

# CUSTOMIZED EXPANDABLE STEEL PRODUCTS



## Operating Principles and Applications of Inflatable Packer Expandable Technology

Made from high quality steel or stainless carbon steel with an elastomer outer skin the Saltel-industries sleeve is expanded on depth using a high pressure inflatable packer, and pushed against the casing or borehole.

The setting tools are then extracted to leave a pressure resistant inner lining inside the well.

The capacity to reliably expand short lengths of steel tubulars in-situ opens up a wide range of possible applications throughout the life cycle of a well:

- **During Drilling**, to cure total loss zones
  - an expandable sleeve can be used to seal a scab liner, prior to drilling ahead.
  - A sleeve can be expanded into an underreamed section to seal without diameter loss.
- **During Completion**, to seal the annulus between completion and open hole for zonal isolation (as a replacement for external casing packers or swellable packers).
- **For remedial applications**, to repair damaged casing, modify well profiles, or to seal in place liners or sandscreens during a workover

For some applications, such as Perforation shut-off or repairing damaged or corroded casings or tubing, a standardised expandable Patch can be used (See technical sheet "Patch specifications").

For more unusual uses the technology can be customized to optimize performance and provide a variety of innovative solutions, these can be studied as required.

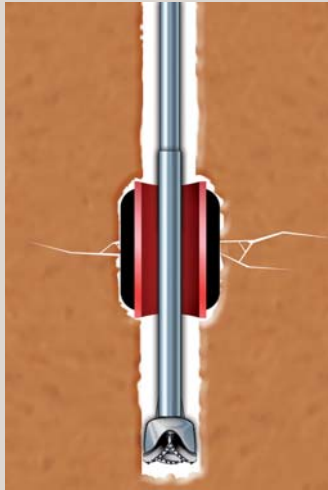


# Examples of customized downhole applications of expandable steel products



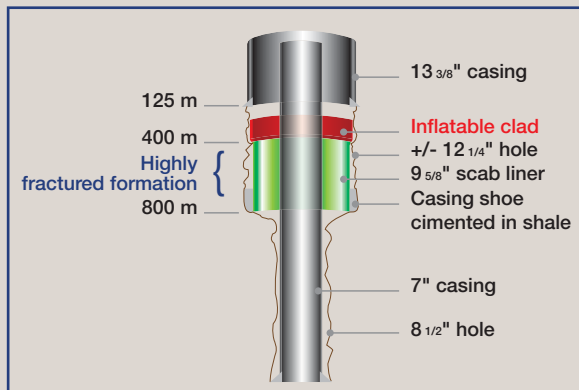
## Applications while drilling

### Under-Reamed Open Hole Patch



A sleeve can be expanded into an under-reamed zone to shut-off losses or consolidate the bore-hole before drilling ahead, with no loss of casing diameter.

### Open Hole Liner Hanger



A sleeve was run on the top of a scab liner to isolate a total losses zone. In this example a 9 5/8 in liner was cemented at the shoe before expanding a sleeve to seal the top into 12 1/4 in open hole and effectively isolate a total loss zone.



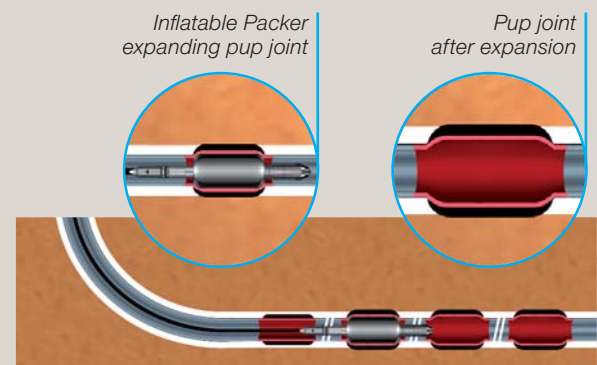
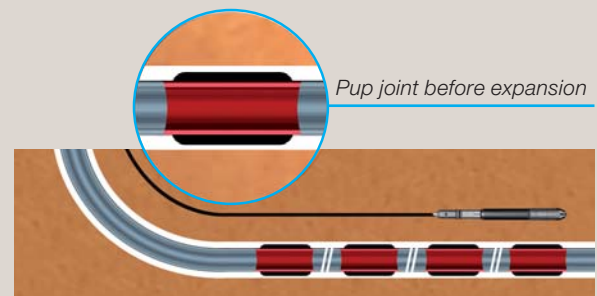
## Applications as part of the completion

### Open hole isolation barriers in multi-zone horizontal completions

The Saltel-Industries expandable steel technology can be adapted to expand special pup joints integrated into the completion string, to create open hole isolation barriers in multi-zone horizontal completions.

The high expansion rating of the steel, of 25%, leaves a large clearance while running in hole, and avoids sticking problems.

