The Herrenknecht Pipe Thruster – Key innovation in Pipeline Construction.

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Herrenknecht Horizontal Directional Drilling (HDD) rigs allow for a fast, inexpensive and environment-friendly installation of supply pipelines underneath obstructions. HDD operations are limited by the pipeline diameter, push force of the drilling equipment (HDD rigs) and geological conditions. Herrenknecht aims at gradually expanding the range of applications of HDD technology. The Pipe Thruster is an important step in this direction. The Pipe Thruster provides additional push force during the pullback of long pipe strings and plays a key role in the development of new tunnelling and pipeline construction methods.

So far the Herrenknecht Pipe Thruster has proven its versatility in several projects worldwide.

For example:

• **Godavari River Crossing, India**

In 2007 Herrenknecht machines played an important role in one of the first complex sections of the East-West Gas Pipeline in India. 2,400 meters had to be excavated, interrupted at about the half-way point by an island which exists only in the dry season. The planned diameter of the protection tunnel for the installation of the 48-inch pipeline is 2.40 meters. First, the tunnel specialists built two launch shafts on the river banks, each with a depth of 12 meters. A 30-meter-deep target shaft followed on the river island. Finally, in spring 2007, the two EPB2400AH tunnelling machines with a drilling diameter of almost 2.90 meters each began tunnelling. EPB Shields are particularly suitable for soft and cohesive geologies with a high proportion of clay. Under the Godavari River they worked in the dual mode configuration, which can be refitted to the slurry mode for coarse, highly water-bearing and instable ground conditions. The installed slurry firebox connects the screw conveyor with a slurry circuit, including feed and slurry lines, and conveys the excavated material into the slurry circuit. The machine can continue tunneling safely in the slurry mode. 1,150 meters had to be excavated from the east to the target shaft, from the west, 1,250 meters had to be drilled. The TBM worked using the pipe jacking procedure. Hydraulic cylinders in the launch shaft and intermediate jacking stations distributed along the pipe string, push the machine forward, including the ever growing pipeline made of concrete pipes, which follows the machine. After work was completed, the two machines were lifted to the surface from the central shaft. The machine used in the east then had to drill a 75-meter sloping tunnel from the eastern launch shaft to the surface for the subsequent installation of the pipeline.

This was also carried out with a Herrenknecht machine. In contrast to the conventional procedure in which a pipeline is installed with cable winches, the Pipe Thruster uses thrust and pulling forces. This procedure is quicker than conventional installation while still allowing careful and safe installation of the pipeline in the protection tunnel – an aspect which was particularly important for this project. The two hydraulic cylinders of the Pipe Thruster were capable of providing a maximum thrust of 500t. At the Godavari River, the Pipe Thruster required less pressure than that. Two pipeline strings of approximately 1,500 and 1,000 meters in length and with an overall weight of approximately 2,000t had to be installed in the Godavari tunnel. They had been welded together before on the river banks.

The Pipe Thruster pushed them into the concrete tube with an average thrust of 80t and a maximum speed of five meters per minute. After only five months the tunnel was completed and the pipeline installed.
Pipeline Maintenance works on the US- Gulf Coast

In late summer 2008 the Herrenknecht Pipe Thruster celebrates its first successful deployment in North America. A total of 800m pipelines (42") with poor quality had to be replaced by contemporary ones. Here the Pipe Thruster smoothly pulled the outmoded pipelines out from the underground with a maximum force of 450tons. Thus the new pipeline, now coupled to the old one, was simultaneously inserted to the underground.

Rhine River Crossing, Worms, Germany

The 464m long culvert below the Rhine River was realized using the new Direct Pipe® method developed by Herrenknecht. The pipeline was welded together on the jobsite and hereafter thrusted in six sections. With this method drilling and installation were carried out in one single step. A Herrenknecht AVN1000XC was deployed for soil excavation in Worms. The Herrenknecht Pipe Thruster provided an average thrust force of 80 tons to smoothly push the pipeline forward. The jobsite team realized advance rates of max. 90m in 24 hours. Breakthrough was achieved only 13 days after the beginning of the construction work – a successful world premiere for Direct Pipe®.