SOLEXPERTS

Swiss Precision Geomonitoring

Info

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Dear Reader,

Solexperts entered the field of «in situ» - hydrologic testing nineteen years ago.

Our first project at the Piz Pian Grand, a potential nuclear waste disposal site, included hydraulic testing in shallow boreholes drilled from a pressurized tunnel. Not long afterwardwe began hydrologic testing at several potential municipal waste disposal sites, involving surface tests in shallow boreholes.

We began our deep borehole testing in 1990 when we were contracted by Nagra to perform double packer hydrologic tests to a depth of 1800 m at the Wellenberg site. Other deep borehole testing project include: Alp Transit, Alpetunnel and Brenner base tunneling projects.

The PDPS system allows optimized testing, enabling efficient hydrologic testing in long horizontal boreholes at high pressure and without removal of the drill string.

Two PDPS systems are compatible with the HQ and NQ Longyear drilling system.

Hydrologic Investigation using the Pump-Down-Packer System

During construction of the Mitholz section of the Lötschberg base tunnel in Switzerland horizontal boreholes were bored along geological features to localize and characterize groundwater zones. Borehole lengths were up to 1300 m and water pressures were expected to be up to 75 bars. Testing specifications demanded high-quality data while requiring testing times and costs are kept to a minimum.

Solexperts developed a tool based on the wireline coring technique for this application. The testing tool (referred to as the «Pump-Down Packer System») can be pumped through the drill string (pushed by drilling fluids behind the tool) and retrieved after hydraulic testing using a standard drill rig wireline system.

Pump-Down Packer System (PDPS)

Horizontal boreholes are drilled to design depth using a standard wireline coring system. The inner core barrel is retrieved via the wireline and the drill string is pulled back to expose an interval between the drill bit and the end of the borehole (the test interval). The PDPS is pumped down the drill string until it lands in the outer core barrel and «latches-in» just like the standard wireline core tube. Once in place, pumping pressure is gradually increased to inflate the two packers of the PDPS. One packer is located in the open borehole and isolates the test interval from the rest of the borehole.

The other packer is located in the outer core barrel and seals to prevent water from the annulus flowing into the drill string. This allows the borehole casing to be used as the test tubing.

At a predetermined hydraulic pressure, a mechanism inside the PDPS shears a plug that stops packer inflation allowing the test to be performed. Two memory gauges located in the end of the PDPS record pressure and temperature inside the test interval.

Another pressure sensor, a flow meter and a shut-in valve are located outside the borehole. This pressure sensor and the flow meter are connected with a central data acquisition system for monitoring and controlling the tests in real-time.

The PDPS test configuration enables both hydrologic withdrawal and injection tests that can be easily modified to optimize the data quality while also minimizing testing times and costs.

