



Slim-line Re-lining

30/06/2000

Slim-line Re-lining is a technique designed to fit a well liner with the minimum reduction of well diameter. It is based on using a Swage Packer to seal the base of the liner into the old casing or a screen. Briefly, a Swage Packer is a thin wall pipe with a vulcanized rubber cover that can be expanded radially using a high-pressure inflatable packer to create a well seal. The attached drawings P663A and P663B show the two most common methods of applying this technique.

The first of these shows re-lining using a swaged packer and cementing the annulus between the liner and the existing casing. The basic installation steps, as indicated on the drawing are:

- Clean the existing casing and inspect to ensure it's ready to receive the liner. In some cases, this may require a deviation survey in addition to video inspection.
- Attach the Swage Packer and one-way grouting valve assembly to the 1st joint of the liner. The drawing shows this as a welded connection but threaded or even glued and pinned connections are also possible.
- Run the liner in to the required depth. Note that, if the liner is to tie back to the surface, the liner can be run as usual, however, it is also possible for the liner top is to terminate below surface which is described below.
- Make-up the High Pressure Swaging Packer, straddle pipe and low pressure cementing packer.
- Run this assembly inside the new liner to locate the HP Swaging Packer adjacent to the Sage Packer. The two different packers each have separate inflation hoses to allow independent operation.
- Inflate the HP packer to sufficient pressure to deform the Swage Packer out into firm, sealing contact with the existing casing. This operation is controlled in terms of both inflation pressure and volume against pre-tested standards for each.
- With the HP packer still inflated, inflate the LP cementing packer to isolate the one-way cementing valve.
- Hook up a pumping head to the drill rods and establish circulation to the liner/casing annulus with water then switch over to cement grout and pump grout to fill the annulus.
- Deflate the LP cementing packer and flush the excess grout out of the rods and straddle zone. Obviously, to minimize flushing, a water tail can be pumped following the cement and the straddle pipe can also be set-up to accept a wiper plug if required.
- To complete the re-lining simply deflate the HP packer and trip out of the hole.

The liner can be manufactured from any compatible material, e.g. standard steel casing, PVC, ABS, FRP, etc. Since the liner is not deformed in any way and the Swage Packer will be expanded to a larger ID than the liner, it's the liner itself which determines the minimum finished ID of the lined well. Selection of the liner will depend on factors such as minimum running and grouting clearance, method of joining, well fluid conditions, minimum allowable ID and, inevitably, availability.

If using a thin wall or other low collapse strength liner, a third inflatable packer (or other closure method) may be run at the surface and the annulus between the drill rods and the liner can be water filled and slightly pressurized to prevent collapse during cementing. In this case it essential to pump a water tail after the grout, preferably with a wiper plug, as the liner must remain pressurized until the grout has reached initial set at least.

The 2nd re-lining technique shown involves deforming both the Swage Packer and the liner. In this case, they are both usually manufactured from the same size pipe – either stainless steel or carbon steel as appropriate to the installation. The installation procedure is similar to that given above except for the steps involved in cementing the annulus. In their place, after performing the initial setting of the Swage Packer, the HP packer is deflated, moved up hole and re-inflated to swage out the liner. This process continues in a stepwise fashion until the complete liner has been swaged out.

Normally, it is the swaged ID of the Swage Packer which represents the minimum ID of the lined well in this case. Typically, for water wells, this will be around ½” (13 mm) less than the existing casing ID and thus represents a minimal reduction of diameter.

As mentioned above, it is possible to locate the liner top some depth below surface. In this case, following make-up of the liner to the length required, the liner is hung off and the packer assembly is run into the liner on drill pipe. Locating the HP packer adjacent to the Swage Packer, as previously, this packer is inflated to a pressure sufficient to provide a high strength anchor on the inside of the liner but less than that required to begin setting the Swage Packer. The liner is then lowered to its required depth using the drill pipe and the frictional anchor provided by the inflate HP packer. On depth, the pressure in the HP packer is simply increase to set the Swage Packer.

Apart from the obvious advantages of these techniques to produce very slim-line re-lines, it may be noted that at no time is a conventional drill rig required. All operations may thus be performed using a crane and simple casing & rod slips thus reducing costs and scheduling constraints. Furthermore, there is no need to kill a producing well, even an artesian well, in order to reline using these techniques as the inflatable packers may be used, in conjunction with appropriate surface equipment, to prevent contamination of the aquifer with cement or uncontrolled flow situations.

The Slim-line Re-lining techniques described were first introduced by AGE Developments Pty Ltd (AGE) of Perth, Western Australia in 1993 and are offered internationally by Inflatable Packers International (IPI).

