Australian Water Well Technology

Australia is the most arid continent, so it's not surprising groundwater plays a key role. In developing these sources Australia has developed some of the world's best practices in water well drilling, completion and management. Recently this has included many well completion techniques that rely on inflatable packers – a product with a long and reliable history in oil and gas applications, but formerly not much used in water wells. The use of such products and general completion practices used in many areas of Australia today is probably best illustrated by looking at a typical deep, gravel packed, water well completion. This well will have a design lifetime of 50 – 100 years with a minimal maintenance expectation.

Depending on water quality, the casing will be either carbon steel or fibreglass and will be placed in a borehole with sufficient annular clearance to ensure a complete and efficient cement grout seal around the casing. Cementing is accomplished from the bottom up using a float shoe specially designed for water well use and drilling out with water well rigs.

After cementing, drilling continues to TD below the target aquifer and a stainless steel, wedge wire wrapped screen is installed telescoping back up into the casing. Many methods are available for screen installation but the preferred system for deep, long screens is via use of a "grab-packer". This consists of a heavy duty inflatable packer with a special high friction surface, which, when inflated in a screen (or pipe), provides excellent anchoring capacity. The screen itself is fitted with a riser pipe, typically 6 meters long, that is rigidly centralized inside the casing.

The grab-packer includes a cone shaped deflector type cross-over which sits in the top of the screen and prevents gravel from entering. This allows gravel packing while the screen is suspended in location, avoiding screen damage from standing it on the bottom of the borehole. The grab-packer also has a central through pipe that allows pumping or reverse circulation through the rods to assist gravel placement. After gravel packing, the screen is safely released by deflating the grab-packer which, in contrast to other techniques which require drill pipe manipulation, will not damage the screen.

Prior to development, the top of the screen must be sealed into the casing to prevent displacement and potential pumping of the gravel pack materials. This is achieved using a Slip-over Packer which seals externally on the centralized riser pipe and internally within the casing. Several varieties of such packers are available, with an Inflatable, Mechanical, Retrievable (IMR) version being the most popular. This provides a long, inverted K-rubber shaped seal on the top of the screen and an inflatable packer to seal inside the casing. The internal seal is actually referred to as an M-rubber seal because of its length, typically 0.3 – 0.5 metres, and the fact that it is fully vulcanised to its outer steel casing preventing any possibility of it coming loose. The principal advantages of the IMR type Slip-over packer are that it is not subject to any possibility of damage from casing joints while running in and, by virtue of the inflatable casing packer, is positively anchored in location - an important feature in the event of high draw-down, which generates a differential pressure across this seal that may be sufficient to pump an MMR type slip-over off location.

A feature of all slip-over sealing packers is that they are retrievable. This offers the option of topping up the gravel pack which may settle during development or subsequent operation.

Another Australian innovation gaining wider acceptance (including oilfield application) is the so-called “Riserless Pump” system. This allows the casing itself to be used as the riser for an electric submersible pump by sealing and supporting the pump in the casing with an inflatable packer. It eliminates the need for a separate riser column ensuring much lower frictional pumping losses and providing a broad range of contingent advantages. This system is ideally suited to large, deep bores and offers even more advantages in new wells where the original casing and drilled hole diameter can often be reduced without any reduction in bore production rates.

The above represent several now well proven technologies, developed in Australia, but applicable to deep, gravel packed, water wells worldwide. They enable well designed, efficient, low maintenance wells with a life of 50 – 100 years, possibly lower initial well costs for deep wells and definitely much lower “life of well” cost.

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