

Casing while Drilling

# Enhanced Casing Installation



**ODFJELL WELL SERVICES**

A PART OF ODFJELL DRILLING

## OWS CASING WHILE DRILLING TECHNOLOGY

# CWD Definition, History & Experience

**1907** Reuben Baker Introduces Cable-drill Casing Shoe

**1920** Retractable bit in Poland/France/USA

**1950** Drill-in the final tubing string and cement in place

**1980** California Heavy Oil Sands, West Texas Infill Drilling

**1990** Renewed interest emphasis on simplicity

## OWS CASING WHILE DRILLING EXPERIENCE

### L2 Non-retrievable Casing while Drilling

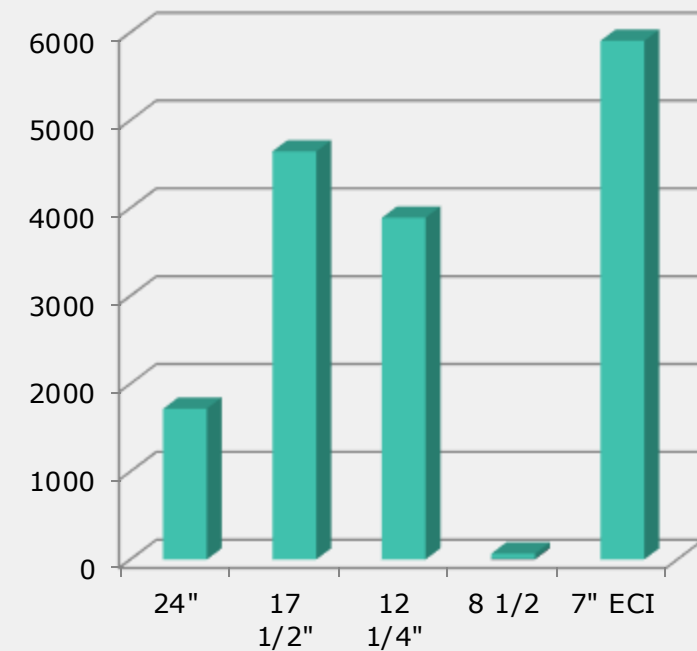
- Drilled in 4 Countries
- Drilled over 65 Wells
- 104,922ft Formation Drilled
- 99% Success Rate

### L3 Enhanced Casing Installation

- 17 Trials
- Drilled 14 wells
- Deepest Well Drilled 5,905ft
- Vertical to 40 Degrees inclination
- 100% Success Rate
- Wireline Retrievable

Casing while Drilling means utilizing the 'casing string' as the 'drill string' instead of drill pipe.

Longest Sections ft.





# Casing While Drilling key Drivers

## Why would you consider Casing While Drilling on your well?

- Problems getting casing or liner to the bottom
- Lost circulation causing hole stability issues
- High rig spread rates – flat time reduction
- Hole stability issues resulting in high NPT(stuck pipe)
- Depleted and thief zones
- Running unplanned contingency strings
- Mature secondary/tertiary recovery fields – UB DwC
- MPD applications
- Shallow gas/shallow water flows
- Massive potential time saving over conventional drilling practices

### BUILD RATE LIMITATIONS

13-3/8"	3 - 4°/100'
9-5/8"	5 - 6°/100'
7"	6 - 8°/100'

### CONNECTIONS

Buttress, semi-premium or premium. With or without torque rings.

