Packer Testing in Wireline Core Holes

by **Joel Adams**, Hydrogeologist and North American Director, Inflatable Packers International

Say the words 'Packer Testing' to some drillers and if they don't immediately run and hide behind the nearest core shack, their eyes might cloud over a bit as they remember dragging awkward nitrogen bottles around the site, fragile nylon inflation lines uncoiling and creating a spaghetti-like tangle at their feet, a leaky stuffing box spraying water in the face, dealing with a hydrogeologist that never learned lefty-loosey/righty-tighty, and maybe a lower meterage bonus that week because the rods weren't spinning during the testing and all the other mucking around.

Fortunately, as core drilling technology has improved to allow deeper and more complex borehole trajectories, packer testing technology has also improved, allowing testing at great depths and even in horizontal or up-holes. Packer testing is used in geotechnical and mineral core holes to determine rock mass characteristics such as permeability (how much water?), hydraulic head (how much pressure?), water quality (can I drink it?), rock strength (is that dam gonna hold?), and rock stress (how will it break if it doesn't hold?).

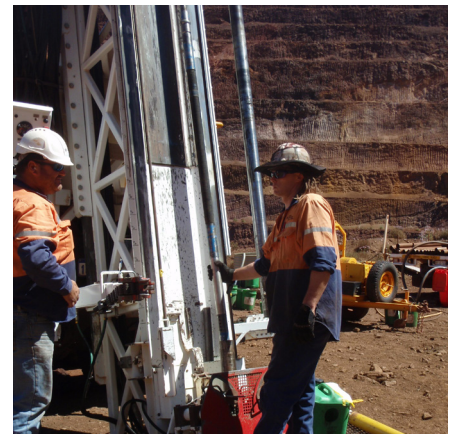
IPI introduced the SWiPS hydraulic inflate packer system in the early 2000s and it is now the industry standard for doing step-injection pressure tests, aka Lugeon tests. The SWiPS design eliminates the need for inflation lines; instead the system locks and seals in the core barrel just like the core tube. The packer, which is positioned just below the bit, is inflated using the fluid in the drill rods. Once a pre-set inflation pressure is reached, the system automatically shifts to testing mode. The system can be run in single-packer format to test from below the bit to the bottom of the hole, or in straddle format

to test a discrete zone of interest in the borehole. A data logging pressure transducer can be integrated into the SWiPS to increase the accuracy of measurements and simplify analysis by eliminating the need to account for friction loss in the rods. A savvy user can also quantify rod leakage (even though we all know that your rods don't leak!) and get a good measurement of static formation pressure. If water samples are needed, a pumping test can be run by dropping a small-diameter pump in the rods (because there are no wireline or inflation hoses in the rods) or an air-hose for air-lift pumping.

SWiPS is ideal for 'testing while drilling' campaigns: stop drilling, pull back the rods, pull the core tube, send down the SWiPS, inflate, test, kindly ask the hydrogeologist to step aside, send down the over-shot, latch-on, pull to deflate, wait a few minutes, retrieve the packer, replace the core tube and get back to drilling. Meanwhile, the hydrogeologist is busy eating lunch and downloading the data from the pressure transducer, and, if you have been successful teaching the lefty-loosey/righty-tighty concept, redressing the packer system for the next test.

The SWiPS system can be pumped in when using an underground core barrel set-up in flat or up-holes. The sequence is the same as above, except that deflation is achieved by pulling back on the rods and shearing a brass shear pin. This is necessary because the over shot can't be pumped down when the packer is inflated, unless of course, the rock is very permeable.

If borehole testing is carried out after the hole is completed, it is better to use the IPI STX tool. This can be run through the bit like the SWiPS in H and P-sized holes, or directly on the rods in N-sized hole. STX can be used to isolate and test multiple intervals without tripping out of the hole to reset. The innovative four-stage valve above the packer allows for more complex hydrogeologic testing, and the higher-pressure rating (up to 10 000 psi for some versions) is perfect for rock stress testing. Once the packer is inflated and anchored in the borehole, the valve is actuated by lowering and raising the rods.



IPI innovation for core drillings doesn't stop at the bottom of the rods – inward inflating packers are used as a BOP to control boreholes when unexpected high flows are encountered or as a flow diverter system that allows well control while diverting high flows to a safe location. In addition to standard tools and systems, IPI excels in OEM and custom-made packer tools for specialized applications, high pressure grouting and well control.