

Casing while Drilling (CwD) Optimizing Drilling Performance



Typically, the conventional drilling process involves drilling with drill pipe, tripping it out of the hole, and then casing the well. The Casing while Drilling (CwD) process uses a standard casing string when drilling, so drilling and casing the well are executed simultaneously, section by section. This eliminates casing runs and isolates formations while drilling. CwD technology produces many results that are beneficial to improving the integrity of the well, particularly when compared to drilling conventionally. The CwD technology can also enhance your safety and drilling performance, bringing value to any of your drilling intervals.

Having commercialized the process of CwD and working with customers over the years to perfect it, no one beats our experience and history with CwD. In fact, the industry's first casing running tool (CRT), the Casing Drive

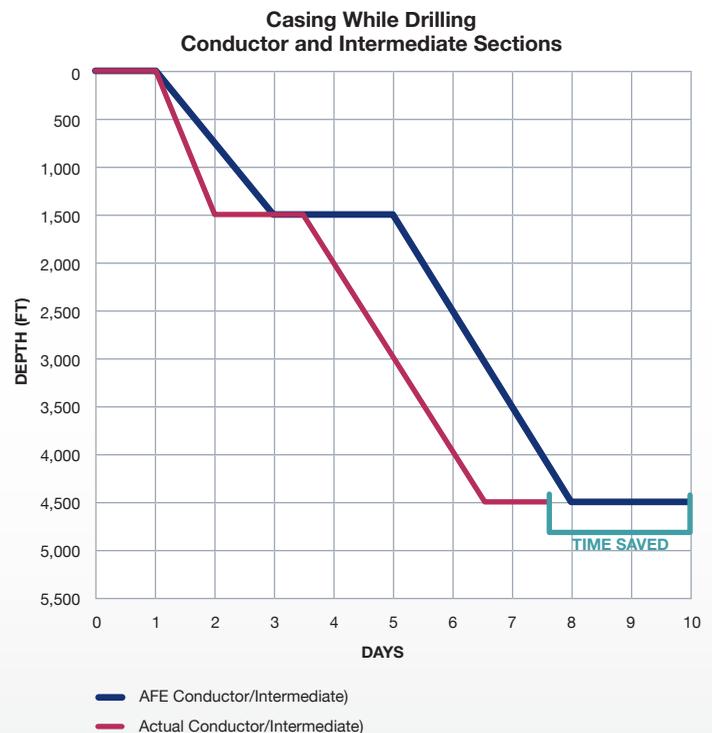
System™ (CDS), was designed primarily for the purpose of executing successful CwD jobs, whose casing sizes range from 3.5-20 in. Since then, the CDS has been used for maximizing value in additional services, such as casing running and reaming operations, bringing even more efficiencies and NPT reduction.

CwD brings many benefits to drilling operations, especially on wells experiencing problems with lost circulation and wellbore instability. Drilling these types of wells conventionally can be challenging, consequently generating unnecessary NPT and sometimes preventing the casing from being set at the right points. For surface or conductor casings, CwD has proven highly beneficial - potentially saving one to three days depending on the area. On an

intermediate section, the correct setting point can be achieved despite losses or unstable formations, since it is possible with CwD to drill through and isolate the zone without the need to trip. Depending on the area, by the end of the intermediate section, as many as five days have been saved using Tesco's CwD practices. Experiences in CwD along pay zones has also been accumulated, especially in depleted reservoirs where skin damage is a concern. If CwD takes place along low-pressure productive sandstones, the process offers the possibility to drill variable pressure zones with much less fluid invasion, consequently skin damage can be greatly reduced.

FEATURES & BENEFITS

- Improves QHSES performance and operations require fewer personnel on board (POB)
- Eliminates the need to trip in and out, which reduces time and mitigates risks
- Complete drilling and casing operations simultaneously, thereby completing sections more efficiently
- While casing rotates, the "plastering effect" is produced, creating a better filter cake and more stable wellbores
- Creates a smoother, more in gauge hole which requires less cement which can save on cementing costs
- Avoids the need for extra casing strings when the casing setting points are not achieved with conventional methods
- When partnered with a Cement Swivel, cementing rig up times can be shortened further reducing NPT



Casing while Drilling (CwD) Summary of Benefits



Cementation Savings

To further maximize efficiency, Nabors recently introduced the Cement Swivel; a sub that can be installed on top of the CDS prior to any job, enabling the cementing process to start immediately after casing is run to TD. Cementing while rotating the pipe is considered a beneficial process to maximize mud displacement by cement. By incorporating the Cement Swivel with the CDS, the rotation of the string while cement is pumped up the annulus, minimizes the

risk of channeling and improves Cement Bond Log (CBL) quality, resulting in fewer or zero cement squeeze jobs. To remotely launch multiple plugs or darts for regular and multi-stage cementing in onshore or offshore applications Nabors developed the first Multiple Plug Launching System (MPLS). The MPLS removes the need for manual plug launching, maximizing safety and efficiency in tubular cementing operations.

Wellbore Strengthening

During CwD operations, the pipe is in constant contact with the wellbore; smearing the cuttings, which in combination with certain types of lithology, work together to close and seal leaking formations and fractures whether pre-existing or induced by drilling. This process also known as "smear or plastering effect" helps minimize the chance for fluid losses and at the same time strengthens the wellbore (Hoop Stress Enhancement), minimizing unstable and trouble-zone sections while drilling by significantly reducing risks and NPT.

CEMENT SWIVEL W/ BALL LAUNCHER



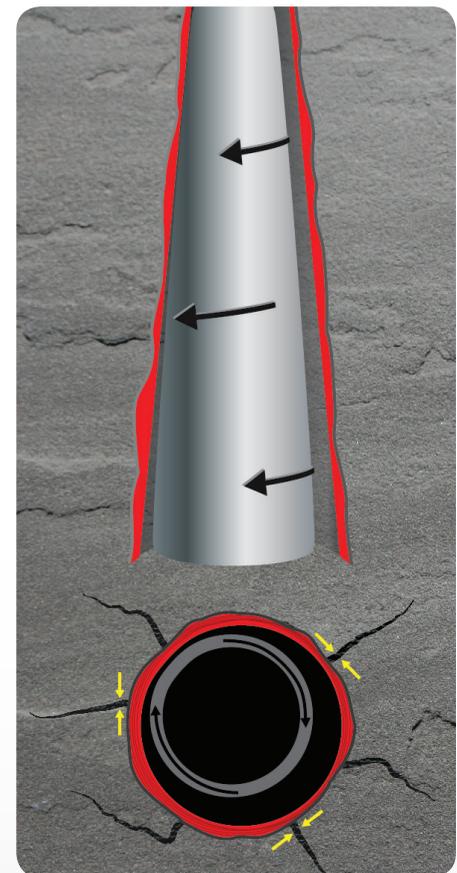
MPLS



350T CDS



500T CDS



*Performance based on drilling conditions