By Clem Rowe, Managing Director, Inflatable Packers International Pty Ltd © 30 June, 2000

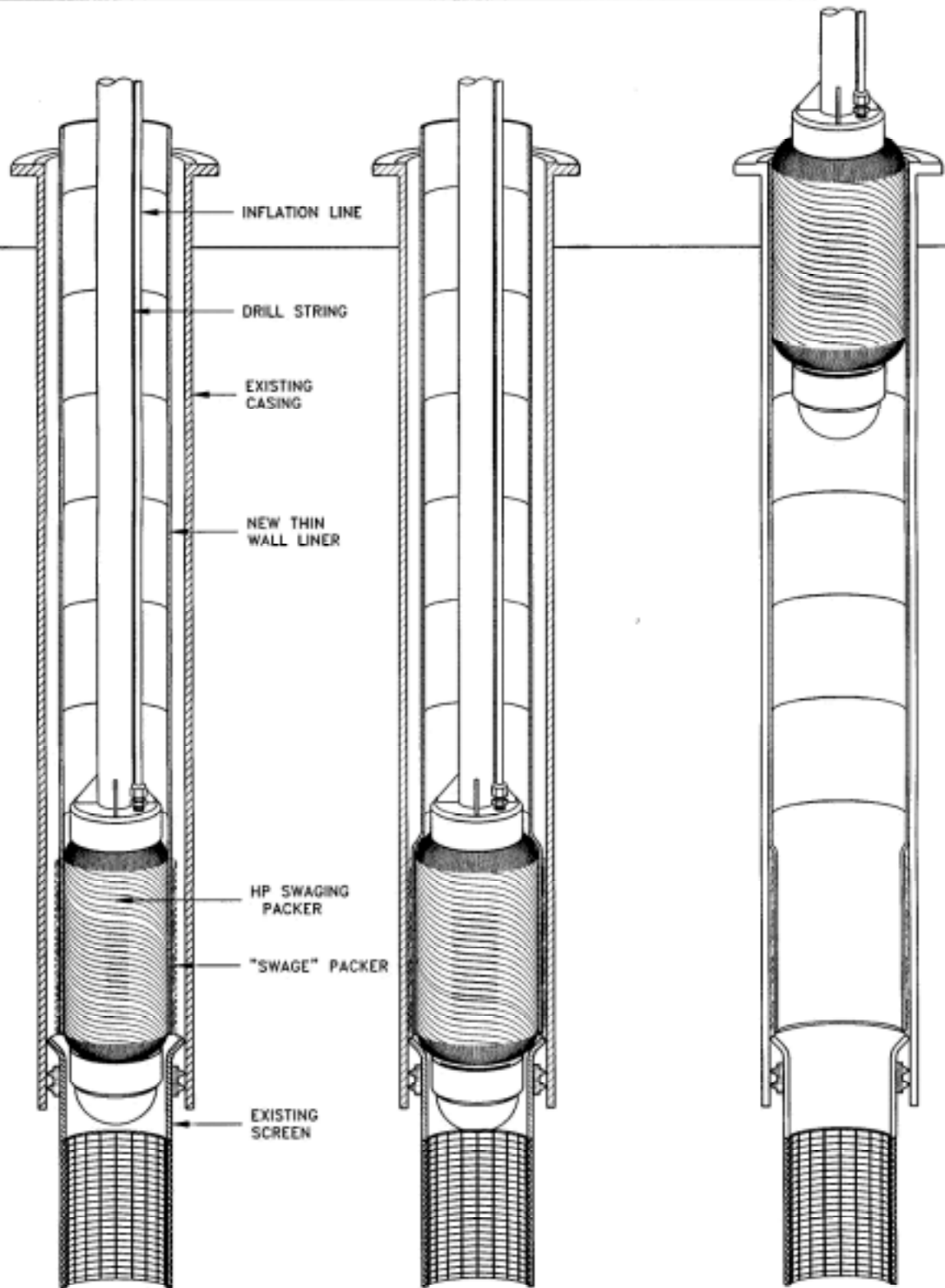


Inflatable Packers International Pty Ltd

Unit 1, 6 Pittino Court, Osborne Park WA 6017 AUSTRALIA
Ph: +61 8 9204 2448 Fx: +61 8 9204 2449
Email: info@inflatable-packers.com.au