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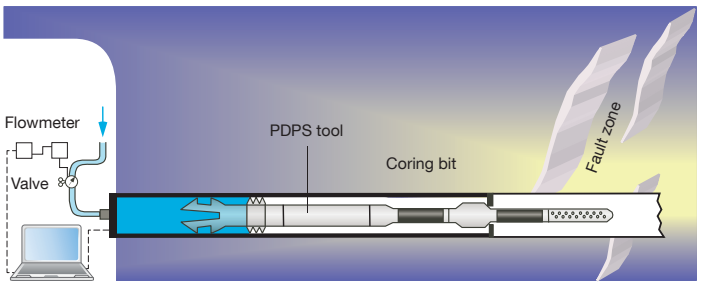
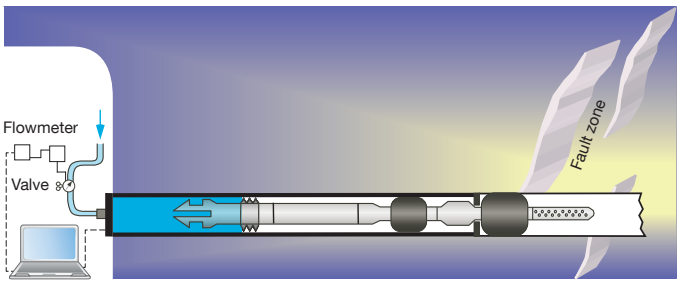
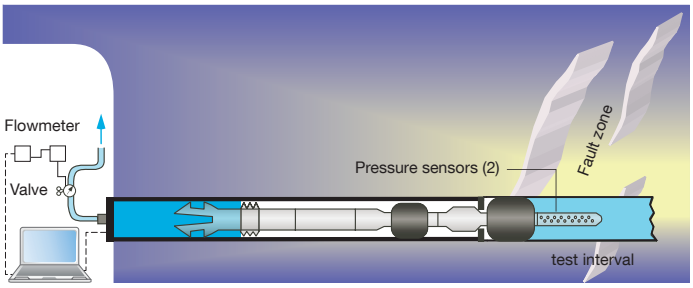
When testing is completed the drill string is pulled back activating the packer defla tion mechanism. After both packers deflate an overshot tool is pumped down the drill string until it locks in the latch head of the PDPS. The PDPS can then be retrieved using the drill rig's wireline system. After the PDPS is removed the data from the two pressure sensor memory gauges is read.The test sequence is documented and analyzed using the memory gauge data together with the flow meter and the external pressure sensor data.
The PDPS is an innovative packer system that opens new avenues for hydrologic testing in long horizontal boreholes. Separate test tubing is not required making it possible to install the system even at high formation pressures because the rig's blowout preventer is always functioning (an indispensable security demand under these drilling conditions).
Project costs are significantly reduced because of shorter installation and retrieval times of the testing equipment that result in less stand-by time for drilling and tunneling machines.



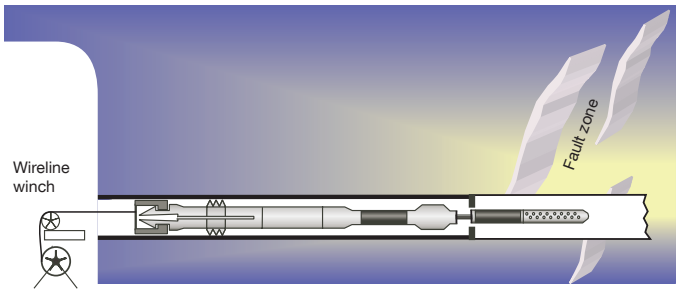
1 *PDPS is pumped down casing,*
System latches into the outer core barrel



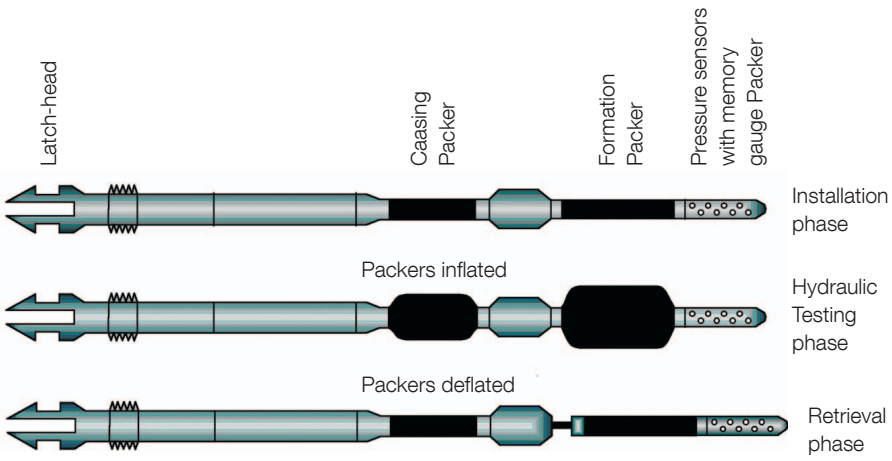
2 *Inflate the packers,*
Open access to the test interval



3 *Performance of the hydraulic test*



4 *Deflate the packers,*
Retrieval of PDPS using overshot tool and wireline system



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