Oiltools

PRODUCT CATALOGUE

Archer

Archer is a global oil services company with a heritage that stretches back over 40 years. With a strong focus on safety and delivering the highest quality products and services, Archer operates in 40 locations over 19 countries providing drilling services, well integrity & intervention, plug & abandonment and decommissioning to its upstream oil and gas clients.

Oiltools Introduction

Archer Oiltools is recognized as an industry leader for its smart and robust solutions for markets where well integrity, reliability and time saving are of upmost importance. In line with our mandate to deliver better wells, we have assembled a range of technologies designed to combat this serious challenge, to extend well life, maximize well performance, and minimize environmental impact. Our well integrity portfolio addresses three key challenges: annulus integrity, well suspension and integrity diagnostics.

Portfolio

The Archer Oiltools portfolio specializes in the design, manufacturing, operation and installation of high-end tools and services, unique within well barrier and well integrity remit. To ensure all of our oil tools products and services meet or exceed client expectations, Archer's engineering department develops and regularly tests tools to ISO 14310 and now recently also the 14998 V0 standard. Our specialized products can be tailored to clients' internal and/or external needs, specifications and regulations.

Our premium product portfolio consists of:

- Plugs, packers and plug solutions, including the LOCK® and SPARTAN™ plugs and SPEARHEAD™, HUNTER™, and VAULT™ solutions
- Stronghold™ perforate, wash, and cement solutions
- Wellbore Cleanup services, featuring Tornar®
- Cflex® stage cementing system
- X-it™ whipstock system
- Tubing Conveyed Perforation (TCP) services
- Greenlight technology
- Cement Heads

Value

Delivering value driven excellence to our clients operations is what we do. Our well barrier equipment is certified to the highest international standards and is consistently being applied by the in most challenging environments around the world.

People

Archer's Oiltools personnel are recognized for their experience, expertise and the personal pride and care they take in performing their work safely and efficiently. We are constantly in search of new ways to deliver outstanding performance, which starts with selecting the right tools to solve customer challenges.

Performance

Our pursuit is to perform to the highest standards in safety, conduct, operations, engineering and service. The desire to succeed, the reliability to deliver on what we promise, and the discipline to be consistent in doing so safely, defines Archer's performance.

Archer

Table of Contents

Plugs & Packers

SPARTAN™

Everyday solution for short or medium term well suspension

The SPARTAN™ is designed for well suspension periods of days to months, ensuring easy deployment, a secure seal and safe removal on task completion.

Benefits

– Absolute protection
– Confidence in retrieval
– Easy and rapid deployment
– Reduces operational time
– Safer and lower cost operations
– Flexible set depths and angles

Features

– ISO 14310 V3 to V6 certified seal
– 100% retrieval record; millable
– No set weight needed below
– High differential pressure elements up to 7,500 psi and 155°C
– Seal testable from above and below
– Sizes 7"–14"

Specifications

Sizes, inches	7 – 14
Pressure rating, psi [bar]	5,000 – 7,500 [345 – 517]
Temperature rating, °F [°C]	39 – 311 [4 – 155]
ISO 14310 qualified	Yes
Max hang-off weight, klbs [tons]	154 [70]
Through-bore diameter, inches	1.1 – 3
Typical suspension period	Days to Months
Drillpipe Connections	NC38 – NC50
Elastomer	HNBR
Ball valve ISO 28781 qualified	Yes

Specifications may be subject to change.

Archer

SPARTAN™ Plug and Perf System

Significantly Improves Efficiency in P&A Operations

The Industry Challenge

A challenge for operators worldwide when plugging and abandoning (P&A) wells, both exploration and wells at the end of a lifetime, is oil based mud in the annulus between two casing strings.

In order to cut and pull the wellhead, the oil based mud between the casings must be circulated out, and a cement plug has to be set as an environmental barrier.

Traditionally this was solved by cutting and pulling the casing; for example, cut the 9-5/8" casing from the 13-3/8"casing shoe, then set the bridge plug and cement inside the 13-3/8" casing. In some cases, casing milling was required to set the environmental plug.

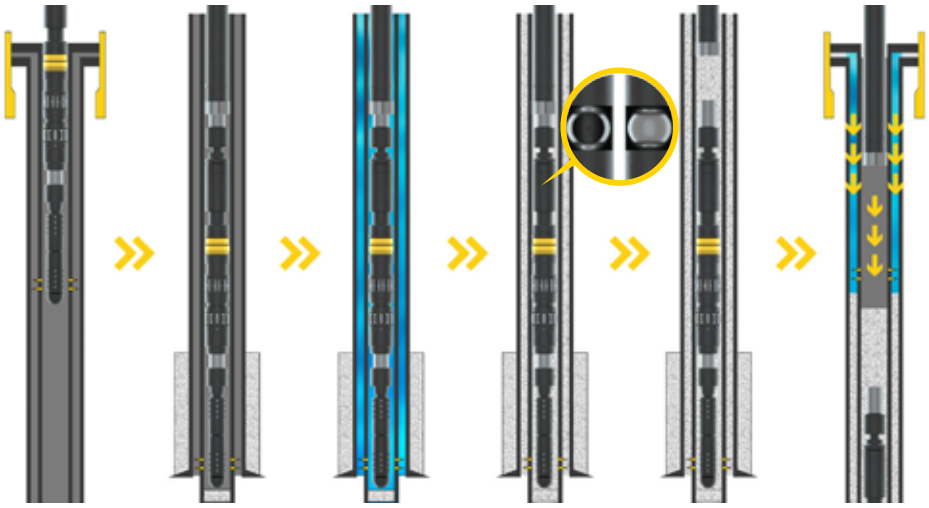
Solution

The solution for this challenge is the SPARTAN plug and perf system. This system consists of the unique SPARTAN retrievable bridge plug, and two separate activated single casing perforation guns. This enables the first casing to be perforated without compromising the integrity of the second casing.

With this solution, the objective of circulating out oil based mud and setting the environmental cement plug can be met with no cutting and pulling, or milling of tubulars.

Result

A permanent barrier is set between two casings without cutting and pulling.



Method

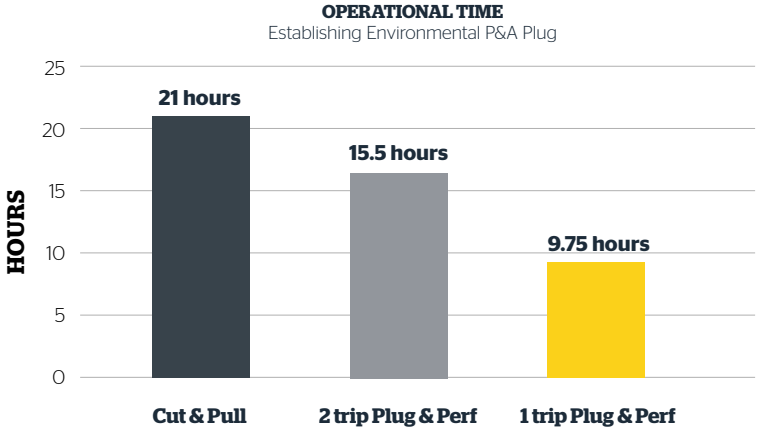
- Run in hole and perforate the casing just below seal assembly.
- Run in hole to just above the casing shoe; set the plug and perforate.
- Pump down string to establish communication between the deep and shallow perforations. Circulate all oil based mud out of the well and displace to seawater to prepare for the cement job.
- Displace the cement slurry through the drill string and into the deep perforations. Returns are taken through the shallow perforations. By displacing the cement through the SPARTAN plug and into the perforations the B annulus is cemented. The integral ball valve in the SPARTAN plug is closed, so that the cement will stay in place without U-tuning back up the drill string.
- After the ball valve is closed, the running tool is released from plug and a balanced cement plug is pumped through the running tool and on top of the SPARTAN plug. This completes the barrier. At this stage, a barrier is complete in both A and B annuli.
- After the cement is set, the barrier can be verified. A unique feature is that due to the shallow perforations, both the A and B annuli can be pressure tested and verified. At this stage, the oil based mud has been removed and the environmental barrier is in place – all without removal of the tubular.

