TDDirect
Casing-drilling and liner-drilling technology
Well construction without dedicated casing runs

TDDirect* casing-drilling and liner-drilling technology delivers a superior wellbore by casing and isolating the formation while drilling. Each foot of borehole is drilled and cased off simultaneously, eliminating the need for separate casing or liner runs. When TD is reached, the borehole is ready for cementing.

This simplified drilling process promotes safer operations by requiring fewer people on the rig floor and less pipe handling than conventional drilling. Plus, with casing constantly on bottom, the potential for NPT due to wellbore instability is reduced.
Since 1998, TDDirect technology has increased drilling efficiency in a wide range of land and offshore applications worldwide:

- over 1,450 wells
- totaling 4 million ft
- deeper than 15,500 ft.

Compared with conventional drilling systems, in a wide range of inclinations, TDDirect technology has recorded equal or better on-bottom ROPs and has reduced time spent on drilling and casing operations by more than 30%.

TDDirect technology has also proven its flexibility in several special applications, such as directional tophole intervals in Malaysia, difficult shales in North America, and 3D wells in the North Sea.
During drilling, rotating casing and the resulting smaller annulus cause cuttings to be smeared into the borehole wall, strengthening the wellbore. This action has been termed the plastering effect. It seals pores in the formation to reduce fluid losses and improves cementing to help protect well integrity. Because cuttings are plastered into the borehole wall, fewer are returned to surface. As a result of being subjected to grinding, the cuttings that are returned to surface are smaller in size.

TDDirect technology has proven to reduce NPT resulting from borehole-related problems, such as

- sloughing shales
- tight holes
- borehole bridges
- lost circulation
- large-diameter surface hole resulting in hard-to-remove cuttings from the annulus
- damaged producing zones
- stuck pipe.

Drilling with conventional drillpipe (left) allows a larger annulus, while drilling with casing (right) minimizes annulus size; rotating casing smears cuttings into the borehole wall, sealing pores in the formation to reduce fluid losses, and producing a stronger borehole for improved cementing.
Flexible technology for diverse applications

To ensure effectiveness across a wide range of applications, TDDirect technology delivers solutions with four drillstring designs.

- **Direct XCD** drillable alloy casing bit, from Smith Bits, a Schlumberger company run on casing or liner string.
- **TDDirect CD** casing-while-drilling service.
- **TDDirect LD** liner-while-drilling service.

Conventional drilling assembly.
Drilling designs that reduce well construction time at every level

SURFACE INTERVAL
Direct XCD bit drills vertical or tangential intervals to TD in a single run.

INTERMEDIATE INTERVAL
TDDirect CD service drills intervals that must be logged or directionally drilled.

PRODUCTION INTERVAL
TDDirect LD service drills liner intervals with the Direct XCD bit or directional BHAs when running casing to surface is not required.
The Direct XCD drillable alloy casing bit is a PDC bit specially made for drilling vertical or tangential wells to TD in one run. The bit drills on standard casing that is rotated at the surface.

The cutting structure of the Direct XCD casing bit can be fitted with 13-, 16-, or 19-mm PDC cutters, which are available in standard or premium grades. The bit’s sub is composed of durable oilfield grade steel, while its body is made of a copper bronze alloy. This unique alloy allows it to be drilled out by any standard PDC bit after the Direct XCD bit has drilled to TD, and the casing has been cemented in place. After drillout, the drillout PDC bit can continue drilling the next interval, eliminating the need for a dedicated drillout run.
Direct XCD drillable casing bit

