HOBAS®
Jacking Pipes
Trenchless Construction - Pushing for a Better Future!

Advantages of Trenchless Technology

- No open trenches required – pipes are installed without the general public noticing.
- Towns and landscapes are not affected by the construction work.
- Falls in water table level, which affect vegetation, can be prevented.
- The amount of soil that needs to be excavated and disposed of is comparably small.
- No special storage areas are needed for materials and equipment.
- Road traffic is not disrupted.
- Pipes can be installed irrespective of the weather.
- Residents and nature are protected against noise, dirt and vibrations.
- There is substantially less damage done than with the open-cut method.
- Carbon emissions are considerably lower during construction and from traffic, as congestion can be prevented.
Decades of Experience

The vision of remote controlled machines installing pipes under ground emerged towards the end of the 1970s. It was not just wishful thinking, as only shortly after, the first field test saw HOBAS DN 800 Pipes jacked into a 10 m high embankment. In Japan, remote controlled machines with hydraulic spoil removal already existed at the time – ideal for jacking HOBAS Pipes. The first project using GRP jacking pipes and remote-controlled jacking machines was carried out as part of a research project in Hamburg. In 1982, pipes with an external diameter \( D_e \) of 752 mm (pipe length: 2,980 mm, wall thickness: 50 mm) were installed using a modified Iseki microtunneling machine without any problems from start to finish.

This experience was so inspiring that initial projects in the man-entry diameter range soon followed. In the 1980s, over 100 km of GRP pipes for interceptors were installed in Baghdad using the open-cut method. One of the contractors proved far-sighted and installed part of his section – 500 m of HOBAS GRP DN 1800 Pipes – by jacking. The results were so encouraging that a further 1,050 m of GRP DN 1200 pipes were jacked in this construction project.

A little later, in 1986, 760 m of DN 1400 GRP pipes and 370 m of DN 1600 were installed in clay and sandy soils in Houston, Texas, using American jacking machines with auger spoil removal. No intermediate jacking stations were required for lengths of up to 143 m and the jacking forces were usually much lower than anticipated.

Within a matter of a few decades, GRP jacking pipes have gained a firm foothold in trenchless technology and today HOBAS manufactures jacking pipes up to a diameter of 3.6 m.

Innovative Centrifugal Casting Process

HOBAS GRP Pipe Systems are made of chopped glass fibers, thermosetting plastics such as for example unsaturated polyester or vinylester resins, and reinforcing agents. These components are enveloped by the resins that create a bond between them. In a rotating mold, the pipe wall is built up layer by layer from the outside inwards. Once all the materials have been fed into the mold, the speed of rotation is increased. High centrifugal forces up to 75 g press them against the mold wall. Any trapped gas is fully vented and the raw materials are condensed to a maximum, creating a high quality, very solid and void free pipe wall. This centrifugal casting process ensures that the pipes are circular, the wall thickness is uniform over the entire length at exact outer diameter, and the material displays the high longitudinal compressive strength that is particularly important for jacking.

Thanks to the three-dimensional chemical bonding of the thermosetting resin, the pipe retains its stability even in very warm environments. One of the benefits of composite material technology is that the pipe’s strength properties can be customized to suit the specific load directions required.

The sandwich construction of the wall thus ensures that HOBAS Pipes can also withstand high loading without any trouble and boast a particularly long service life. Nothing but the best for our customers!
Material Properties & Outer Diameter

The composite used for HOBAS Products has the following properties (for specific project-related values, please contact our technical service):

<table>
<thead>
<tr>
<th></th>
<th>Short term</th>
<th>Long term</th>
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<tbody>
<tr>
<td>Density</td>
<td>2,000 kg/m³</td>
<td>2,000 kg/m³</td>
</tr>
<tr>
<td>Circumferential flexural modulus</td>
<td>12,000 MPa</td>
<td>4,800 MPa</td>
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<tr>
<td>Flexural strain at break, circumferential</td>
<td>1.0 %</td>
<td>0.8 %</td>
</tr>
<tr>
<td>Axial compressive strength</td>
<td>90 MPa</td>
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Given their high stiffness and smooth outer surface, HOBAS Jacking Pipes are also suitable for very long drives. Over 900 m have for example been jacked with HOBAS Dₑ 3000 Pipes.