SPARTAN

Archer

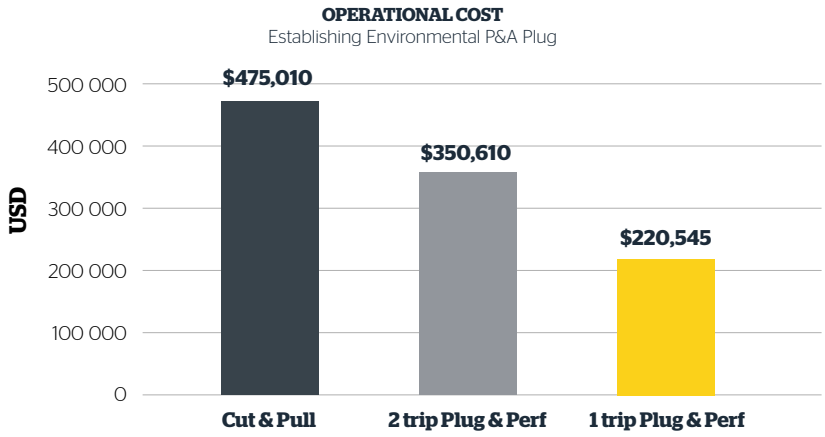
Gaining Efficiency

- Cutting and Pulling 9-5/8" casing, and setting a cement plug is estimated at 21 hours
- The 2-trip Plug & Perf operation took 15.5 hours
- The new 1-Trip Plug & Perf operation takes only 9.75 hours
- Improving efficiency by more than 50%
- Setting a new benchmark for environmental barriers



Saving Operational Cost

- A traditional Cut & Pull operation has an operational cost of $475,010
- The 2-Trip Plug and Perf operation had an operational cost of $350,610
- The new 1-Trip Plug & Perf operation has an operational cost of $220,545
- Operational cost per hour $ 22,619



Benefits

- No need for Cutting & Pulling tubulars
- No need for handling, shipping and disposal of tubulars
- No Casing Milling, or Swarf handling
- No BOP Damage from Swarf
- Reduced risk profile

Archer is a global oil services company with a heritage that stretches back over 40 years. With a strong focus on safety and delivering the highest quality products and services, Archer operates in 40 locations over 19 countries providing drilling services, well integrity & intervention, plug & abandonment and decommissioning to its upstream oil and gas clients. **We are Archer.**

Archer

LEAKFINDER

Leak detection plug

LEAKFINDER is a leak detection plug that builds on the exacting standards set by SPARTAN™ and LOCK® plugs. It is s a simple and cost effective plug for various types of testing and leak detection.

Benefits
- Reliable packer, with similar mechanisms as SPARTAN™ & LOCK®
- Multiple set
- Can be run with cleanout tools as an integrated part of the assy

Typical Applications
- Leak testing
- Pressure testing
- Setting tie-back anchor agains plug
- Inflow testing
- Annulus testing
- Formation testing

Features
- Easy to set/release. Same setting/releasing mechanism as LOCK® plugs that are used for our customers
- High pressure ratings up to 7500 psi (517 bar)
- High pumping capacity due to large 3" ID through plug when set.
- Easy to monitor leakage when testing against elements from above, leakage past plug can be monitored up DP

Archer

TIMELOCK®

Long term suspension and harsh conditions

Archer's TIMELOCK® plug is designed for longer-term suspension periods and harsh well conditions. TIMELOCK® is part of the LOCK® plug series that brings absolute protection, efficiency and flexibility to deliver time and cost savings.

LOCK®

Benefits

- VO protection for extended periods or harsh well conditions
- Confidence in retrieval
- Easy and rapid deployment
- Safer and lower cost operations
- Flexible set depths and angles

Features

- ISO 14310 VO certified gas-tight seal with enhanced seal technology
- High performance elastomer (NORSOK M-710 approved)
- 100% retrieval record; millable
- No set weight needed below
- High differential pressure elements
- Seal testable from above and below
- Multiple sets without tripping

Specifications

Sizes, inches	7 – 14
Pressure rating, psi [bar]	5,000 – 8,850 [345 – 610]
Temperature rating, °F [°C]	39 – 311 [4 – 155]
ISO 14310 VO qualified	Yes
Max hangoff klbs [tons]	154 [70]
Through-bore diameter, inches	1.1 – 3
Typical suspension period	Days to Years
Drillpipe connections	Pin NC38 – NC50
Elastomer	HNBR
Ball valve ISO 28781 qualified	Yes

Specifications may be subject to change.

Archer

STORMLOCK®

Storms, long term suspension or harsh conditions

Engineered to support up to 300 tons of pipe and with enhanced seal technology, STORMLOCK® takes suspension plug performance to its highest peak. Rapidly deployable, reliable and absolutely secure once set, STORMLOCK® delivers V0 protection for short or long suspension periods, harsh well conditions—and storms.

Benefits

- V0 protection for storms, extended periods or harsh well conditions
- Confidence in retrieval
- Easy and rapid deployment
- Safer and lower cost operations
- Flexible set depths and angles
- Reduces rig time

Features

- ISO 14310 V0 certified gas-tight seal
- Up to 300 tons hanging capacity
- 100% retrieval record; millable
- No set weight needed below
- High differential pressure elements up to 10,000 psi and 150°C
- Seal testable from above and below
- Multiple sets without tripping
- Unrestricted 2" straight-through bore

Specifications

Sizes, inches	9-7/8 – 16
Pressure rating, psi [bar]	8,000 – 10,000 [551 – 689]
Temperature rating, °F [°C]	39 – 302 [4 – 150]
ISO 14310 V0 qualified	Yes
Max hang-off weight, klbs [tons]	551 – 660 [250 – 300]
Through-bore diameter, inches	2
Typical suspension period	Days to Years
Drillpipe Connections	6 5/8 in FH
Elastomer	HNBR
Ball valve ISO 28781 qualified	Yes

Specifications may be subject to change.

Archer

LASTLOCK®

Total security in permanent well abandonment

As part of the LOCK® series to provide gas-tight barriers for wells, LASTLOCK® brings total security and maximum protection for permanent plug and abandonment (P&A).

Benefits

– Permanent barrier (V0 protection)
– Easy and rapid deployment
– Safer and lower cost operations
– Flexible set depths and angles

Features

– ISO 14310 V0 certified gas-tight seal with enhanced seal technology
– High-performance elastomer (NORSOK M-710 approved)
– No set weight needed below
– High differential pressure elements
– Multiple sets without tripping
– Sizes 7"–14"

Specifications

Sizes, inches	7 – 14
Pressure rating, psi [bar]	5,000 – 10,000 [344 – 690]
Temperature rating, °F [°C]	39 – 311 [4 – 155]
ISO 14310 V0 qualified	Yes
Max hang-off weight, klbs [tons]	154 [70]
Through-bore diameter, inches	N/A
Typical suspension period	Permanent
Drillpipe Connections	NC38 – NC50
Elastomer	HNBR

Specifications may be subject to change.

