

Alignment Application

# Aligning vertical pumps and checking for plumbness

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With eight pumped storage units and a rated power output of 320 MW, the pumped storage power plant at Hohenwarte II in Thuringia is the largest power plant on the Saale River. In times of excess power generation – generally at night – water is pumped into the elevated storage tank to make it available to the turbines for power generation during peak consumption.

## Vertical alignment with ROTALIGN® Ultra

As part of an inspection of machine C, PRÜFTECHNIK Machinery Service was contracted to align the shaft. The equipment of choice was ROTALIGN® Ultra, ideally suited for this type of machine with its functions for aligning vertical machines and for the wireless transmission of data between computer and sensor.

First, the gear coupling between the turbine and pump was disassembled and the laser and sensor were attached to the flange faces using magnetic clamping equipment (Figs. 2 and 3). To take the measurements, both shafts were rotated to the clock positions at 0(=elevated water storage)–3–6–9.

In the next set of measurements taken at the second coupling between the turbine and generator, the bearing clearance of the journal bearings had to be taken into account. The air gaps at the clock positions were filled with 0.4 mm shims.

The machinery was aligned with the aid of hydraulic presses by inserting shims at the radial bearings under the pump. Fig. 4 shows the alignment result. Alignment is now well within the tolerance specified for a speed of 428 rpm.

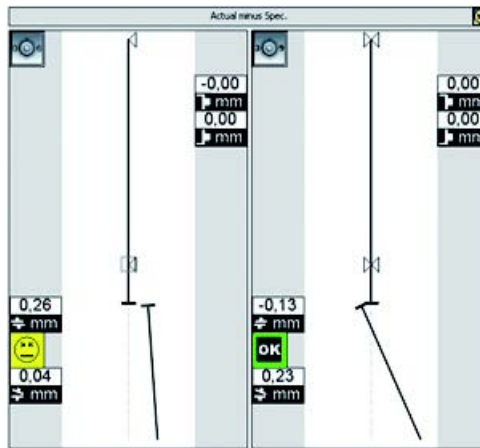


Fig. 4: Alignment result at machine C



Fig. 2: ROTALIGN® Ultra laser transmitter attached with a magnetic bracket



Fig. 3: Sensor attached with a magnetic bracket – equipped for wireless data transmission

## Plumbness measurement using INCLINEO®

The relative alignment of the shafts to each other is not the only criterion for large vertical machines. The plumbness of the shafts – i.e., the relationship between the rotating centerline to gravity – is also important. The tolerance



Fig. 5: Principle of plumbness measurement with INCLINEO®

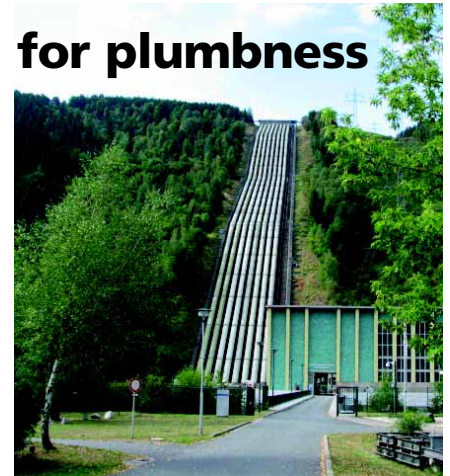


Fig. 1: Pumped storage power plant Hohenwarte

here is **0.02 mm/m**. If the shafts are not plumb, this will result in imbalances, vibrations, higher temperatures, a shorter bearing life span and/or lower efficiency.

The measurements were taken with the new INCLINEO®, a high-precision, electronic inclinometer. It is simple to attach to the shaft with its magnetic base. The value for the plumbness of the shaft was obtained by comparing two measurements at opposite positions.

The measurements were taken in two directions as well as at the 45° positions to ensure repeatability. These measurements were repeated at every



Fig. 6: Plumbness measurement on a vertical shaft with the INCLINEO®

section of the shaft, thus determining the position of the entire shaft relative to the plumb line.

If you require support for similar measurement tasks, our globally active Machinery Service will be glad to assist you. ■