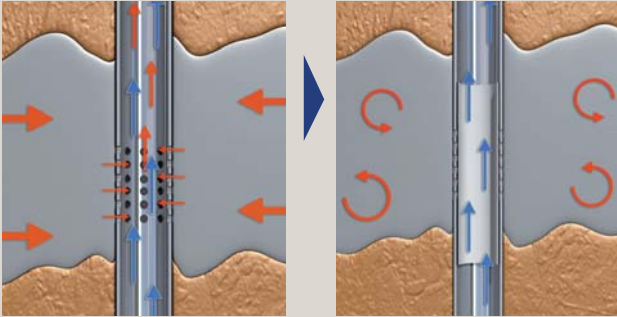
The Expandable Pup Joints are covered with an elastomer outer skin. They can be designed using a hydrogenated nitrile for sealing in good gauge hole, or run with a combined elastomer - swellable outer skin for sealing in ovalised or out of gauge hole. The expansion of the steel combined with the expansion capacity of a swellable elastomer can solve isolation problems in extreme conditions.



during well lifecycle

## Remedial Applications, during the production cycle

**Tubing or casing Patch**



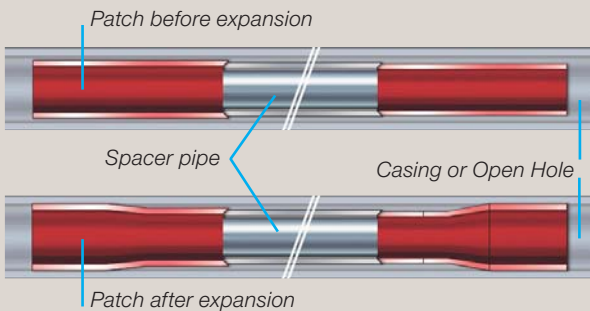
Patches can be manufactured with varying thickness' optimized for a given well specifications. Different sealing systems are available for perforation shut-off or to create a perfect gas tight seal in gas production wells.

**Multi diameter sealing**



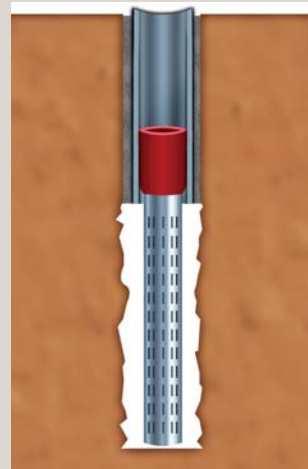
The elasticity of the steel combined with the high expansion pressure makes it possible to set inside variable inside diameters, for example sealing inside a leaking sliding sleeve or nipple.

**Straddle Patch**



For sealing long lengths two patch's can be attached top and bottom of spacer pipe, both are then expanded to seal and isolate long intervals.

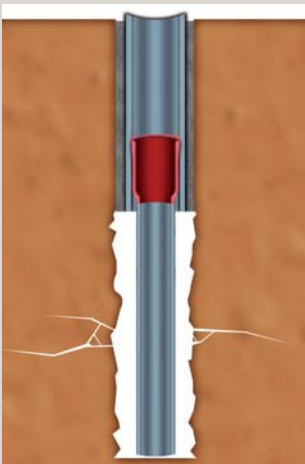
**Screen Hanger**



A sandscreen can be hung-off into existing liner or casing using a Saltel Expandable.

**Liner hanger**

A liner can be sealed into existing casing using a Saltel Expandable.



**Expanded in ovale casing**



# CUSTOMIZED EXPANDABLE STEEL PRODUCTS



## Features, benefits and limitations of Saltel-Industries inflatable packer expandable system

- The Saltel-Industries high pressure inflatable packers have service pressures of up to 10,000 psi / 700 bar, enabling expansion of sleeves with diameters from 2 ½in to 10¾in (63.5 mm - 273 mm), with thickness' from 0.08in to 0.5in (2 mm up to 12.5 mm), to set in open-hole or casing ID up to 12 ½in / 320 mm.
- Packers available with diameters of 3in, 3¾ in, 5in, 6in, or 8 ½ in for a wide range of expandable sleeves.
- Steel expansion ratios up to + 25%.
- The high expansion ration enables running the Patch's with a large clearance, avoiding sticking problems while running in hole.
- A sleeve can set in variable diameters (such as inside sliding sleeves or nipples).
- Seals effectively even with ovalisation up to 20% in casing or open hole.
- A wide range of high quality carbon steel or stainless steel can be used for different well conditions.
- Outer skin in hydrogenated nitrile (HNBR) profiled to ensure a good seal, or manufactured using swellable elastomers for sealing in out of gauge or heavily ovalized hole.
- The sleeve will set effectively in any intermediate diameter within it's range.
- Lengths up to 40 ft / 12 m.
- Downhole tools rated to 300°F / 150°C.



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