RE-LINING WITH SWAGED PACKER AND LINER

P663B



RUN IN NEW CASING
AFTER WELL CLEANING
& VIDEO INSPECTION

SET SWAGE PACKER

CONTINUE SWAGING
TO SURFACE

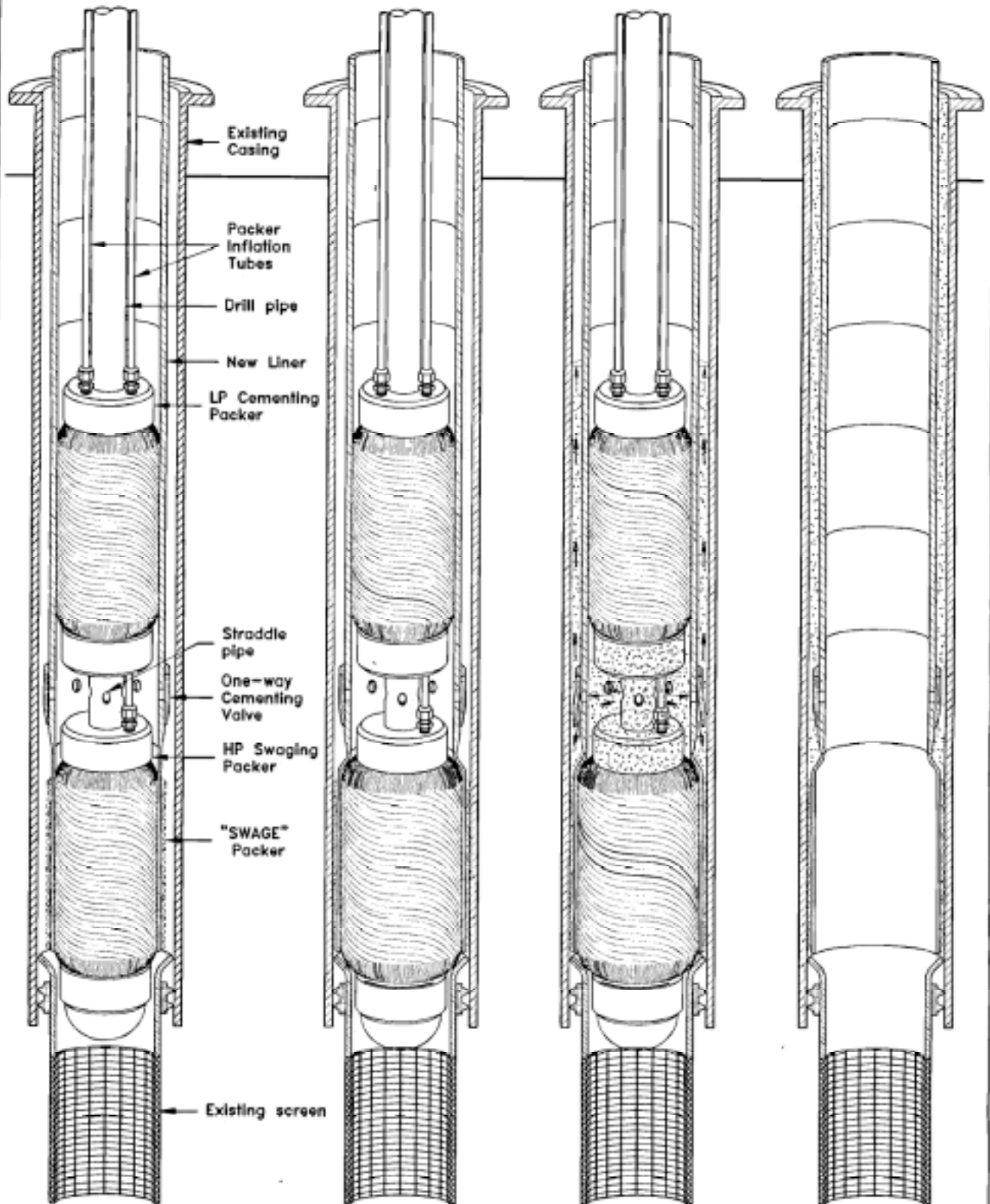


Inflatible Packers International Pty Ltd

Unit 1, 6 Pittino Court, Osborne Park WA 6017 AUSTRALIA
Ph: +61 8 9204 2448 Fax: +61 8 9204 2449
Email: info@inflatible-packers.com.au

RE-LINING WITH SWAGE PACKER AND CEMENTED ANNULUS

P663A



RUN IN NEW LINER
AFTER WELL CLEANING
& VIDEO INSPECTION

SET "SWAGE" PACKER

PUMP CEMENT GROUT
THROUGH CEMENTING
VALVE INTO ANNULUS

RE-LINE COMPLETE