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

HOBAS Jacking Pipes are joined with the following flexible and tight couplings, depending on project requirements:

**GRP Coupling**
The coupling sleeve is made of glass fiber reinforced polyester resin.

Primarily used for larger diameters, it features a sliding seal for leak tightness.

**Stainless Steel Coupling**
The stainless steel coupling consists of a stainless steel ring with an EPDM seal firmly attached to it.

It is used on pipes that are smaller or medium in diameter.

**FW Coupling (FWC) for Pressure Jacking Pipes**
The FW Coupling consists of a GRP sleeve with a permanently fitted, full width EPDM gasket seal.

This coupling is used on HOBAS Pressure Pipes of various nominal pressure ratings.
Supplementary HOBAS® Products

Upstream and Downstream Pipes for Intermediate Jacking Stations
An intermediate jacking station is often used when jacking forces for the complete drive are expected to exceed the capacity of the main jacks due to the soil conditions or drive lengths. It enables the complete pipeline to be divided into more easily jackable sections. HOBAS supplies upstream and downstream pipes specially manufactured for intermediate jacking stations to customer specifications. The dimensions of the pipe ends are tailored to the steel cylinder used. They are joined with double seals on the downstream pipe and usually lubricated.

Lubrication - Injection Nozzles
Injection nozzles serve to pump lubricant and/or drilling fluid between the jacking pipe and the soil. HOBAS integrates these nozzles made of a corrosion-resistant material into the pipes. The injection nozzles are securely fitted, have a female thread, and a plug for sealing. Jacking companies specify the number, size and location for each project; ¾” to 1½” openings are generally used.

Manholes for Jacking Sites
HOBAS Standard or Tangential Manholes can be installed after jacking – for example where intermediate jacking stations have been removed. The manhole design is customized to suit the actual location and height constraints of the pipeline involved. Apart from this, tangential manholes can of course also be placed on the jacked pipeline.

HOBAS Manholes are supplied as complete components without requiring any protective coatings or sealing. They can be connected to other materials without any problems and installed quickly and easily.
Uncompromising Quality and Service

**HOBAS® Quality:**
Nothing but the Best!
The quality, environmental and safety management systems in place at the HOBAS Subsidiaries comply with the latest requirements of ISO 9001, ISO 14001 as well as OHSAS 18001 and are certified by independent institutes. Uniform high quality standards are a key feature of HOBAS Products and firmly rooted in the corporate philosophy. The quality management system covers all areas in each company, including product development, quality control processes, shipping, and service – what you receive is consistent high quality without any ifs and buts.

Our comprehensive quality control program not only meets international standards but also 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 bodies keep a permanent check on us, carrying out tests and inspections. Our internal HOBAS Quality Control Program also includes the following quality assurance measures:

- Testing raw materials
- Testing semi-finished products
- Testing services
- Technical release for production
- Strength tests on finished products
- Visual and dimensional inspection of finished products
- Hydrostatic and hydrodynamic tests
- Calibration of instruments
- Ensuring the identification and traceability of products
- Checking planning processes and design
- Checking suppliers

Our HOBAS Experts at the research and development departments, application engineers and installation teams are highly qualified. State-of-the-art technical equipment and cooperation with internationally recognized institutes and experts are your guarantee for comprehensive, top quality service.

**Reliable Service**
As system supplier, HOBAS attaches great importance to service. Our experts will support you to ensure that your project runs smoothly – from initial planning right through to completion. HOBAS is committed to providing customers worldwide with a broad range of products and professional support.

This includes:

- Technical advice for planning, installation, and rehabilitation
- Static calculations to various regulations
- Hydraulic calculations
- Design and drawings for manholes and special constructions in 2D and 3D
- Consultancy, training and support for contractors
- Installation services
- Technical documentation and information material
- Development of tailor-made fittings and special pipes
- Logistics service

Our engineers can provide feasibility studies and accurate technical drawings so that you can be sure you have selected the right material. Hydraulic and static calculations are just as much part of the service as are HOBAS Pipe Consultants on site during construction work to ensure that even the most difficult challenges can be overcome without a hitch.
Jacking **HOBAS**® Pipes: Impressive Benefits

**High Compressive Strength**
HOBAS Jacking Pipes feature high compressive strength and, compared with conventional materials, a good ratio of wall thickness to inside diameter. Smaller outer diameters and lower weight are the resultant advantages. Where outer diameters are comparable, HOBAS Pipes have larger inner diameters and – thanks to the particularly smooth inner surface – display unbeatable hydraulic characteristics.