Archer

VAULT™
Dual Plug System

The VAULT™ dual plug system enables two Archer barrier plugs to be installed in one run. VAULT™ streamlines plug operations with the ultimate goal of reducing operational (rig) time.

Benefits
- Saves operational time
- Saves operational costs
- Reduced rigsite handling, improving safety standards

Features
- Dual plug system
- ISO 14310 certified, available as a V0 rating
- No set weight needed below
- High differential pressure elements

Specifications

Sizes, inches	7 – 16
Pressure rating, psi [bar]	5,000 – 10,000 [345 – 689]
Temperature rating, °F [°C]	39 – 311 [4 – 155]
ISO 14310 qualification	V0 – V6
Max hang-off weight, k lbs [tons]	661 [300]

Specifications may be subject to change.

Archer

SPEARHEAD™

Strong, extensive hangoff and pull capability

The SPEARHEAD™ system is designed to withstand increased hang off loads, or pull forces, whilst qualifying as a barrier plug. This system allows customers to combine two or more operations, using the SPEARHEAD™ as an anchor before or after it has been set as a barrier.

SPEARHEAD

Benefits

- Saves operational time
- Saves operational costs
- Reduced rigsite handling, improving safety standards
- Reduced rigsite handling

Features

- Extensive hangoff capability
- ISO 14310 certified
- Ability to pressure test above and below the plug

Specifications

Sizes, inches	9 5/8 – 16
Pressure rating, psi [bar]	5,000 – 10,000 [345 – 689]
Temperature rating, °F [°C]	39 – 311 [4 – 155]
ISO 14310 qualification	V0 – V6
Max hang-off weight, k lbs [tons]	661 [300]

Specifications may be subject to change.

Archer

HUNTER™
Tandem Plug System

The HUNTER™ tandem plug system enables a barrier plug to be run in combination with tools or equipment, allowing string rotation without the plug being set. HUNTER™ streamlines plug operations with the ultimate goal of reducing operational (rig) time.

Benefits
- Saves operational time
- Saves operational costs
- Reduced rigsite handling, improving safety standards

Features
- Tandem plug system
- ISO 14310 certified, available as a V0 rating
- No set weight needed below
- High differential pressure elements

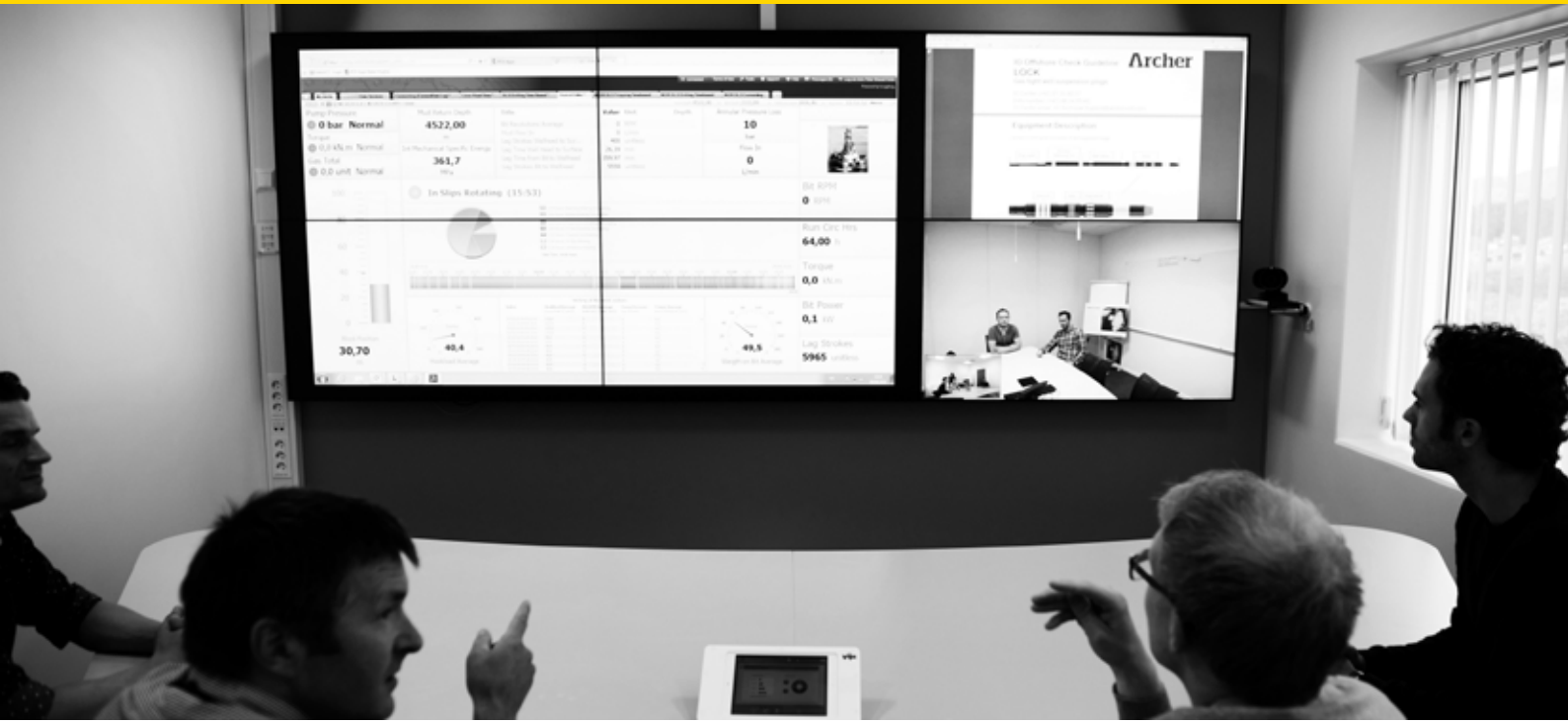
Specifications

Sizes, inches	7 – 16
Pressure rating, psi [bar]	5,000 – 10,000 [345 – 689]
Temperature rating, °F [°C]	39 – 311 [4 – 155]
ISO 14310 qualification	V0 – V6
Max hang-off weight, k lbs [tons]	660 [300]

Specifications may be subject to change.

Archer

Integrated Operations (IO)



Archer's Integrated Operations (IO) delivers a step change in delivering enhanced processes and performances remotely with advanced real-time technology, while reducing operational costs for the oil and gas sector.

Benefits
- Reduces Personnel on Board (POB)
- Saves millions of dollars
- Low personnel mobilization time
- Multiple simultaneous operations
- Reduces operational risks

Features
- 3 fully operational IO centers
- 24/7 availability, fast response
- Primary and backup communication abilities
- Real-Time performance
- Skilled and experienced IO specialists
- Best-in-class technology

More information:
Jens Peter Wessel Holst
Integrated Operations Supervisor
Archer Oiltools AS
Mobile number: + 47 93 46 81 89
Office phone: + 47 51 30 88 36
jpwh@archerwell.com

Archer Oiltools is the leader in developing Integrated Operations (IO) in the North Sea region. Closing 2015 with over 150 IOs for a major operator, we are currently close to running 100% of all operations supported by our local IO centers for this customer.

