The first industrial application for HOBAS Pipes was as penstocks for hydroelectric power stations in the 1960s. It was not however long before they were also used in the wastewater sector. The reasons are obvious: low weight and practical push-on couplings for easy installation, inner surface as smooth as glass for good flow characteristics and virtually no maintenance, high quality resins for excellent chemical resistance and a service life of more than fifty years. In other words, HOBAS Pipes are ideal for wastewater systems and have consequently been in use since the 1970s. Time has not stood still and ongoing developments in materials, manufacturing, joining and installation methods have made HOBAS the most universal supplier of pipe systems today.

What has basically remained the same is the centrifugal casting process: HOBAS GRP Pipe Systems are made of chopped glass fibers, thermosetting resins such as for example unsaturated polyester or vinylester resins, and reinforcing agents. The pipe wall is built up step by step from the outside inwards in a rotating mold. Once all the materials have been fed into the mold, the speed of rotation is increased. Spinning at an acceleration of up to 75 g presses the material against the mold wall, which removes the gas, compacts and cures it. This centrifugal casting process ensures that the pipes are circular, void free and have an uniform wall thickness over their entire length.

Thanks to the three-dimensional chemical bonding of the resin as a thermoset, the pipe retains its stability even in very warm environments. One of the benefits of composite material technology is that the products’ strength properties can be designed for the specific load directions required. In addition, HOBAS Pipe Systems react to unexpected excessive loads by deflecting; the pipeline therefore reliably remains intact.

Last but not least, the extremely resin-rich inner layer of at least 1 mm guarantees that our products comply with the stringent safety regulations applying to sewer operation and feature a particularly long service life. Where various different materials had to be used in order to meet load, operation and installation requirements, HOBAS supplies a complete system from a single source – nothing but the best for our customers!
Highest Quality, Eco-Friendly

Technical Data
The most important raw materials for HOBAS Pipes are polyester resin, chopped glass fiber and mineral reinforcing agents. Resin envelopes all the components and creates a bond between them. HOBAS Pipes have the following characteristics, depending on the design:

<table>
<thead>
<tr>
<th>Physical Properties</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Density</td>
<td>~ 2000 kg/m³</td>
</tr>
<tr>
<td>Linear expansion</td>
<td>26 - 30 x 10^-6 1/K</td>
</tr>
<tr>
<td>Thermal conductivity</td>
<td>0.5 - 1.0 W/m²</td>
</tr>
<tr>
<td>Tensile elastic modulus at 23°C (circumferential)</td>
<td>10000 - 15000 MPa</td>
</tr>
<tr>
<td>Specific volume resistance</td>
<td>&gt; 30 x 10^9 Ω</td>
</tr>
<tr>
<td>Surface resistance</td>
<td>9.6 x 10^10 Ω</td>
</tr>
<tr>
<td>Flexural strain at break, long-term (strain corrosion test pH 0.1 and pH 10)</td>
<td>min. 1 %</td>
</tr>
</tbody>
</table>

Dedicated to Environmental Protection and Occupational Safety
The environmental management system in place at HOBAS Organizations conforms to the strict requirements of the ISO 14001 standard. We see the continuous improvement of our environmental protection measures as part of our corporate social responsibility and the HOBAS Group has therefore set itself the goal of improving our eco-balance year by year. Cost- and energy-efficient management of raw materials and production processes is a matter of course for us, as is minimizing resource use and any impact on the environment.

The HOBAS Group also follows the international standard OHSAS 18001 (Occupational Health and Safety Assessment Series), which provides a comprehensive system to improve planning, implementing and monitoring the legally required work safety measures in order to sustainably reduce accident risks. In combination with ISO 14001 and 9001, OHSAS 18001 represents an extensive and standardized management system in the areas safety, environment and quality.

Top Quality
Certified by independent institutes to various international standards, the HOBAS Plants ensure that the finished products meet the highest customer specifications. Compliance with ISO 9001 as well as uniformly high quality standards are key features of HOBAS Products and firmly rooted in the corporate philosophy. Continuous quality control from incoming raw materials through finished products is carried out by our experts and monitored by external testing agencies.