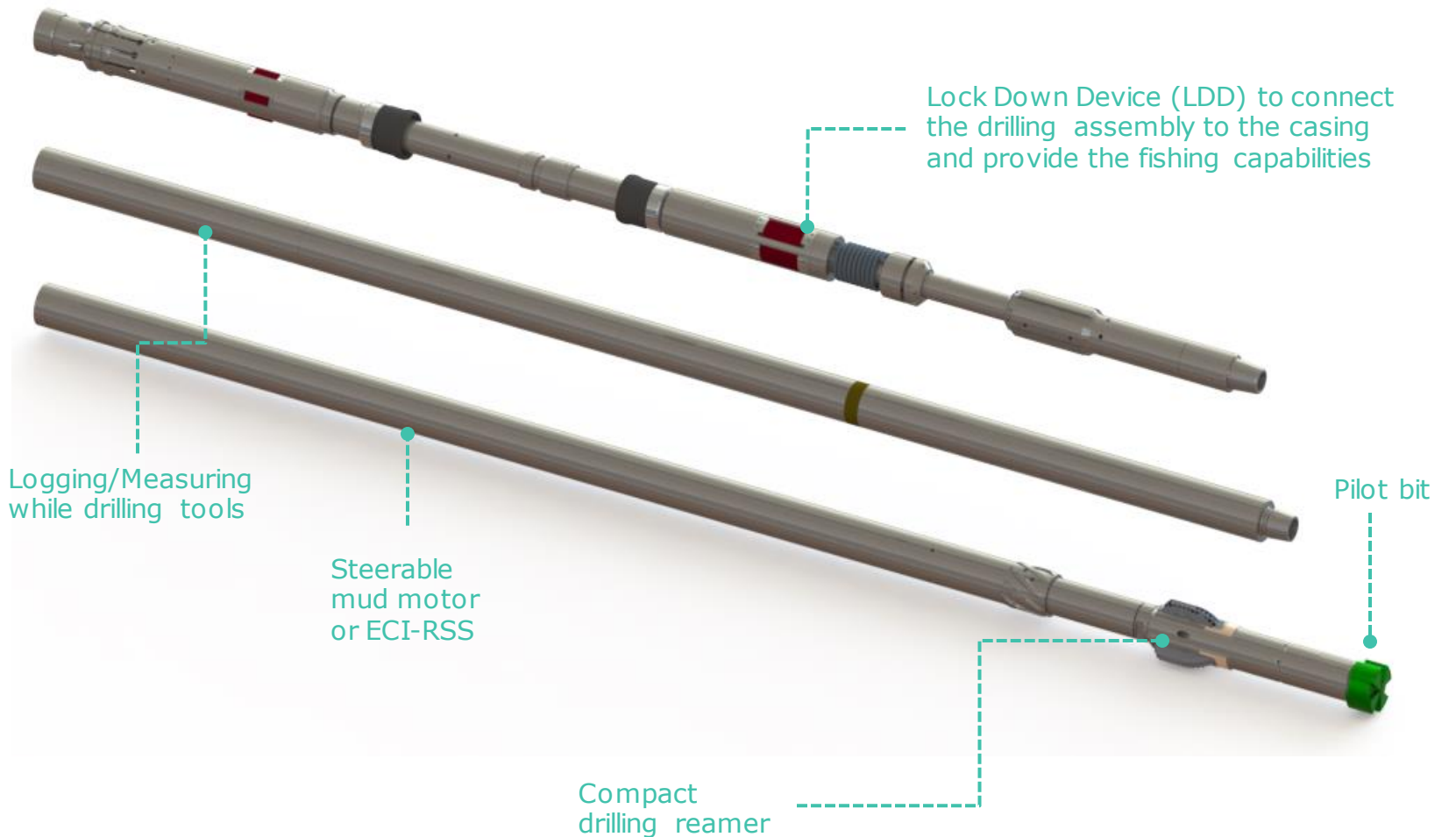


# Enhanced Casing Installation (ECI) system

## What is Enhanced Casing While Drilling?

ECI is a modular casing drilling system that is designed to drill and case the well simultaneously, with the added ability to measure and log a well using industry standard logging tools.

- ECI CwD is a rotary drilling process that drills and cases a well simultaneously
- The casing is used as drill pipe and to convey mechanical and hydraulic energy to the bit
- Steerable with PDM or RSS, compatible with MWD and LWD also still providing wellbore strengthening
- ECI gives the ability to drill more complicated wells through problematic formations where conventional drilling is unsuitable