We bring the IO solution to customer challenges by:
- Reducing operational costs for well operations
- Scaling down personnel on board (POB)
- Ensuring faster and safer operations
- Providing operational flexibility

The purpose-built, robust equipment and streamlined, standardized operations, as well as specified IO procedures and checklists, have made Archer's Integrated Operations successful in delivering best-in-class service quality.

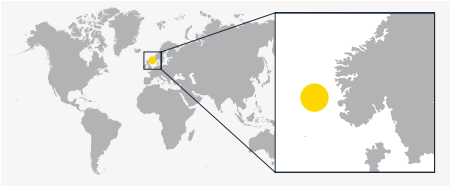
Cost savings related to the reduced POB and transportation are directly tied with the high number of operations run by IO. Archer's IO solution also focuses on the importance of ensuring reduced health and safety risks and environmental impacts in all well operations for.

Archer

Plugs & Packers
Case Studies

Archer

Archer's SPARTAN Plug Ensures Success for Challenging Wells with Heavy Losses



Region: North Sea
Customer: Major operator

Case benefits
- For customer to continue well operations
- Saves time
- Saves operational costs

Key capabilities
- ISO 14310 certified plug
- Fast and efficient installation
- Robust plug

Typical Applications
- Plug & Abandonment (P&A)
- Barrier

Challenge

The customer requested to install an Archer plug in a well that suffered from very challenging conditions. The well was completed in 2006.

The customer planned to set a new casing after pulling the old casing, however losses were incurred during the job.

The challenge was to cure heavy losses in the well to continue with the operation. Another challenge was to pass an undressed 9 5/8" casing cut twice.

The plug had to be set several times to find the location of the losses.

Solution

Archer's solution was to deploy the 9 5/8" SPARTAN to meet the challenge.

Result

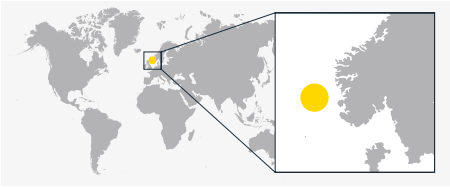
The SPARTAN plug successfully completed the customer's challenge so normal operations could continue.

Following this job, Archer received feedback that our plugs were most robust and best in class in the market.

Picture of severe localized corrosion on the pin end of the 10 3/4" tubing.

Archer

Archer's Plug and Perforate System Saves Major Operator Nearly $3 Million, 11 Days' Rig Time



Region: North Sea
Customer: Major operator

Case benefits
- Saves nearly $3 million
- Saves 11 days of rig time
- Perfect for deviated wells due to no need for weight below to set
- Plug & Perforate solutions provide full lateral isolation

Key capabilities
- ISO 14310 V0 rated gas tight seal
- Easy, rapid set and retrieve
- No weight below to set
- Mulitiple sets without tripping
- Unrestricted 3" fullbore
- Ultra shallow, deep or Horizontal set 20m to 6550m
- Designed to be run with TCP guns

Typical Applications
- Temporary suspension
- Permanent abandonment
- Leak detection
- Storm contingency suspension that requires high hang off weight
- In-flow testing

Challenge

When drilling the well, the 9 5/8" casing became stuck and no circulation was possible through the shoe. The decision was made to plug and abandon (P&A) the wellbore, and facilitate a new side track.

The operator started recovering 4,577m of casing and achieved limited progress. They spent 21 days cutting and pulling 3,182m of the casing. The open hole fishing operation with a well profile of 73 degrees inclination proved to be challenging. The operator needed to explore an alternative technical solution to complete the P&A operation.

Solution

The solution was the Archer Plug and Perforate system. The Plug and Perforate system is built on the SPARTAN plug and Archer's own Tubing Conveyed Perforation (TCP).

A benefit with the SPARTAN plug is that it does not require any weight/tail pipe to set, making it a unique choice for deviated wells like this one. Another benefit is that it is designed to hang perforation guns below and the unique 3" ball valve enables activation balls for perforation guns to be dropped through the plug to fire the TCP guns. casing above the cut.

The first step of the operation was to run down and set a SPARTAN plug at 4,852 m to provide a path for the cement and to isolate the bottom of the hole. The SPARTAN was run through approximately 900 m of open hole before it entered the 9 5/8" casing fish. The plug was set according to plan and procedure, and running tool was pulled out of hole.

The second step was to run the second SPARTAN plug with TCP guns, then perforate the casing between 4,838m and 4,840m, with 12 spf 0,5 holes. Part of the job was to set the SPARTAN at 4824m and circulate the 9 5/8" casing annulus.

The third and last stage was to cement the 9 5/8" up to 4,342m through the SPARTAN ball valve and into the perforations and up. At the end of the cement displacement, the pressure was held inside the string. At that stage, the SPARTAN ball valve was closed to stop the cement from u tubing from the annulus. Two cement plugs were set inside the casing up to 4390m to complete the P&A operation.

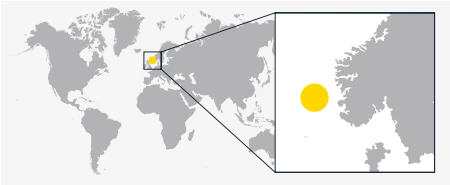
Result

The result was a flawless P&A operation saving the customer 11 days of rig time vs the planned cut and pull operation. The cost saving was estimated to nearly $3 million, providing a solid blueprint for future operations.

*Currency is in US dollars.

Archer

Archer's Plug and Perforate System Helps Operator Qualify an Annular Barrier



Region: North Sea
Customer: Major operator

Case benefits
- Saves time
- Saves costs
- Efficient plug setting with no need for weight
- Retrievable plug
- Qualifies a formation barrier

Key capabilities
- ISO 14310 certified plug
- Field proven
- Can be set and retrieved multiple times
- Perforation gun that only penetrates single casing

Typical Applications
- Plug & Abandonment
- Slot recovery
- Seal of annulus pressure
- Stuck casing with no circulation through the shoe

Challenge

A major operator was looking to qualify a "Green Clay" formation to be used as an annular barrier.

Solution

The solution was the Archer Plug and Perforate system, which is built on the SPARTAN plug and Tubing Conveyed Perforation (TCP).

To verify the formation, the SPARTAN plug and TCP BHA guns were placed in the Green Clay section of the well. The TCP guns were then fired.

The SPARTAN plug was set and a leak off test against the Green Clay was performed. The leak off test was successful and the annular barrier was proved.

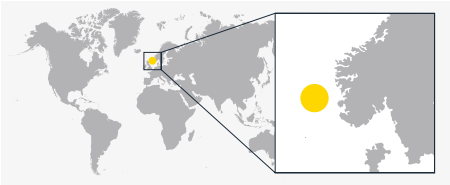
The final step of the operation was to cement the inside of the casing through the SPARTAN to complete the barrier.

Result

The cement job was flawlessly executed and the formation was qualified as a barrier.

Archer

LOCK™ Plug Passes V0 Test for Wells with Extended Casing Wear



Region: North Sea
Customer: Major operator
Well Type: Producer

Case benefits
- Saves time and costs with slot recovery and re-entry
- Total security in permanent well abandonment

Key capabilities
- ISO 14310 V0 rated gas tight seal
- Enhanced seal technology
- Flexible
- High running speed
- Fast and efficient P&A

Typical Applications
- Fundament for whipstock
- Permanent and temporary barrier
- Combined with wellbore cleanup

Challenge

A high number of slot recoveries has been and will be performed, where potential casing wear can be up to 30%, therefore existing API standards and test methods cannot be applicable to these casings.