**Smaller Outer Diameter – Lower Machine Costs**
The smaller outer diameter in relation to comparable inner diameter leads to an array of advantages. Smaller machines are required for the pipes, for example, which means less equipment and lease costs. This results in considerable savings for larger diameters in particular, especially if the equipment class does not have to be changed. In addition, the costs for construction site and thrust pit preparation can also be substantially reduced.

Smaller Outer Diameter – Less Excavation
A smaller outer diameter requires a smaller borehole, which in turn means less soil to be excavated, carried away and disposed of. Compared with alternative materials, HOBAS Pipes can reduce spoil by more than 50 percent, depending on the pipe diameter. What is more, less bentonite is used for lubricating smaller outer diameters and smoother surfaces, thus further reducing costs.

**Lower Jacking Forces Required**
Given that the outer surface is impermeable, HOBAS Jacking Pipes only absorb very little water and do not adhere to damp soil material. There is therefore comparatively low resistance when jacking is initiated, even after longer standstills. HOBAS Pipes’ smooth outer surface is also a guarantee for low friction during jacking, thus enabling impressively long drives without the need for intermediate jacking stations.
Further Benefits of HOBAS Pipes:

- Pipe design, manufacture, and installation are based on decades of experience
- Perfect dimensional accuracy
- Variable pipe lengths (to customer specifications)
- Low weight and practical push-to-fit couplings
- High abrasion resistance (inside and outside)
- Very smooth inner and outer surfaces (k ≤ 0.01 mm)
- High chemical resistance
- High jacking forces possible
- Low-absorption of outer surface
- High stiffness
- Angular deflection possible in couplings
- Even force transmission without timber joint packers (ideal for curved jacking drives)
- Very long service life of more than 50 years
- Installation irrespective of weather conditions
- Complete pipe system including manholes and fittings
- Simple to cut and adjust, also on site
- Absolutely no infiltration
- Easy handling

On the following pages you can assure yourself of the advantages and receive an impression of the technical challenges you can meet with HOBAS Jacking Pipes. The reference projects describe pipes installed around the world and include some very old projects, jacking very large diameters, pressure as well as curved pipe jacking, and trenchless installation in sensitive areas such as under a railroad.
HOBAS made its debut with Centrifugally Cast GRP Jacking Pipes in 1982. Before then, the pipes had only been used on some test construction sites in northern Germany for drives of up to 50 meters. The world’s first large and technically demanding jacking project with GRP products was undertaken at Hamburg’s port.

A sewer was to be installed under a very busy part of the port in the north of Germany. The specifications were challenging: a fire service exit, port railway and federal railway lines were not to be disrupted under any circumstances and settling had to be prevented over the entire length of the pipeline. Given the fact that trenchless construction saves space and is highly accurate, jacking was truly predestined for this application. The HOBAS Products’ corrosion resistance also to aggressive wastewater, their smooth outer surface and easy handling persuaded the clients and they ordered jacking pipes with an outside diameter of 752 mm and wall thickness of 50 mm. The pipes were installed six meters under the groundwater table in two drives over a length of 165 meters without any intermediate jacking stations.

Although their outer surface is very smooth, the HOBAS Pipes were lubricated with bentonite every 30 meters to reduce friction and speed up the jacking process. It is hardly surprising therefore that the greatest jacking force applied was only 1700 kN, which is far less than the limit for the pipes. What is also remarkable is the great precision with which the HOBAS Pipes were jacked through the silt and clay soil under the groundwater table at that time: the pipeline only deviated 15 mm from the planned route over a length of more than 100 meters, thus remaining well below the specified tolerance.