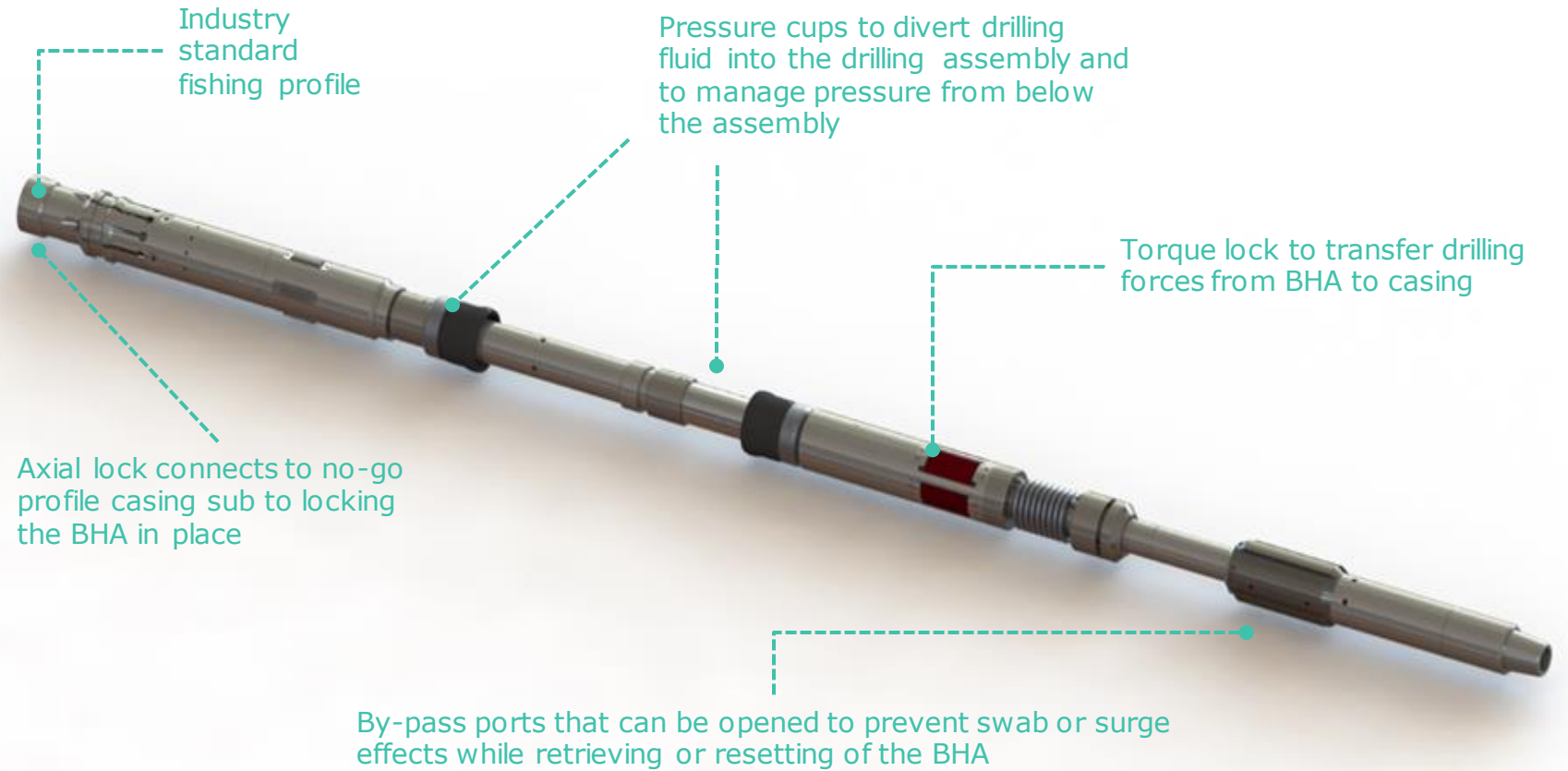


# Lock Down Device

The ECI Lock Down Device connects the drilling assembly to the casing while drilling and enables BHA retrievals on drill pipe or cable.

## KEY FEATURES:

- Reliable locking system requiring a minimum of setting and releasing actions
- Large surface area non-marking dies will not damage the casing
- Unique axial lock profile to enable retrieving and resetting of BHA's
- Large By-Pass ports to prevent swabbing and surge when tripping BHA
- Torque dogs activated by reactive torque, transferring maximum hydraulic and mechanical energy to the bit
- Drill pipe or cable retrievable
- No go profile preventing the BHA passing the latch assembly
- Changeable stabilizer sleeve
- Available for a range of casing sizes and weights