A major operator needed to install barrier plugs for temporary plug and abandonment (P&A) in these wells. The test criteria was 20-70 degrees Celsius and 160 bar.

LOCK®

Solution

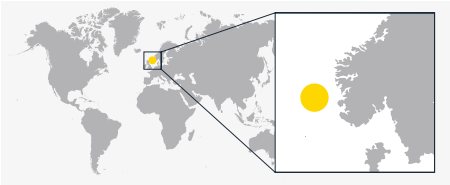
Archer used a LOCK plug to conduct a V0 test in a casing with 45% wear. which is 15% above the standards from the customer.

Result

Archer passed the V0 test on the first attempt.

Archer

Pre-installed TIMELOCK™ in Dummy Hanger Saves 6 Hours' Rig Time and $70,000 for Operator



Region: North Sea
Customer: Major operator
Well Type: Producer

Case benefits
- Saves 6 hours' rig time
- Saves $70,000'
- No need to to mobilize casing running equipment or personell.
- Plug was set and pressure tested off-line without use of rig-time.
- Installation and shallow barrier with the BOP crane.

Key capabilities
- ISO 14310 certified plug, available as V0 rating
- Plug is pressure tested onshore, no risk of any miss-runs.
- No offshore personnel required.
- Can be installed in the well on off-line activity without using rig-time.

Typical Applications
- Plug & Abandonment
- Can be used for wells that have no tie-back installed

Challenge

A major operator challenged Archer to to successfully set a barrier plug in the dummy hanger with minimum length and weight available.

Solution

Archer preinstalled the TIMELOCK plug, conducted a pressure test, and made up the dummy hanger with the torque machine. The BOP crane was used for installing the same offshore.

When entering the well, the customer can equalize the plug with surface equipment and lift out the plug with rig-equipment efficiently and effectively.

Result

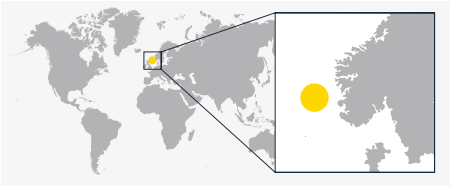
Archer's solution saved the customer approximately 6 hours of rig time, equating to approximately $70,000*.

From a health and safety perspective, the solution reduced any manual handling risks performed by the rig crew.

*Currency is in US dollars.

Archer

TIMELOCK™ Solution Saves North Sea Customer Over $170,000 and 12 Hours of Rig Time



Region: North Sea
Customer: Major operator
Well Type: Producer

Case benefits
- Saves 12 hours' rig time
- Saves over $170,000
- Safer and more efficient operations

Key capabilities
- ISO 14310 V0 rated gas tight seal
- Easy, rapid set and retrieve
- No weight below to set
- Only 8T required to set plug
- Easy and robust design allows customer to run LOCK plugs without personnel on board (POB).

Typical Applications
- Pressure testing
- Leak testing
- In-flow testing
- Barrier
- Hang-off tubing, liner, casing, drillpipe, tubing conveyed perforation and more
- Formation testing
- Fundament for whipstock
- Plug, perforate, and cement
- Combined runs with other downhole tools

Challenge

Archer was challenged to save time and costs with finishing a Plug and Abandonment (P&A) and execute a slot recovery.

The original plan was to: a) retrieve a shallow set plug; b) make a separate run with a 9 5/8" bridge plug; c) run a cutter to cut the 9 5/8" casing.

LOCK®

Solution

The solution was that Archer completed this job in 1 combined run instead of 3 separate runs by utilizing already in-well equipment, for example, the existing TIMELOCK plug.

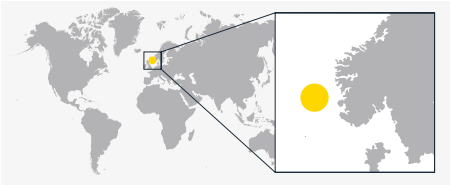
Result

Archer's solution resulted in saving approximately 12 hours of rig time, equating to an approximate cost savings of over $170,000*.

*Currency is in US dollars.

Archer

TIMELOCK™ Combined Run and Integrated Operations Save Customer $70,000



Region: North Sea
Customer: Major operator
Well Type: Producer

Case benefits
- Saves 3 hours' operational time
- Saves $70,000
- Reduced personnel on board (POB) with IO Center

Key capabilities
- ISO 14310 certified plug, available as V0 rating
- No offshore personnel required.

Typical Applications
- Plug & Abandonment (P&A)
- Barrier plug
- Combined run with other downhole tools

Challenge

To reduce rig time, a customer challenged Archer to pull a shallow set plug and seal assembly in a combined run on a new rig using Archer's Integrated Operations (IO) Center.

Solution

The solution was to run in hole (RIH) with the TIMELOCK retrieving tool, then to space out with a drill pipe and RIH with the pulling tool for a seal assembly.

Result

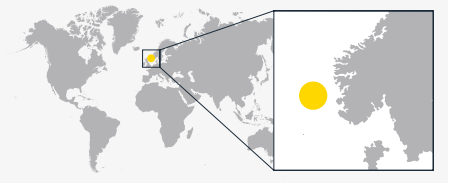
The conventional method for this operation was to RIH, pull the seal assembly, and RIH with the retrieving tool to pull the TIMELOCK plug. This usually requires 2 runs.

The result with Archer's solution was that, with the IO center, the operations were done in just 1 run in only 11 hours. The time that this operation was completed exceeded the customer's expected target time of 14 hours. Three hours, which equates to approximately $70,000*, was saved.

*Currency is in US dollars.

Archer

Tailor-made TIMELOCK™ Plug Solution Reduces Costs for Customer in Severe Weather Conditions



Region: North Sea
Customer: Major operator
Field: Various floaters
Well Type: All subsea wells

Case benefits
- Saves time despite harsh weather conditions
- Saves operational costs
- Tailor-made solution for customer

Key capabilities
- ISO 14310 certified plug, available as V0 rating
- Multiple settings
- Easy, rapid set and retrieve
- No weight below to set
- Easy and robust design allows customer to retrieve plugs even in bad weather conditions.

Typical Applications
- Plug & Abandonment (P&A)
- Shallow set barrier
- Deep set barrier

Challenge

Archer was challenged by European customer's STEP program to set a plug in severe weather conditions where heave limitations have been a time factor in the past, particularly with regard to wait on weather (WOW).

Solution

The Archer solution was to tailor make a procedure to meet the above-mentioned challenge, where the stroke length on the active heave compensating system on various floaters normally is the limiting factor.

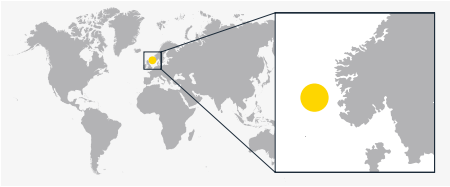
Due to this change, the Archer plugs are no longer the limiting factor on rigs with active heave compensators. Archer had installed and retrieved deep and shallow set plugs in accordance with the tailor made procedure.

Result

Archer's solution saved days during the operation, in spite of the harsh weather conditions. Archer has never been limited by harsh weather conditions after this implementation.

