

External Casing Packers, ECPs

Industry wide, there is a lot of variance between the success rates of ECP's. Here are learnings that I have gathered over the years.

1. Having a very experienced ECP hand in at the design step and when it is run makes the job much more successful.
2. The ECP is rarely viewed as a long term seal, but can be useful if the setting area is a stable rock and the ECP is filled with a low shrinkage cement.
3. SPE 35592 is a very good reference, particularly since it shows failures as well as successes.
4. Long slides (1000 ft or more of open hole are very detrimental, especially in horizontal holes, with heavy casing loads, in rough holes or through windows in the casing. If the ECP is set in pipe, success is about 90%. If set in open hole, success is about 70% where the slide is short to less than 50% success where the slide is over 1000ft.
5. Expansion ratios (Hole ID:ECP OD) of more than about 1.8 to 2 can not hold much pressure differential. Inflation ratios of 1.1:1 to 1.3:1 are much more reliable.
6. Hydraulic lockup during inflation is a problem with non-gauge holes and limited volume below the packer (depends on design). Whenever a small volume in the annulus and/or the pipe is trapped during ECP inflation, this trapped volume may not leak off fast enough to allow full inflation of the ECP - this is hydraulic lock. When trapped annulus volume is large (>200 times inflation volume), and leakoff is fast, lockup usually is not a problem.
7. Check the valve operation on the ECP inflation device to determine if it is a good "fit" for your application - is movement required or does it close the valve on pressuring up? Can you reliably pressure-up enough to close the valve? Usually the inflation valve is pinned to a set pressure - one valve to open and inflate, one to close. The opening valve is pinned - the pressure must be raised to a level sufficient to shear the pin. The closing valve will operate once the internal pressure reaches a pre-set level. An LSV will open one time (no top off). A DOV will open and close repeatedly.
8. An ECP on blank casing can be set by surface pressure inflation and cement fill. An ECP on a slotted or perforated liner must be set with a setting tool and a string. A setting tool isolates the inflation port part of the valve.
9. A set of "dogs" keeps it from moving when the string is pressured up. This is important - without the dogs, the inflation tube can pull out of the seat.
10. Inflation fluid: Cement - least shrinkage and best reliability, use overpressure to build formation force. Mud - poor inflation fluid - very low reliability. Gas - has been done - not dependable.
11. On shrinkage: Cement contraction shrinkage of 5 to 12% produces a bulk volume loss (BVL) of 1 - 4%. You can offset the BVL with stored strain energy in the casing (very minor), non shrink cement, and strain in the rubber element. The contact stress needs to remain after both cement contraction and any temperature change of the set packer (remember cement heats up while setting).
12. Some running/inflation tools have swab cups - the cups must have a fluid bypass to allow wellbore fluids to move through the tool when running or pulling the tool. The bypass is closed when inflating, usually by pressuring up. An independent bypass is included to allow wellbore fluids to move as a result of the inflation.