**Optimized erosion-resistant nozzles**
direct flow and hydraulic force to maximize ROP.

**Bit cutting structure**
can be fitted with 13-, 16-, or 19-mm premium grade PDC cutters on each blade.

**Optimal tungsten carbide coating**
applied to bit body and blades resist erosion in aggressive applications.

**Large-face waterways**
and junk-slot areas maximize cuttings removal.

**Spiral-gauge pads**
maximize bit stability and reduce vibration.

**Bit body design**
allows drill out by any PDC bit.

**Bi-metal composition**
drillable body includes a bit sub made of oilfield-grade steel.
Case Study

Direct XCD Drillable Casing Bit Saves Two Colorado Wells and USD 8.6 Million

Unstable shale application threatens operation
An operator working in Fremont County, Colorado, was drilling a 9½-in well section through a part of the Denver-Julesburg basin’s Niobrara formation, which is characterized by unstable Pierre shale. Although the planned well depth was 5,000 ft, at 3,800 ft the BHA became stuck and was lost. After drilling a sidetrack to 3,410 ft, the drilling team attempted to run 9⅝-in casing, but was unable to get the casing string past 2,444 ft. The operator pulled out of the hole and made a cleanout run with drillpipe to 3,095 ft. Upon reentering the well, following cementing, the operator could only reach a depth of 2,800 ft.

Casing-while-drilling saves investment
After 68 rig days, the operator considered abandoning the well but decided to try reaching the planned TD using TDDirect technology. Reaming the casing back to bottom enabled the operator to drill the remainder of the interval to TD using a 8½-in Direct XCD drillable alloy casing bit on 7-in casing. Upon landing and cementing the casing, the bit was drilled out. The casing-while-drilling operation took approximately 10 rig days, after which the operator continued running the production string.
Direct XCD bit protects investment in first well and reduces costs on second
Once the well was completed, the operator skidded the rig 20 ft to drill a second well. Using the same drilling design from the first well, the operator ran a Direct XCD casing bit on 9\(\frac{5}{8}\)-in casing to drill from 1,600 ft to interval TD at 4,900 ft in seven days. When compared with the USD 5.5 million investment in the first well, the investment in the second well was reduced by USD 3.1 million.

The Direct XCD casing bit substantially reduced the operator’s well construction time in the Denver-Julesburg field’s unstable Pierre shale by drilling while casing two wells, saving USD 8.6 million.
TDDirect CD casing-while-drilling service

Retrievable system provides increased flexibility
The TDDirect CD casing-while-drilling service is used with a retrievable BHA when the interval must be logged while drilling or drilled directionally. Conveyed on drillpipe, the service works with any BHA and can be used to drill boreholes that require multiple bit changes, or for applications that require rotary steerable systems (RSS) or MLWD tools.

The service includes a drill-lock assembly (DLA), which connects the BHA to the bottom of the casing shoe joint and enables torque and weight to be applied by the casing during drilling. The rig’s top drive rotates the casing, and a downhole motor provides additional rotation speed and torque to the BHA and bit.

The DLA seals and connects the BHA to the casing string with a triaxial lock. At any point during the drilling process, the DLA can be disengaged for BHA retrieval. If needed, the BHA can be tripped back in and reseated in the DLA to continue drilling.
The TDDirect technology Type 5C PDC retrievable underreamer is also used to provide high-ratio borehole enlargement in the required gauge. At any point during drilling, the BHA can be retrieved through the drift of the casing, ensuring recovery of RSS and MLWD tools. When tripping drillpipe out, a casing circulating tool is used to ensure pressure integrity of the casing and wellbore.

**Service overcomes problematic formations**

For directional applications, the retrievable TDDirect CD service uses a steerable BHA, which is compatible with RSS or positive displacement motor (PDM) directional tools. When drilling in depleted or mature fields characterized by lost circulation and wellbore instability, this service offers several key capabilities:

- constant casing rotation breaks static friction, allowing consistent weight on bit
- rotation and high-annular velocity improves borehole cleaning, moving cuttings into the flowstream
- the plastering effect maximizes borehole strength and stability.
The liner hanger’s multiset capability enables the liner to be suspended at any point during drilling. By decreasing the swab and surge on the formation, BHA change-out times are much faster. The multiset liner also allows the entire liner string to be suspended inside the parent casing, where it is protected from borehole instability, reducing the chance of becoming stuck.

