# USING NITROGEN AS A THERMAL INSULATOR

## IN EOR AND UPSTREAM OPERATIONS

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**Nitrogen** is a colorless, odorless and inert gas that makes up 78% of the volume of atmospheric air, and under normal conditions it forms a **diatomic gas that is not chemically reactive.** However, its uses in the oil industry are diverse; it can be used as cleaning elements, inerting and pressure generators. In addition to these uses, nitrogen is usually present at all phases of oil operations, from drilling and production to oil well repair and maintenance to storage and distribution. Thanks to today's advanced technology, injector equipment is now designed to enhance operational flexibility and versatility. It is also extremely useful for thermal insulation.

In enhanced oil recovery processes, **thermal insulators are used in steam and hot fluid injection wells for two main purposes:** Reducing heat loss to ensure as much energy is injected into the formation as possible and reducing thermal stresses generated during casing to avoid collapse. In both cases, steam or hot fluid is pumped through the annular space between the casing and injection tubing to prevent heat loss from the surface to the reservoir.

THERMAL INSULATORS HELP BRING THE MOST POSSIBLE THERMAL POWER TO THE WELL

### What is the disadvantage of not using thermal insulation or a bottom packer?

It is simpler and seemingly more economical not to use these solutions, but **in completion systems without thermal insulation, casing temperature is very close to the steam saturation temperature.** Because of this, more than 90% of the annular space between injection tubing and casing will be in contact with the steam, causing a great deal of heat loss and generating dangerously high thermal stresses in the casing. This can lead to catastrophic failures, such as wellbore collapse if the casing is not well-cemented.

### What is the procedure to carry out a completion WITH thermic packaging and expansion joint?

An EPDM gasket, which is made of high thermal resistance elastomers and designed to allow the injection tubing to expand due to heating effects, is placed at the bottom of the well. This configuration avoids steam reflux in the annulus, but the water present during the conversion from producer to injector tends to evaporate because it is in contact with the packing (which is at a high temperature). Steam can even leak out if the injection pressure is too high.

This is where nitrogen can be very helpful; to prevent steam backflow, high-pressure nitrogen is pumped until it covers the entire annular space. This pressure must be kept stable during the entire steam injection process to guarantee the required thermal insulation, so the injection string should be made of something like a conventional N-80 grade pipe, which can withstand higher compressive and tensile stresses.

With this addition to completion systems, high-pressure nitrogen helps move the heat to where it needs to go, without losing a significant amount of it and causing undue structural stresses on the way.

**Thermal Completion with N80 Tubing + Nitrogen**