The facts sounded spectacular then but are now exceeded many times over. In 2009, HOBAS supplied D₆ 3000 jacking pipes that were installed without using the intermediate jacking stations in sections of almost a kilometer.
The project to establish the collector leading to the new wastewater treatment plant Czajka in Warsaw was broken down into three sections. The first is 5,714 m long and was realized with HOBAS Jacking Pipes Dₜ 3000 which were installed along the right side of the Vistula river, whereas 1,400 m HOBAS Pipes Dₜ 3000 pipes were laid within the second part and on the left river bank. The pipelines meet in the third section with two lines DN 1600 inserted in a 4.5 m diameter concrete tunnel traversing beneath the Vistula.

The contractors Hydrobudowa 9, PRG Metro and KWG (all part of PBG Group) worked as consortium on the first project section. Worthwhile mentioning is the 840 m long part of the first section where the pipes were supposed to be jacked from both ends meeting in the middle. However, installation with HOBAS Pipes can be conducted so precisely that the section could be jacked with one single drive and from one side only. The smooth and even outer surface and high stiffness of the relatively light-walled HOBAS Pipes were significant for this success. Despite the small friction and low forces needed to jack HOBAS Pipes, the contractor followed the project plan and erected an intermediate station every 100 m. None of these but the last was put into service to make sure that also the last drive at 1,200 tons would run smoothly. After completing the works the intermediate stations were replaced by HOBAS Tangential Manholes and reused for other sections in the project.

For the following stage, pipes were jacked beneath the main road of the district Białołęka. An open trench would not have been possible here since the construction works would have impaired the traffic on this important road (3 lanes in each direction). The pipeline route runs beneath the middle, the green line, of the road and a single drive over 910 m broke the record of longest single drives in the project.

Within the second part of the project, the contractors POL-AQUA and Sonntag Baugesellschaft mbH layed 1,400 m HOBAS Pipe Dₜ 3000 almost unnoticed by the population and also via jacking on the left side of the Vistula.

HOBAS®
Goes XXL

Pipes De 3000 Jacked under Warsaw, PL

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The sewers of Pforzheim in Germany are for some part over 100 years old. It comes as no surprise that these no longer suit today’s requirements and urgently need to be rehabilitated. The majority of newly installed HOBAS Pipes has been jacked: A rather infrequent and demanding project was in this case the installation of an air cushion inverted siphon beneath two rivers.

In a recent stormwater treatment project on the south bank of the river Seine in France, 205 m HOBAS GRP Pipes D₂ 2160 have been jacked on a curve. Two horizontal bends at 500 and 400 m radii as well as an altimetric curve for the transition from a 0.5 to 1% incline had to be realized.

On the islands of Hawaii, HOBAS Jacking Pipes have been utilized to renew heavily damaged sewer networks in coastal areas and harbors without influencing tourism or inhabitants in the course of a couple of decades. With the installation of corrosion resistant HOBAS Products the most beautiful beaches in the world have been step by step protected from being flooded – despite the aggressive sea water.

Within less than three weeks, 203 meters of HOBAS Pipe D₁ 1099, SN 100000, PN 1 were jacked under a thermic power plant in the Antofagasta region in Chile. The line will convey seawater to the Sierra Gorda Mine for copper and molybdenum extraction.

Jacking Around the Globe
Selected HOBAS® Jacking Projects
Australia’s Gold Coast expects heavy annual rain falls during their “wet season.” The project, known under the name Burleigh Waters Rising and Gravity Main PS B47, involves the design and construction of 1097 meters $D_e$ (external diameter) 718 mm HOBAS GRP Pressure Mains PN 10 and 428 meters DN 750, DN 960 HOBAS GRP Gravity Mains.

Since the concrete culvert crossing beneath the railway line E65 Warsaw - Gdynia in the polish city Gdańsk could no longer handle high water levels from the nearby stream, it was decided to replace it. For this purpose, HOBAS Pipes with an external diameter of 3600 mm were jacked beneath the railway embankment.

During the summer of 2013, the very first jacking project with HOBAS Pipes in Singapore pushed the envelope of what has been feasible in the region up to now. HOBAS Pipes jacked with traditional Swiss precision impressed the customer with a deviation of just 6 mm over a drive length of 63 m and a record installation speed of 10 cm per minute. In total, 728 m HOBAS Jacking Pipes $D_e$ 427 to 718, PN 1 were installed.

420 meters of HOBAS Pressure Pipe $D_e$ 860, SN 640,000, PN 6, have been jacked beneath the bay of Golden Sands in Bulgaria to convey purified wastewater from a treatment plant into the Black Sea.
Who Invented It?