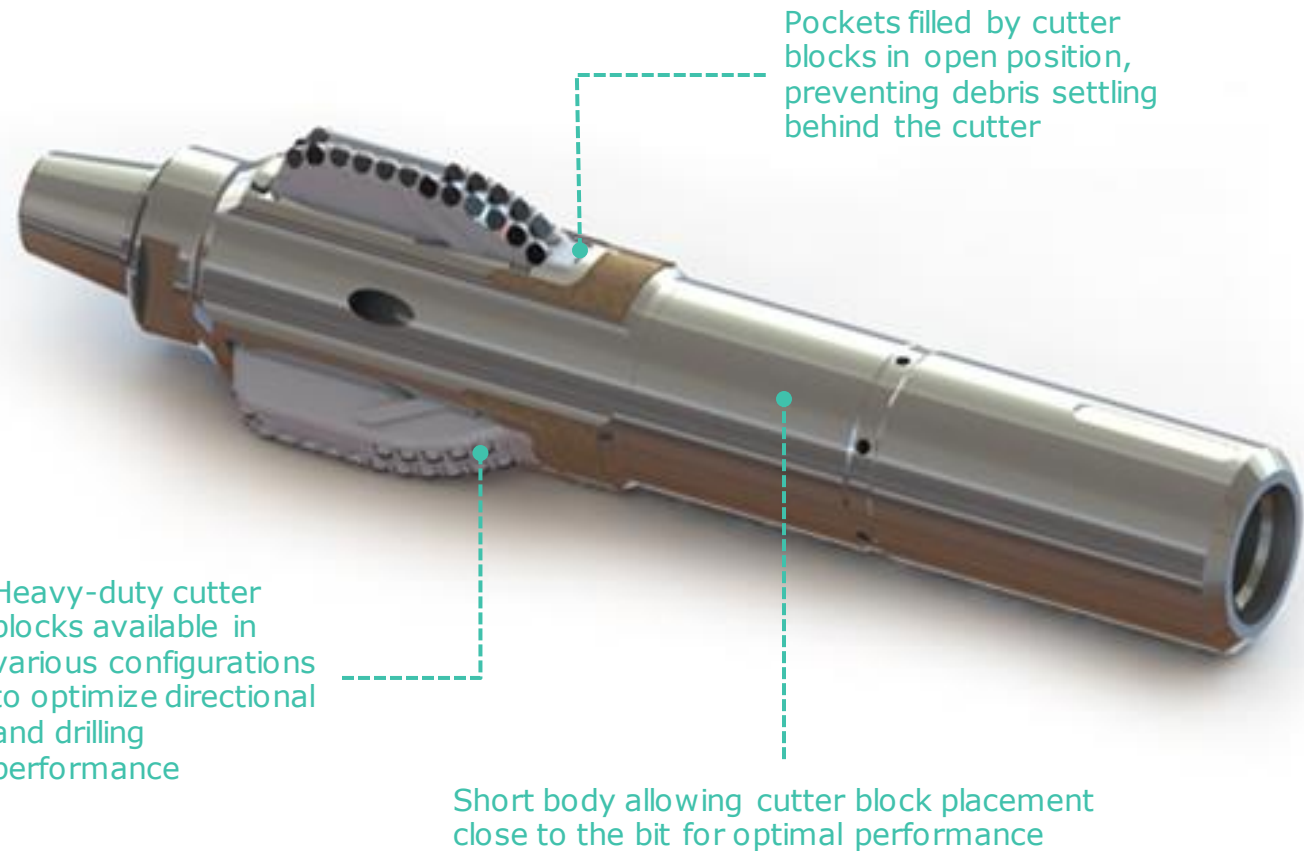


## Under-reamer

The compact under-reamer is designed to handle high drilling loads. The block-type cutting elements are hydraulically opened and don't allow debris to prevent them from closing.

### KEY FEATURES:

- Short, robust design to allow placement below mud motor
- Increases hole by up to 50% more than the pilot size, even in the smaller diameters
- Cutting blocks with active or passive gauge to alter directional behavior
- Blocks with different size and number of PDC cutters to match formation requirements