Service options set liner at any point during drilling
Based on the TDDirect CD service, the TDDirect LD liner-while-drilling service is used to drill intervals that do not require running casing to surface.

The service includes a unique multiset liner hanger that allows the liner to be parked in tension inside the parent casing or across an openhole section at any point during drilling.
The TDDirect technology Type 5C PDC retrievable underreamer is also used to provide high-ratio borehole enlargement in the required gauge. After a return trip from surface, the drillstring is locked back into the liner, and the hanger is reset for continued drilling. The service cannot be preset while drilling and can only be activated with a ball drop.

Torque controls ensure borehole stability
By internally bypassing the liner, TDDirect LD service minimizes the difference between static and dynamic equivalent circulating density (ECD), helping to ensure borehole stability. By routing torque to the drill bit through the inner drillstring, the service also prevents drilling torque from passing through, and possibly damaging, the liner or its connections. The liner connections are subjected only to the friction generated by the liner rotating in the wellbore, which produces the service’s signature plastering effect that strengthens boreholes.
Casing accessories

TDDirect technology includes a wide range of tools and casing accessories, which enable almost any land or offshore drilling rig to be adapted for a casing-while-drilling operation. This efficient drilling capability, coupled with the knowledge and experience of Schlumberger drilling professionals, puts any downhole environment within reach, so your drilling production goals can be fully realized.
Pumpdown displacement plug cementing system
Provides cement isolation and backflow prevention

TDDirect technology cementing system is used because conventional float equipment cannot be used in casing-while-drilling applications. The system includes a plug landing nipple (PLN), which is pre-installed in the casing string and a pumpdown displacement plug (PDDP).

After TD has been reached and the drilling BHA has been returned to the surface, cementing of the casing begins. The PDDP is launched after the tail slurry and locks into the PLN to hold pressure and complete the cementing operation.

The system wipes the casing or liner behind the cement and provides a barrier between the cement and displacement fluid. Upon landing, the system provides a barrier that prevents cement from U-tubing into the casing or liner.

Composed of a PLN and PDDP, the cement system prevents backflow and isolates cement.
Hydro-formed casing centralizers
Positive borehole centralization for cementing vertical or deviated wells

The hydro-formed casing centralizer provides positive center positioning for cementing in vertical and deviated wells. The centralizers are placed on the outer diameter of the casing string to create standoff between casing and the borehole during TDDirect technology applications.

The centralizer’s design promotes the plastering effect, which strengthens wellbores for an effective cement bond that helps protect well integrity. Made with a special Hydro-forming process, the centralizer has an exclusive design and attachment method. The result is a casing drilling tubular that provides the strength and rigidity to withstand dynamic downhole loads while maintaining standoff under large side forces without crushing.

Nonhardfaced centralizer
Hardfaced centralizer

The casing centralizer’s helical blade design enhances circulation, borehole cleaning, and cementing.
Multilobe torque rings
Increase torque capacity while protecting tubular connection threads

Multilobe torque (MLT) rings, which provide a positive makeup shoulder to increase torque capacity when installed in standard API buttress-threaded connections when using TDDirect technology applications. The increased torque capacity prevents pins and couplings used in API casing and tubing connections from being overstressed in drilling and workover applications, thereby reducing tubular connection maintenance and replacement costs.

![Graph showing connection torque capacity with MLT rings and standard connection torque capacity.](image)

Normal or shoulder torque capacity of a 9-5/8-in API buttress-threaded connection in N-80 grade steel is increased when MLT rings are installed.

The MLT rings provide a reliable makeup shoulder to increase torque capacity while protecting connection threads.
Find out more about TDDirect technology at slb.com/TDDirect.

Case Study
By using a Direct XCD casing bit in Colorado’s Niobrara formation, an operator saved a USD 5.5 million investment in one well and reduced the cost of another by USD 3.1 million.

Direct XCD
Drillable alloy casing bit
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i-DRILL
Engineered drilling system design
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