Our comprehensive quality control program meets international standards and takes special customer specifications into consideration. HOBAS holds the octagon quality mark issued by Germany’s TÜV technical service and many other approvals. Auditors from renowned certification companies and our specialists in the HOBAS R&D departments, application engineering and installation teams ensure that you can rely on consistently high, uniform quality no matter from what country the pipes are delivered to you – without any ifs or buts.

Pipe Wall Structure*
1. External protective layer
2. Outer reinforced layer (glass fiber, thermosetting plastic)
3. Transition layer (glass fiber, thermosetting plastic, sand)
4. Reinforcing layer (sand, thermosetting plastic, glass fiber)
5. Transition layer
6. Inner reinforced layer
7. Barrier layer
8. Inner pure resin layer

*Schematic illustration of in reality seamlessly merged pipe wall construction. Layer design is adapted to suit requirements set by e.g. the conveyed medium, installation method, pressure, external forces, etc.
Resistance and durability are probably the most important demands placed on sewer pipes. Selecting a suitable pipe material is therefore essential, above all to prevent corrosion damage on the pipeline. What also has to be taken into consideration is that the pipeline’s service conditions can change substantially throughout its life. Demographic changes, fluctuating water consumption or alterations in people’s habits are just some of the aspects that can have an impact on the sewage composition.

A particular danger in wastewater systems is biogenic sulfuric acid corrosion. It is caused by bacteria converting sulfates in the sewage into sulfuric acid with a very low pH-value, which attacks concrete and steel. Made of GRP, HOBAS Sewer Pipes have a very high resistance to acids in sewage. To provide our customers with the best possible quality, experts at the HOBAS Research and Development Center in Wietersdorf (Austria), the HOBAS TechCenter, constantly carry out tests for chemical resistance. Of particular significance for the simulation of practical operating conditions is the strain corrosion test. It involves subjecting the pipe to a combined, extreme load consisting of external forces and sulfuric acid. Inadmissible structural loads are therefore simulated while the surface is exposed to concentrated sulfuric acid at the same time. HOBAS Pipes achieve excellent results on this internationally standardized test with an outer fiber strain of 1.1% (50-year figure). Our customers can therefore trust in higher long-term safety factors for the typical loads experienced in sewer operation than with other materials.
Properties and Benefits

- Design drawing on decades of experience in pipe manufacture and installation
- Perfect dimensional accuracy
- Variable pipe lengths (to customer specifications)
- Low weight and practical push-on couplings for high installation rates
- High abrasion resistance (inside and outside)
- Very smooth inner and outer surfaces ($k \leq 0.016$ mm)
- Low-absorption on outer surface
- High stiffness classes available
- Angular deflection possible in couplings
- Very long service life of more than 50 years
- Installation possible irrespective of weather conditions
- Complete pipe system including manholes and fittings
- Simple cutting, also on site
- Leak-tight pipe wall and joint
- Little incrustation and sludge deposits
- Not sensitive to frost and high temperatures
- UV resistance
- Corrosion resistance
- High structural load capacity

Installation Methods
In whatever way you are planning to construct your pipeline, HOBAS Products are definitely the right choice and deliver convincing results for every conceivable installation method:

- Open-cut installation
- Trenchless installation by jacking
- Trenchless pipe rehabilitation by relining
- Above ground installation on bedding
- Above ground installation suspended under bridges
- Installation in tunnels
- Sea outlets
HOBAS® System Solutions - Your Complete Package

Pipe Diameter - from Tiny to Titanic

HOBAS Sewer Pipes can be supplied in the following sizes:

<table>
<thead>
<tr>
<th>Available diameter DN*</th>
</tr>
</thead>
<tbody>
<tr>
<td>150 400 650 900 1280 1600 2160 3270</td>
</tr>
<tr>
<td>200 450 700 960 1348 1720 2200 3600</td>
</tr>
<tr>
<td>250 500 750 1000 1400 1800 2400</td>
</tr>
<tr>
<td>300 550 800 1100 1500 1940 2555</td>
</tr>
<tr>
<td>350 600 860 1200 1535 2000 3000</td>
</tr>
</tbody>
</table>

* Other diameters on request.