Around the Corner under the Rhine, CH

What was originally planned as double pipeline without curved jacking – the actual pressure line was to be located inside a protective pipe made of reinforced concrete – was redesigned by HOBAS Experts as a single pipeline. It was then installed by curved jacking: the Swiss have always been pioneers regarding innovations.

The pipeline involved was a water supply line for cooling purposes that went under the River Rhine in Basel. HOBAS supplied pressure jacking pipes PN 10, 1,499 mm in outer diameter. The entry pit was no less than 32 m deep to avoid underground water courses and endangering the Rhine’s water. At this depth, it was possible to drive through one horizontal soil layer whereas traversing different formations beneath the Rhine would have posed additional risks in an already highly complex project. As the exit pit was located at a depth of 28 m, the pipes were jacked four meters uphill over the length of 433 m. To avoid crossing the border between France and Switzerland, the contractors pushed the pressure jacking pipes on a curve with a radius of 1,000 m. Here too, HOBAS Pipes proved how unique their properties are.

A Pipe Arch for the Railroad beneath Zurich’s Historic Center, CH

What do you do when you want to link two stations under a densely built-up area, but do not want to disturb the public or disrupt the traffic flow and cannot simply move the historic buildings? The answer is simple: you use HOBAS Jacking Pipes to form a pipe arch that reliably supports the part of the town above it. Then you can safely bore the tunnel for the railroad.

Construction of the urban Weinberg Tunnel placed considerable demands on the contractors. As there is not much soil cover in the area of the station, a large pipe arch was jacked before building the tunnel to prevent the buildings and roads above the site from subsiding. The arch consisted of seven sections, six thereof using HOBAS Pipes in D=1940, which were installed in a semi circle above the tunnel partly under the River Limmat. These pipes were then filled with concrete to meet the structural requirements for building the actual railroad tunnel. Trains are scheduled to start running through the Weinberg Tunnel by the end of 2013, which will enhance Zurich’s infrastructure considerably.
Both industry and agriculture in the surrounding area have caused the lagoon in Venice to become increasingly polluted in recent years. In 2000, a plan was therefore developed to prevent pollution and improve water quality in the catchment area emptying into the Venice lagoon. The project was aimed at converting the existing treatment plant in Fusina so that it can process the sewage from local households, stormwater from Mestre, Marghera and the area of Mirese, industrial effluent and polluted groundwater from Marghera harbor. A 20-km-long outlet would then convey the treated wastewater to the sea.

In order to cross the Lido sandbar, 351 m of DN 1400, PN 6 pipes had to be installed by jacking. 'We spent a long time looking for pipes that suit our requirements', explains engineer Meneghini, site manager at Mantovani SpA. 'After a great deal of research, we chose HOBAS Pipes, as they combine two key characteristics that we need: the mechanical strength of a jacking pipe with the hydraulic properties and leak tightness of a pressure pipe. Normally, two different pipe systems would have to be used to meet such demands.'

The 3-m-long HOBAS GRP Pipes with a wall thickness of 85 mm and $D_e$ 1720 were designed for a maximum jacking force of 6,926 kN and an internal pressure of 6 bar. This enabled them to comply with the project specifications and withstand crossing the Lido. Contrary to original assumptions, the entire 351 m section was jacked in one single drive. Although three intermediate jacking stations were planned, none were used because the very smooth outer surface of the HOBAS Pipes significantly reduced the jacking force required. Having the same inner diameter, GRP pipes with their excellent ratio of wall thickness to inner diameter allowed a smaller machine to be used than would have been necessary with concrete. This not only meant there was less work involved, but also resulted in less spoil to be removed – important factors that reduced the installation costs to a minimum.

As the contractor and HOBAS Specialists cooperated very well, construction work on the pipeline was completed in less than a month.
HOBAS Group Worldwide
HOBAS manufactures and markets HOBAS GRP Pipe Systems. The HOBAS Network includes HOBAS Production Facilities and Sales Organizations in Europe and throughout the world.

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When developing and manufacturing HOBAS Products, we are dedicated to conserving resources and respecting the environment. Visit our website to find out more about the HOBAS Environmental Policy.