# ECI Specifications

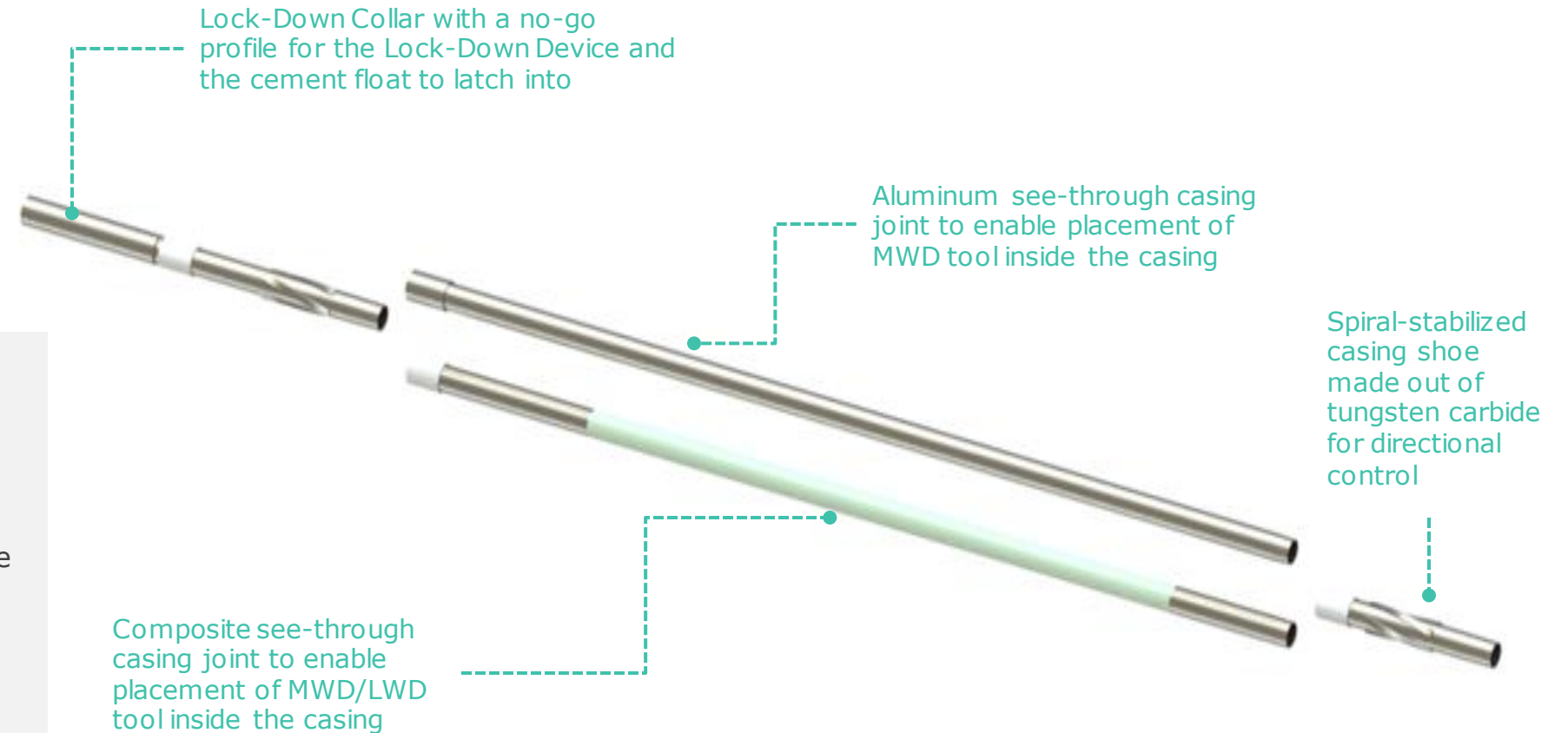
	<b>ECI 7000</b>		<b>ECI 9625</b>		<b>ECI 13375</b>	
	Lock Down Device	Under reamer	Lock Down Device	Under reamer	Lock Down Device	Under reamer
<b>Casing OD</b>	<b>7"</b>		<b>9-5/8"</b>		<b>13-3/8"</b>	
<b>Casing range</b>	<b>17 – 29 #</b>		<b>36 – 53,50 #</b>		<b>48 – 72 #</b>	
<b>Max OD</b>	5,98" (152 mm)	5-3/4" (146 mm)	8,267" (210mm)	8-1/4" (209,5 mm)	12" (305 mm)	11-3/4" (298mm)
<b>Overall Length</b>	14,8 ft (4515 mm)	2,67 ft (813 mm)	18,4 ft (5608 mm)	3,57 ft (1089 mm)	30 ft (9100 mm)	4,64 ft (1413 mm)
<b>Weight</b>	827 lbs (375 kg)	170 lbs (77 kg)	1800 lbs (826 kg)	418 lbs (190 kg)	4,400 lbs (2000 kg)	1,026 lbs (466 kg)
<b>Top Connection</b>	5" Internal Fish Neck	PIN 3-1/2" REG	5" Internal Fish Neck	PIN 4-1/2" REG	7" Internal Fish Neck	PIN 6-5/8" REG
<b>Bottom Connection</b>	PIN 3-1/2" IF (NC-38)	BOX 3-1/2" REG	PIN 4-1/2" IF (NC-50)	BOX 4-1/2" REG	PIN 6-5/8" REG BOX 6-5/8" REG PIN 7-5/8" REG	BOX 6-5/8" REG
<b>Max Flow Rate</b>	350 gpm (1300 lpm)		900 gpm (3400 lpm)		1,300 gpm (5000 lpm)	
<b>Max Torque</b>	7,000 lbs-ft (9500 Nm)*		11,000 lbs-ft (15000 Nm)*		28,000 lbs-ft (37960 Nm)*	
<b>Max WOB</b>	14,300 lbs (6,5 ton)*		19,840 lbs (9 ton)*		26,455 lbs (12 ton)*	

## Shoe track accessories

Accessories available for the ECI system, including stabilized shoes, see-through joints in composite or aluminum, lock-down collars and cement plugs, drill pipe or wireline retrieval tool.

