in order to integrate the technology into new products. While comfort is paramount in the private sector, protection against vandalism and maintenance of hygiene are the highest priorities in the public sector. Automatic flush actuators and touchless washbasin taps in busy public toilet facilities are increasingly popular.

### **Advanced Electronics**

Geberit mainly employs active infrared sensors for touchless control of bathroom facilities. Short-wave infrared emissions detect the presence of people within a precision-defined area. Electronics in sanitary technology necessitate a great deal of technical skill because of the wet room conditions. In this respect, Geberit's experience is hard to beat.

### **Trend-Setting Optimisations**

A glance into the future sees the use of electronic washbasin taps

with remote control where users can communicate with the tap via customary hand-held computers. We also predict a variety of enhancements to remote control options in sanitary facilities, which are equipped for handicapped users. Geberit is also active in microelectronics and continually attempts to simplify electronic circuitry so that it can be more easily integrated into compact, elegant and progressive products.

### **Drinking Water Hygiene is Increasingly Important**

People are also becoming more aware of drinking water hygiene and standards are becoming stricter. In the drinking water hygiene department, experience and information on this topic are being exchanged nationally and internationally via a variety of channels. The department of drinking water hygiene is in close and constant contact with markets and customers, conducts training seminars, produces publications and advises the development department.

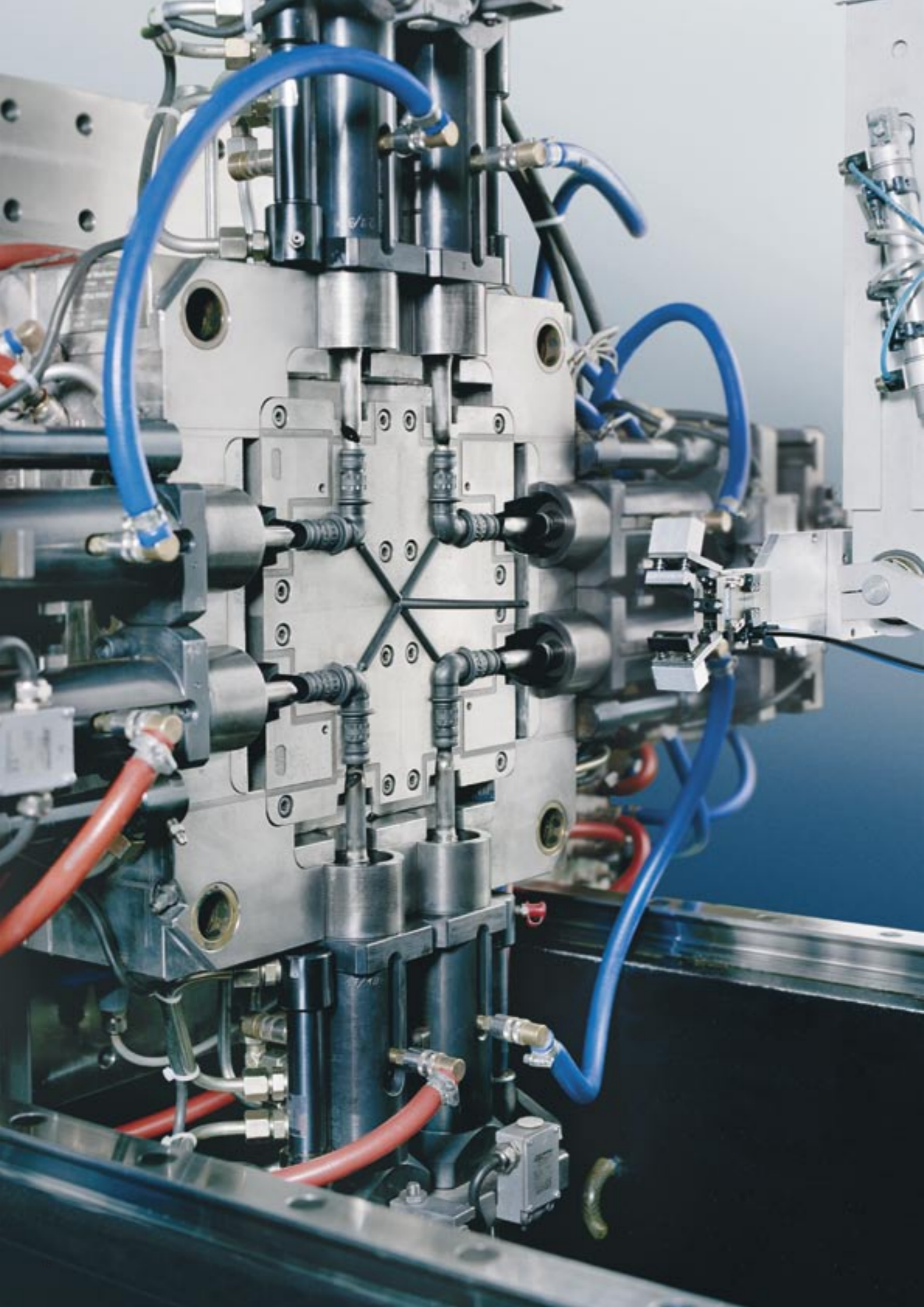
### **Training Seminars based on Practical Experience**