Archer

TIMELOCK™ with Pump Open Sub Saves Over $110,000, or 5 Hours, for Each Well



Region: North Sea
Customer: Major operator
Well Type: Producer

Case benefits
- Saves 5 hours' rig time for each well
- Saves over $110,000 for each well

Key capabilities
- ISO 14310 certified plug, available as V0 rating
- Multiple setting
- Easy, rapid set and retrieve
- No weight below to set

Typical Applications
- Plug & Abandonment (P&A)
- Shallow set barrier
- Deep set barrier

Challenge

During a standard plug and abandonment (P&A) operation, a customer challenged Archer to pull the shallow set plug without a dedicated run.

Rig time is a high cost on a floater, so Archer needed to find a solution to perform this operation faster, in a safe and cost efficient manner.

Solution

Archer developed the V0 rated Pump Open Sub (POS) with an integrated circulation sub, creating a self-filling assy.

The TIMELOCK was set as a shallow barrier according to standard procedure.

When entering the well again, the POS was operated by pressure and the well was monitored for pressure build-up.

Result

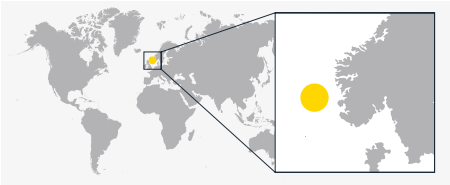
By having the 10 3/4" TIMELOCK installed and pulled, together with the dummy hanger, the need for a separate run for retrieving the plug was eliminated. At the same time, well control was achieved through the equalized POS.

A time savings of 5 hours of rig time, equating to over $110,000*, for each well was made.

*Currency is in US dollars.

Archer

Inflow Testing with the TIMELOCK™ Plug Saves Major Operator Over $170,000 & 15 Hours' Rig Time



Region: North Sea
Customer: Major operator
Well Type: Producer

Case benefits
- Saves 15 hours of rig time
- Saves over $170,000
- Well control
- Safe inflow test
- Barrier already in place

Key capabilities
- ISO 14310 certified plug, available as V0 rating
- Fast and efficient installation
- Multiple setting
- Ball Valve can be operated multiple times

Typical Applications
- Plug & Abandonment (P&A)
- Inflow testing
- Leak testing
- Barrier

Challenge

A major operator needed to inflow test a well after parting the liner hanger running tool to ensure that cement was in place before temporarily plugging and abandoning (P&A) the well in the North Sea.

The original plan was to run in hole (RIH) with special inflow test equipment. If the inflow test failed, the customer would require a deep set TIMELOCK as primary barrier, followed by a shallow set TIMELOCK as a secondary barrier.

The customer challenged Archer to come up with a cost and time saving solution for the operation to be more efficient.

Solution

Archer suggested that the customer use the TIMELOCK plug for inflow testing, instead of using special inflow-test equipment. Archer specifically produced two inflow-test procedures for this type of application. In addition, Archer recommended to utilize wellbore cleanup tools as there was a potential for cement inside the casing after cementing liner.

Result

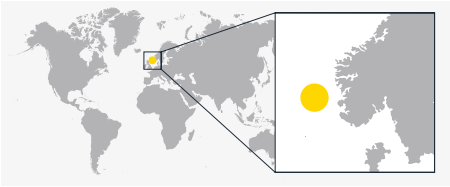
It was decided that the TIMELOCK would be placed as a temporary barrier, regardless of inflow test results. The decision was made due to uncertainty of the liner hanger packer's condition.

The customer saved approx 15 hours of trip time, which equates to over $170,000*.

*Currency is in US dollars.

Archer

9 5/8” TIMELOCK Creates a New Benchmark in Rapid Plug Operation in line with STEP Program



Region: North Sea
Customer: Major operator
Well Type: Producer

Case benefits
- Saves nearly $82,000
- Saves nearly 7 hours
- 9 5/8” TIMELOCK can be run and retrieved without Wear Bushing installed
- No weight below plug so it can be set shallow, and save rig time.
- Operation ran from onshore Integrated Operation (IO) center

Key capabilities
- ISO 14310 V0 rated gas tight seal
- Easy, rapid set and retrieve
- No weight below to set
- Mulitiple sets without tripping
- Unrestricted 3” fullbore

Typical Applications
- Temporary suspension
- Permanent abandonment
- Leak detection
- In-flow testing

Challenge
In line with a major operator’s STEP program, Archer took the challenge to save time and reduce risk while setting a shallow 9 5/8” barrier.

Solution
The solution was to run and retrieve the 9 5/8” TIMELOCK without installing the Wear Bushing. Archer installed and retrieved the plug faster than originally planned.

LOCK®

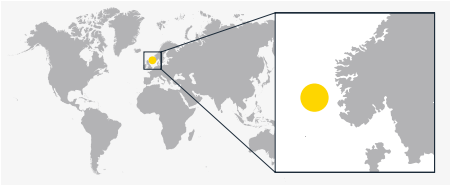
Result
The job was flawlessly executed from Archer’s Integrated Operation (IO) center. This was the first job using the IO center for a particular North Sea field for this customer.

A total time saving of nearly 7 hours, which equates to close to $82,000* of cost savings.

*Currency is in US dollars.

Archer

2 TIMELOCKs™ Pulled in 1 Run Save Over $200,000



Region: North Sea
Customer: Major operator

Case benefits
- Saves up to 9 hours of rig time
- Estimated cost savings on planned time is over $200,000.
- Safer and more efficient operations

Key capabilities
- ISO 14310 V0 rated gas tight seal
- Reduced trip time
- No offshore personnel required
- Reduced handling of equipment at surface
- Less time spent on running in and laying out assemblies at surface

Typical Applications
- Plug and Abandonment (P&A)
- Deep set barrier
- Shallow set barrier

Challenge

The conventional method for pulling deep and shallow barrier plugs is to conduct 2 separate runs for the operation. Archer took the challenge to execute this operation in a cost and time efficient manner.

Solution

To reduce rig time and save money for the customer, Archer pulled deep and shallow barrier plugs in one run using a pre-installed retrieving tool for the deep set plug below the shallow set plug.

The Archer solution reduced the number of hours spent on trip time with the retrieving tool for the deep set plug. The shallow set plug was released, then RIH until it was on top of the deep set plug. The deep set plug was released and POOH. Both plugs were laid out from drill floor as one assembly.

Result

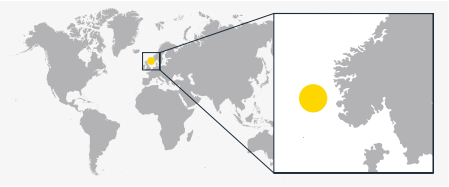
Archer pulled 2 TIMELOCKs in 1 run, compared to the conventional method of this operation being done in 2 separate runs. The planned time for this operation was nearly 17 hours in a standard well, and 10.4 hours in a perfect well. This operation was performed in just 9 hours.

This gives a total cost savings on planned time of over $200,000*.

*Currency is in US dollars.

Archer

Archer Recovers PVC Pipe Dropped on Top of TIMELOCK™ Plug Using the Jet Vacuum Tool



Region: North Sea
Customer: Major Operator
Well Type: Producer

Case benefits
- Rapid recovery of fish without extra runs
- Extremely effective Jet Vacuum Tool
- Flexible Plug running tool

Key capabilities
- ISO 14310 V0 rated gas tight seal
- Easy, rapid set and retrieve
- No weight below to set
- Mulitiple sets without tripping
- Unrestricted 3" fullbore
- Ultra shallow, deep or Horizontal set 20 - 6550 m

Typical Applications
- Temporary suspension
- Permanent abandonment
- Leak detection
- Storm contingency suspension that requires high hang off weight

Challenge

A 44" PVC pipe with low specific gravity was unintentionally dropped in hole and expected to be sitting on top of the TIMELOCK at 300m measurable depth (MD).