HOBAS Sewer Pipes are produced in standard lengths of 1, 2, 3 and 6 meters (tolerances to company standards). Other pipe lengths can also be supplied on request.

HOBAS Couplings - and Pipes Stay Sealed!

FWC Couplings (FWC) are used as the standard means of joining HOBAS Sewer Pipes. This coupling consists of a GRP sleeve with a full-width rubber gasket (EPDM). It means that the couplings mounted on one end of the pipe at the factory are verifiably leak proof and the pipes only have to be pushed together on the construction site. The well-designed HOBAS FWC Couplings enable higher installation rates and are also used as standard for the various HOBAS Pressure Pipes.

The DC Coupling is used for smaller diameters. It consists of a GRP sleeve with EPDM sealing rings.

The mechanical coupling consists of a stainless steel sleeve with a mechanical screw connection and an EPDM gasket seal and is primarily utilized for subsequently mounted structures.
**HOBAS® Fittings and Shafts**

- Bends
- Tees
- Pipe Junctions
- Saddle Junctions
- Masonry Couplings
- Flanges
-Reducers
- Manholes
- Tangential Shafts
A combined sewer collects sanitary sewage and stormwater runoff in a single pipe system. During dry periods the system functions like an ordinary sewer system, but whenever heavy rainfalls occur it has to cope with additional water quantities. In order to avoid the surcharge or flooding of the sewage systems, sewer overflows are installed to discharge a part of the combined sewage into a storage system (e.g. stormwater retention tank) or directly into a receiving water course.

In cooperation with the CVUT University Prague, HOBAS developed a particularly efficient GRP overflow system for combined sewers: The HOBAS CSO Chamber separates suspended solids from the wastewater very efficiently and directs them to the wastewater treatment plant, while the cleaned part of the water is discharged into the receiving water course.

The system is based on a design which has been verified by means of a mathematical CFD (Computational Fluid Dynamics) model and a physical model. Through this basic model, flow analyses for various flow rates and dimensions can be simulated and optimized. The model has been repeatedly verified by laboratory tests and actual projects. Each HOBAS CSO Chamber is individually designed and optimized according to the specified requirements.
The sewer authority in the district of Gleisdorf (eastern Styria, Austria) put a combined sewer out to tender in 1979. What was planned was a rectangular channel with a gradient of 2 ‰ and a depth of up to 4 m as well as an egg-shaped section with a gradient of 1 ‰ and a depth of up to 4.2 m. Fortunately, the building contractor thought outside the box and submitted an alternative quotation with HOBAS GRP Sewer Pipes in DN 1200 and DN 1600. Although pipes made of glass reinforced plastic were not very well known at that time, the benefits of HOBAS Products convinced the client and the project was implemented with HOBAS Sewer Pipe Systems.

Time passed and over 30 years later an authorized and accredited testing company set about inspecting the sewer system. Primarily testing for leak tightness, they found no fault with the HOBAS Pipe Systems: "The positive test results – all the lines are leak-tight – show that we made the right decision", says engineer Scharnagl, general manager of the Gleisdorf basin sewer authority, in a testimonial. As no problems whatsoever occurred in service with what was then a little known pipe material, the sewer authority installed many more kilometers of HOBAS GRP Pipes in the years that followed. "And everything to the sewer authority’s total satisfaction", adds Scharnagl delighted with the excellent quality of the HOBAS Sewer Pipes.

