

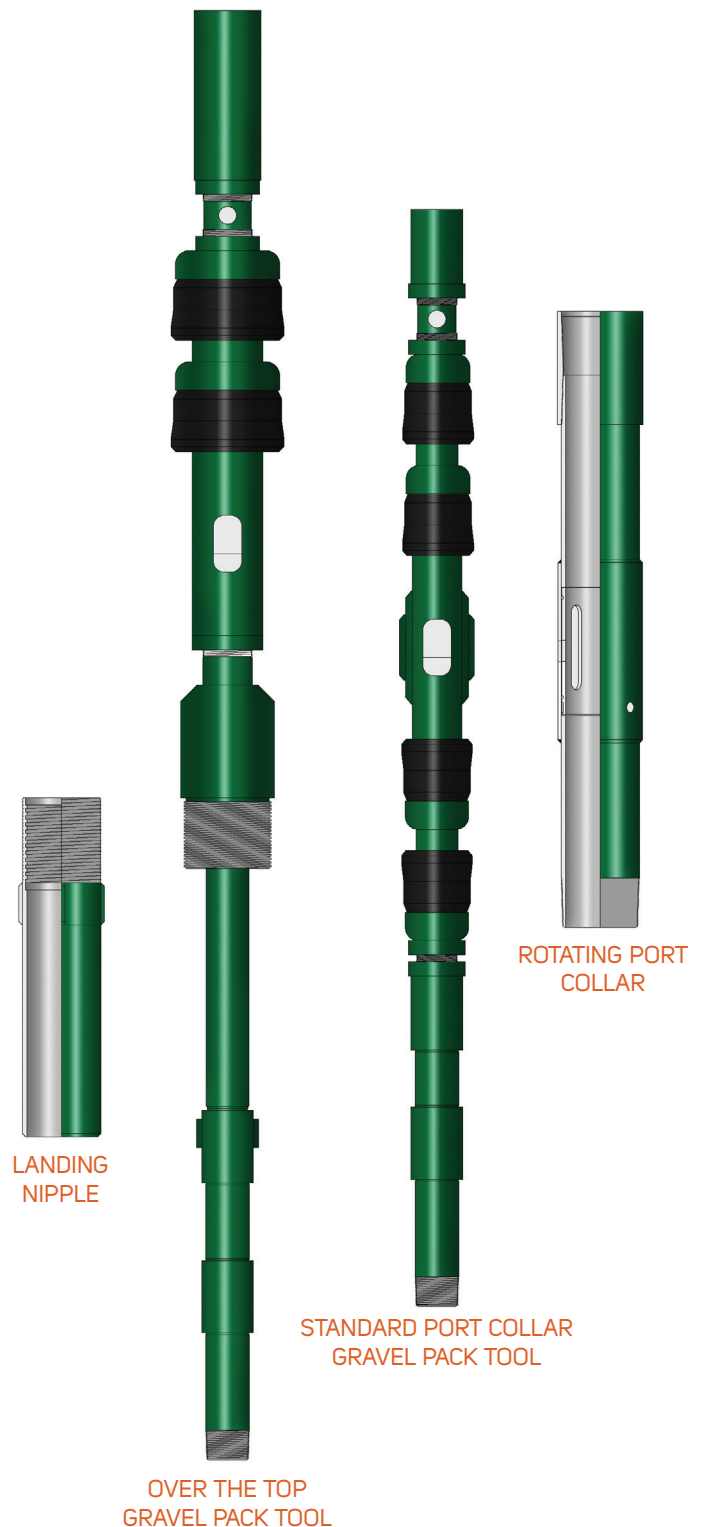
# GRAVEL PACKED LINER OVER THE TOP AND ROTATING PORT COLLAR TOOLS

Gravel packing is a systematical process designed to further control unconsolidated sand formations from entering the well bore. This utilization of gravel as a controlled filtering device was first introduced to the oil industry in the 1930's. Since then techniques and methods have been refined and designed to fit special requirements. Chancellor's involvement with gravel packing is primarily the manufacture and sales of liner assembly and setting tools as required for the common techniques. These gravel pack systems are part of Chancellor's broad capabilities.

The conventional method or, "over the top", technique is very common for the shallow heavy crude formations. This simple method may utilize fresh or KCL water, polymers or foam as the carrying fluid. Slotted liner is run in the hole with a landing nipple on top. An open ended tubing string is run inside the liner and connected to the "over the top" tool (or combination tool). The liner is run in on drill string. Gravel is pumped down the drill string, out gravel ports located below a dual set of packer cups and over the top of the liner. Gravel packs around the liner and a pack off occurs when gravel covers the slots. Excess gravel is then reversed out and the gravel pack tools and tubing are released and pulled out of the hole. A drive over adapter is run and set to seal off the liner/casing annulus.

Port collars are typically used to gravel pack longer liners. Staging the pack from two or more port collars helps to prevent packing off early. Port collars can also be installed above the zone to receive gravel, if there is a significant amount of blank liner above the slotted liner, to avoid unnecessary hole under reaming. The port collar is capable of handling all types of gravel. The combination gravel pack tool is picked up to locate and straddle the port. After pack off, the port is closed and excess gravel is reversed out. When multiple port collars are run, the setting tool is moved up to locate the next port collar and the gravel pack process is repeated.

The inner rotating sleeve is sealed with O-rings above and below the gravel ports (2). O-ring side seals can be added to the rotating sleeve around the port to provide a pressure tight seal when closed. Rotating splines are deep so that the gravel pack key tool remains engaged during rotation. The sleeve is opened with LH rotation and closed with RH rotation. A steel pin and mill groove positively locate the open and closed port positions. This limits the rotation to 90° from stop to stop.



LANDING NIPPLE

OVER THE TOP GRAVEL PACK TOOL

STANDARD PORT COLLAR GRAVEL PACK TOOL

ROTATING PORT COLLAR