The challenge was that this could affect the retrieval of the TIMELOCK.

Solution

Archer responded quickly and developed a solution utilizing our existing Jet Vacuum Tool.

Archer ran the Jet Vacuum Tool just above the handling pup joint on the Washover Retrieval Tool.

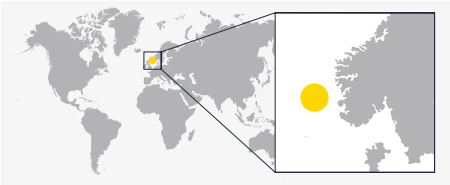
Circulation was initiated above the TIMELOCK to generate the vacuum effect below the washover running tool, and pull the PVC pipe into the Jet Vacuum Tool, then easily engage the TIMELOCK.

Result

The TIMELOCK plug was successfully retrieved, even with large debris above the plug.

Archer

VAULT™ Dual Plug System Saves North Sea Customer a Total of 9 Hours' Rig Time with 2 Successful Runs

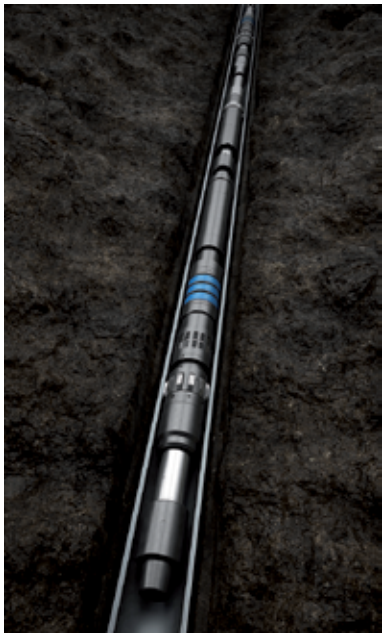


Region: North Sea
Customer: Major operator
Well type: Production
Rig type: Semi-submersible (floater)
Reference: 106013, 105999

Case benefits
- Saves 4.5 hours of rig time for each job, totalling to 9 hours for 2 jobs.
- Saves operational costs
- Safer and more efficient operations

Key capabilities
- ISO 14310 V0 rated gas tight seal
- Dual plug system
- No set weight needed below
- High differential pressure elements
- Combined run (pulling MUT prior to set deep plug)
- Reduced red zone activity
- High tripping speed
- High heave limitation

Typical Applications
- Plug and Abandonment (P&A)
- Barrier



Challenge

The recompletion of some wells on the Norwegian continental shelf required these wells to be temporarily abandoned prior to running an X-mas tree and upper completion.

The customer needed 2 V0 certified barrier plugs to be installed in 2 separate jobs.

The conventional method is to run in and install a deep plug, pull out of hole (POOH) with the running tool, then run in hole (RIH), and install a shallow plug prior to POOH with the running tool .

In addition, the wearbushing needed to be pulled in a separate run for both jobs. Archer was challenged to come up with a solution to reduce the time spent on these operations.

Solution

Archer's **VAULT™ dual plug system** made it possible to set two barrier plugs in just one run. A standard **TIMELOCK®** was used for the deep barrier, while the VAULT™ plug was utilized for the shallow barrier. Both plugs is ran in hole as one assembly.

From an operational perspective, after setting the lower plug, the drillpipe was picked up to setting depth for the shallow plug, which was activated set as per procedure. A multi-utility tool (MUT) was incorporated in the running string to also pull the wearbushing in the same run.

All together, the number of runs were reduced from 3 runs to just 1 run. With this solution, it was possible to retrieve both plugs in one run when the X-mas tree and BOP were installed.

Result

The operation was performed in just over 9 hours, for both jobs. This included pre-job meetings, tripping, setting and pressure testing of both plugs and handling of equipment at the surface.

For each job, the average tripping speed when RIH to set deep plug was 996 meters (3268 feet) per hour. The average tripping speed when pulling out to set the shallow plug was 1007 meters (3304 feet) per hour. The average rig heave during the operation was 3.8 meters (12.5 feet).

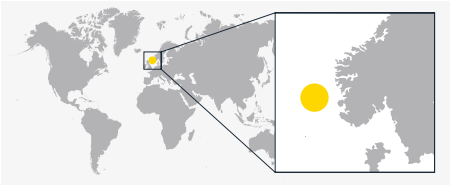
For each of the two jobs, the estimated time and cost savings were:

Time savings for installing two plugs in one run:	1,5 hours of rig time.
Time savings for pulling wear bushing:	1,5 hours of rig time.
Time savings for pulling both plugs in one run:	1,5 hours of rig time.

Estimated total time savings for both jobs = 9 hours.

Archer

VAULT Solution Saves Customer Over $140,000 and 12 Hours of Rig Time



Region: North Sea
Customer: Major Operator

Case benefits
- Saves 12 hours' rig time
- Saves over $140,000
- Easy and rapid deployment
- Flexible set depths and angles

Key capabilities
- ISO 14310 V0 rated gas tight seal
- Easy, rapid set and retrieve
- No weight below to set

Typical Applications
- Long-term suspension
- Plug and Abandonment (P&A)

Challenge

In line with a major operator's STEP program, Archer took the challenge to retrieve 2 plugs in 1 run: both the 7" and the 9 5/8" TIMELOCK plugs.

Solution

Archer's VAULT dual plug system has been designed to set and retrieve 2 plugs in 1 run instead of 2 runs.

Compared to conventional methods, Archer installed the deep plug, short trip and set the shallow plug in one single run in line with legislate P&A requirements.

Archer retrieved both plugs in 1 run by releasing the shallow set, short trip in, releasing the deep set, and pulling both plugs as a single BHA.

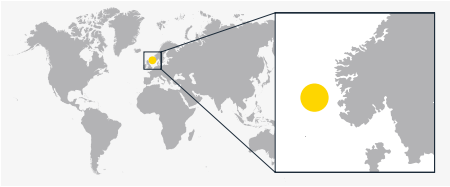
Result

The cost savings for this operation was approx. 12 hours, or over $140,000*.

*Currency is in US dollars.

Archer

Archer's SPEARHEAD System Saves Statoil 54 hours' Rig Time During a 3-well P&A Campaign



Region: North Sea
Customer: Statoil
Field Huldra

Case benefits
- Saves time
- Saves costs
- Reduced risk profile
- Reduced handling of the retrieved tubing on the surface

Key capabilities
- Extensive hangoff capability
- Ability to pressure test above and below the plug

Typical Applications
- P&A prior to sidetrack
- Permanent P&A solution
- Barrier plug

Challenge

Statoil, a major international operator in the North Sea, planned a 6-well plug and abandonment (P&A) campaign on the Huldra field. The original plan was to cut, pull and lay down more than 4,000m of 7" tubing from each well. The customer intended to continue setting a bridge plug at 2,000m, then cut the 9 5/8" casing above the plug, and finally displace the well to water-based mud.

SPEARHEAD

The process of retrieving and handling the tubing is time consuming and costly. The customer asked for a plug solution that could avoid pulling the entire tubing string and save rig time.