**HOBAS® Sewer Pipes Impress Testing Company, AT**

<table>
<thead>
<tr>
<th>Year of Construction</th>
<th>Stiffness Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1979</td>
<td>SN 5000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Total Length of Pipe</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>935 m</td>
<td>Sewer</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Special Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>DN 1200 and DN 1600</td>
<td>Long service life; problem-free, quick installation; the lines are leak-tight after over 25 years in use</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pressure Class</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PN 1</td>
<td></td>
</tr>
</tbody>
</table>
Once upon a time there was a little river that wound its way through the scenic countryside in southern Poland. In the course of time however more and more wastewater was discharged into it until the small river turned into an open sewer, posing a considerable threat to the environment. Only ten percent of its water came from the source and 90 percent consisted of storm water and wastewater. It was time to act!

Because of the high level of pollution and resultant unpleasant odor, the Rawa was routed through underground channels in the 1970s and 1980s. In 2008 the authorities finally started restoring the river. The core idea of the project was to pipe the water, convey it to the wastewater plant, treat and return it to the river.

First the client and the planning office compared the various alternatives in depth. They initially contemplated using concrete, but soon rejected the idea. The soft soil could have led to subsidence and subsequently structural damage, which would have required additional shoring making the concrete solution too expensive. The choice finally boiled down to polyethylene (PE) and glass reinforced plastic (GRP). Comparing the investment involved, the HOBAS GRP Option proved to have considerable advantages, especially thanks to the easier installation. Also in view of the subsequent operating conditions, HOBAS definitely had the edge. Given that most of the sewer was only to have little cover, it would have to withstand great differences in temperature and other loads. GRP as a thermoset displays far superior properties in relation to structural load capacity under the influence of temperature and thermal expansion than PE.

Having taken the technical and economic advantages into account, the client awarded HOBAS the contract to supply the pipes for this challenging project. Before installation, the contractor stripped the top soil up to a meter under the pipe bed, removed the earth contaminated by the polluted water and replaced it with new material. The Rawa now flows through the HOBAS Pipes to the treatment plant and the unpleasant odor in the surrounding area is a thing of the past. At the wastewater plant, the water is treated before being returned to the natural river bed - and the local residents are delighted to have a recreational area with a clean river.
Preferred for Wastewater Treatment Plants

**HOBAS® Pipe Systems: A Material for Any Challenge**

Treatment plants form the core of every wastewater disposal system. The wastewater is collected in sewers and conveyed to the plants where it is treated in several stages. Inside a sewage plant, the pipelines have to meet various demands. In the past, different materials were used, depending on whether the pipes were for intake lines, lines between treatment basins, sludge dewatering lines, air lines, etc. HOBAS GRP Pipes can reliably meet all these diverse requirements, making them the frequent and ready choice for use in wastewater treatment plants for many decades.

It is not just its functionality and diversity that make the HOBAS Pipeline System a particularly suitable material for wastewater treatment plants, but also its benefits in planning and installation that positively eclipse alternative materials. Hardly any other material can meet so many requirements at the same time: The pipes are ideal for use as sewer and pressure pipelines for wastewater, sludge dewatering, pressure aeration and many other areas. The HOBAS Fitting range, including manholes, provides complete system solutions. Custom-made fittings are also manufactured simply and flexibly in all shapes and sizes (e.g. culverts, various reducers for large diameters, etc.).

In the wastewater treatment plant sector, HOBAS has extensive experience enabling our experts to support both the planning office and the construction company. As a result, even highly challenging projects can be implemented quickly and easily with custom-made products. In such cases the contractor only has to join the pipes with push-on couplings - a great advantage over welded structures where the weather conditions play a role. It is therefore not without reason that HOBAS Pipes are used frequently and readily, proving their outstanding quality in a large number of wastewater treatment plants in various countries around the world.

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**Use**
- Since the 1970s

**Diameter**
- DN 150 - 3000

**Locations**
- Around the world

**Application**
- Pipelines for sewage plants

**Special Features**
- Various applications
- One material, quick and easy installation,
- HOBAS Experts provide professional advice on all aspects of the project, complete range of fittings
The Hobas technology is owned and licensed worldwide by Amiblu. Find more information and contact details at www.amiblu.com.