### KEY FEATURES:

- All casing accessories available in different lengths and threads
- Tungsten carbide dressed casing stabilizers and casing shoe, to optimize the directional behavior
- Lock Down Collar with non-oriented latch profile, including contingency profile
- "See through joints" allows for LWD, MWD measuring tools to be used from inside the casing to reduce BHA "Stick Out" allowing for better steering ability
- "See through joints" made from high strength Composite or Aluminum casing designed for down hole applications





# See-through joints

The use of see-through joints made from aluminum or composite material makes it possible to place the drilling assembly inside a casing to minimize the BHA stick-out and risk of getting stuck while optimizing stabilization for directional and drilling performance.

Type see-through joint	MWD	LWD	EM-MWD
Composite (HSCT)	YES	YES <sup>1)</sup>	YES
Aluminum	YES	NO	NO
Aluminum with gap sub	YES	NO	YES
Steel	Inclination only	NO	NO

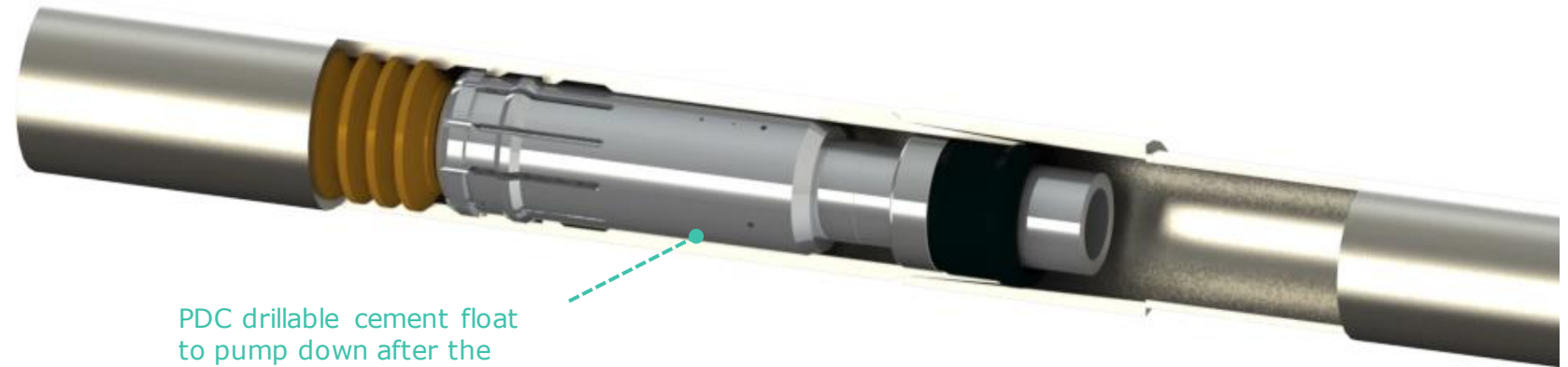
	OD	ID	Length (m)	Collapse (bar)	Burst (bar)	T. yield (ton)
Aluminum	7"	6.184"	Max 12 m	180 <sup>1</sup>	265 <sup>1</sup>	142 <sup>2</sup>
Composite	7"	6"	Max 9.9 m excl x-overs (steel)	-	80	55

1calculated value

2calculated value on pipe not on connection

## PDC Drillable Cement Float

- Pumped down into same profile used for the drilling assembly
- Rupture disc for positive latch indication
- PDC drillable
- Suitable for all regular temperature and pressure cement jobs



PDC drillable cement float to pump down after the BHA retrieval, latches into the Lock Down Collar



# Plastering Effect

- The Plastering Effect is an inherent and unique feature of Drilling with Casing that strengthens the wellbore, prevents lost circulation, and mitigates formation damage.
- Plastering Effect augments the pressure containment of the wellbore by smearing the drilling cuttings into the formation face, hence sealing the pore spaces.
- This continuous process creates a low porosity, low permeability filter cake on the wellbore wall, reducing or preventing losses to the formation and effectively widening the operating mud weight window.