The drinking water hygiene department contributed significantly to the development of the "drinking water tower" in Langenfeld, Germany.



With the opening of this internationally unique demonstration building in 2005, Geberit set a milestone in customer information and training. In the training centre, installers, planners, operators and other interested parties can be instructed practically in numerous aspects of drinking water hygiene which are to be observed with the installation of supply systems in single-family and multiple-family housing as well as in public buildings.

The dissemination of basic and applied know-how is a decisive competitive factor in today's business world and an advantage that Geberit uses by bringing its hygiene competences into service for customers and employees.



## From Sketch to Tool to Product

### High-Precision Injection Mould Tools

Process Technology develops and optimises the procedural and manufacturing processes for new products and evaluates facilities, machinery and tools. It supports product development when selecting suitable materials and advises the department on the form and mechanical design of the components.

### Essential Computer Simulation

Before the first injection mould tools are made, the filling procedure is computer-simulated, with particular attention paid to material smelting and possible form changes after the cooling of the material parts.

The knowledge gained through this process is then implemented into the tool design and assures the production of flawless material parts.

Geberit has over 20 years of experience in filling image recognition, multi-component technology and the calculation of shrinkage and deformation, which facilitates the effective and cost-efficient production of high-precision injection mould tools.

Our modern, automated assembly lines then assemble the individual components for millions of products.



### Facts

- Simulation of the filling image recognition of tool cavities via specialised FEM calculations (Cadmould)
- Thermal tool design
- Optimisation of tool/machine combinations
- Mechanical design of the components as well as the calculation of shrinkage and deformation
- Continuous quality monitoring via internal tool pressure measurement (PROMON)



## Always One Step Ahead

### Groundbreaking Tests and Trends

Our Future Technologies department researches, evaluates and develops new materials, surface technologies and procedures. The results of their applied research and foundational work may be implemented into numerous product lines. The department seeks inspiration directly from customers and markets, but also conducts its own scientific and technological research. For testing which cannot be carried out in the company's own labs, the department collaborates with accredited universities and testing institutes.

### Functional Surfaces

By using chemical or physical procedures, construction part surfaces or products can be modified to attain attributes, which the untreated surface does not have. Such functional surfaces can provide, for example, enhanced durability, active dirt and limescale repulsion, easy cleaning or even give the surface germicidal properties. Our future-oriented technicians make use of the latest developments from the field of nanotechnology. An additional example of trend-setting services from this department is the exploration and development of innovative metallisation processes.

### Sanitary Technology of the Future

Recognising trends, setting trends, actively designing the future: our developers and engineers are already working meticulously on new technologies for innovative bathroom concepts because we are certain that the bathroom of



tomorrow will look different and will need to meet new demands. Sanitary elements may be moved away from the wall towards the middle of the room. The borders between living rooms, bedrooms and bathrooms may well become less defined. Sanitary elements are continually developing into more multi-functional furniture units. In order to be able to turn such concepts into reality, innovative technical solutions are required.

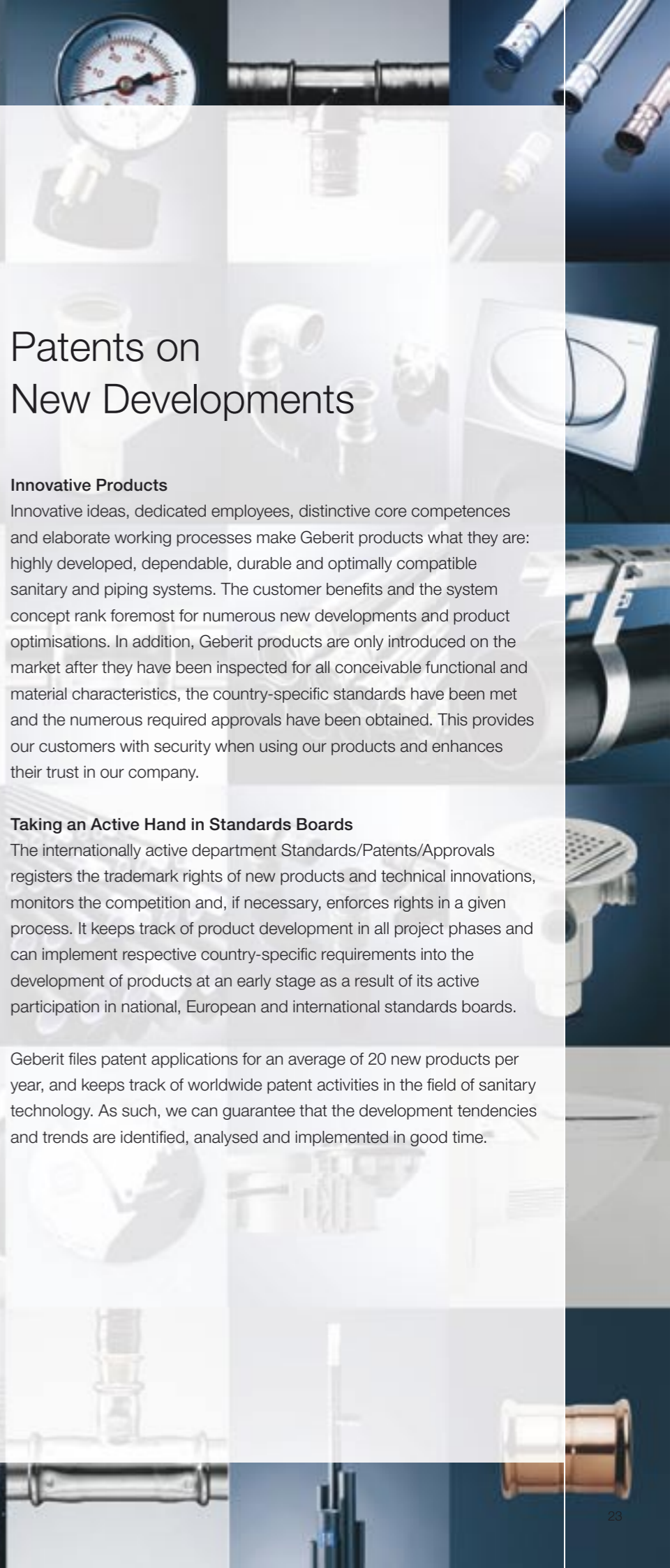
### Facts

#### Groundbreaking tests and trends

- Abrasion and wear tests as per automotive and electronic device inspection standards
- Inspection of drinking water after contact with pipeline materials
  - Smell inspection with test persons and an electronic nose
  - Identification of washed out substances with gas-chromatography/mass spectroscopy
- Work in international work groups on the topic of "European Approval Procedures for Building Products in Contact with Drinking Water" (European Acceptance Scheme, EAS)

#### Functional surfaces

- Chemical functioning of surfaces
- Metrological examinations and mathematical modelling of deposition procedures



# Patents on New Developments

### Innovative Products

Innovative ideas, dedicated employees, distinctive core competences and elaborate working processes make Geberit products what they are: highly developed, dependable, durable and optimally compatible sanitary and piping systems. The customer benefits and the system concept rank foremost for numerous new developments and product optimisations. In addition, Geberit products are only introduced on the market after they have been inspected for all conceivable functional and material characteristics, the country-specific standards have been met and the numerous required approvals have been obtained. This provides our customers with security when using our products and enhances their trust in our company.

### Taking an Active Hand in Standards Boards

The internationally active department Standards/Patents/Approvals registers the trademark rights of new products and technical innovations, monitors the competition and, if necessary, enforces rights in a given process. It keeps track of product development in all project phases and can implement respective country-specific requirements into the development of products at an early stage as a result of its active participation in national, European and international standards boards.

Geberit files patent applications for an average of 20 new products per year, and keeps track of worldwide patent activities in the field of sanitary technology. As such, we can guarantee that the development tendencies and trends are identified, analysed and implemented in good time.

## Know-How Installed

Geberit is the European market leader in sanitary technology. This is no accident. We continuously focus our knowledge on innovations. We exploit synergies and in so doing, optimise the performance of entire systems. In so doing, we set the standard for the entire sanitary industry with our state-of-the-art products. That's what we mean by Know-How Installed.

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