Solution

Archer Oiltools' integrated P&A solution was to retrieve approximately 2,000m of tubing and suspend permanently the remaining 2,000m of tubing below the SPEARHEAD plug. When the plug and the tubing were run in hole (RIH), a casing cutter was installed above the SPEARHEAD running tool.

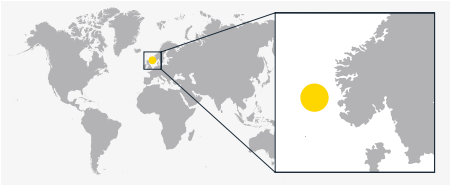
The SPEARHEAD, with the tubing below, was set at approximately 2,000 m, and pressure tested. The 9 5/8" casing was then cut above the plug – all this was achieved in one run. The P&A operation continued with the retrieval of the 9 5/8" casing above the cut.

Result

Statoil saved approximately 18 hours' operation time for each well. The total saving for this operation was 54 hours for 3 wells, as well as economical costsavings associated with rig time. The overall safety and risk profile of the operation was also reduced, along with the time and costs associated with logistics, transport, and handling.

Archer

Archer's Integrated Operations: Innovation Leader in the North Sea Saves Over $2.5 Million



Region: North Sea
Customer: Major operator

Case benefits
- Saves over $2.5 million
- Reduced POB
- Reduced environmental footprint
- Reduced operational risk profile
- Reduced health and safety (HSE) incidents
- Boosted service quality and delivery

Key capabilities
- Simultaneous operations
- Low mobilization time for operational personnel
- Operational flexibility
- Operational support
- Low trainee cost

Typical Applications
- Plug & Abandonment (P&A)

Challenge

A major operator challenged Archer to provide a solution to reduce operating costs for plug settings by scaling down persons on board (POB), while ensuring excellence in delivering best-in-class service quality in the North Sea.

Solution

Archer built a total of three IO centers in two different locations to be able to serve multiple operations 24 hours a day.

The IO centers can receive real-time data from the rig operation and communicate through landline telephone, mobile telephone or Skype, to ensure a high standard of operational quality and safety.

Result

Archer delivered 131 IOs in North Sea for the customer throughout 2015, saving 655 days of POB and traveling. This total savings amounted to over $2.5 million*. The IOs, which began in early 2015, covered 100% of the operations by the end of the year.

As a result, the customer reduced time and costs related to:
- POB
- Transport (helicopter flights)
- Overall health and safety (HSE) risk
- Any negative environmental impacts

All of the above were achieved without any compromise to ensuring excellent service quality.

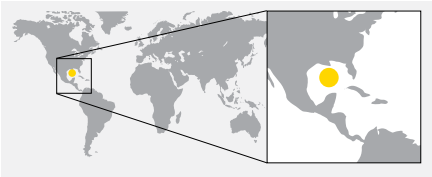
*Currency is in US dollars.

Archer's IO centers can receive real-time data direct from the rig. This technology saved a major operator over $2.5 million. (USD), or 22 million NOK.

Archer

Case study: Deepest TIMELOCK® Setting Completed

Archer's TIMELOCK® makes a record-setting depth in North America



Region: North America
Customer: Major Operator
Well type: Production Well

Challenge

In 2016, a major operator was conducting a program consisting on batch drilling, followed by batch completions. The drilling was conducted in approximately 1150 m of water.

In view of the above conditions and environmental regulations, well integrity during the period of temporary suspension was a very critical element.

The well suspension program required the setting of a proven gas-tight plug in the 13-5/8" casing section and another to be set in a deep (7560 m) deviated (50 degrees) 9-7/8" casing section.

Solution

The LOCK® series of well suspension plugs, which gives the assurance of an absolute seal, is independently certified as gas tight, and qualifies as V0 under ISO 14310.

With over 2,300 deployments, mostly in the harsh North Sea environment, the LOCK® plugs also come with an unrivalled 100% retrievability track record..

The 13-5/8" TIMELOCK® was utilized as the upper barrier, and for the challenging 7560 m deep 9-5/8" casing, a TIMELOCK® was deployed as the operator's lower barrier of choice as its installation is not hampered by high well deviation, allows for rapid deployment and can be set as deep possible because this does not require a tail pipe.

Case benefits

- Proven gas tight and V0 ISO 14310
- Excellent track record in deep water environment
- Rapid and easy deployment—no weight required below plug for setting purposes, which saves costly rig time on deepwater drill ships and allows to set deeper
- 3" ID allows high circulation rate during fluid displacement and well cleaning
- Extended period of suspension does not affect retrievability efficiency—up to 365 days to date
- Sealing element fully retracts even after long suspension period and enables efficient retrieval
- Ball valve allows monitoring of well pressure without unsetting the plug and enables well control when required

Case study: Deepest TIMELOCK® Setting Completed

Result

The installed TIMELOCK® was successfully set and pressure tested from above and below. Additionally, the 9-5/8" TIMELOCK® was able to be set as deep as possible because it did not require a tail pipe. The plugs are planned to be in the hole for about a 12-month period.

Key capabilities

- ISO 14310 V0 rated gas-tight seal
- 100% retrievability record and mill tested
- Easy, rapid set and retrieve
- No weight needed below to set
- Unrestricted 3" ID
- Test from below and above
- Ultra-shallow, and ultra-deep
- High differential pressure 3,625 psi ball valve equalisation
- Mechanically operated ball valve

Typical Applications

- Planned temporary well suspension that requires the highest gas tight qualification—ISO 14310 V0
- Storm and contingency suspension that requires high hang off weight capability without sacrificing gas tight assurance
- Leak detection—multi-set in one trip and not limited by depth or well deviation
- In-flow testing while maintaining full well control capability

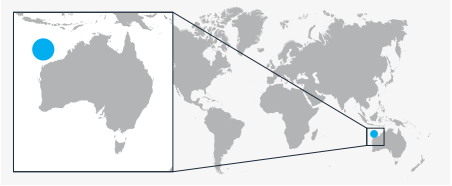
Archer

Case study: LOCK®

When exploiting your energy reserves without impacting your nature reserves you need absolute protection.

Challenge

A major international operator is involved with part of the largest natural gas projects in the world and the largest single resource development in Australia's history. The gas field is situated in an environmentally challenging area, with a history of severe tropical storms and cyclones. The area is also ecologically sensitive and includes Barrow Island, a Class A Nature Reserve. The field is situated in approximately 1,350 m of water and operations are performed using a 5th Generation ultra-deep water drill ship to execute a program of batch drilling and batch completion. In view of the above conditions, well integrity is understandably a critical element. The well suspension program requires setting of a proven gas tight plug in 13-5/8" casing section and another to be set in a deep (3500 m – 4000 m), highly deviated (up to 70 degrees) 9-5/8" casing section to ensure that integrity is maintained and the environment is protected.



Region: Western Australia
Well type: Gas development

Case benefits

- Rapid deployment enables significant time/cost saving in ultra-deep water drilling environment.
- Sealing element fully retracts even after long suspension period and enable efficient retrieval. All plugs were retrieved with sealing element in good condition – there was no drag during pulling out of hole.
- Integral ball valve enables full control of well pressures whilst maintaining complete well integrity.

Key capabilities

- ISO 14310 VO rated gas-tight seal
- 100% retrievability record and mill tested
- Easy, rapid set and retrieve
- No weight needed below to set
- Multiple sets without tripping
- Unrestricted 3 inch through bore
- Test from below and above
- Ultra-shallow, deep or horizontal set 20 m to 6550 m
- High differential pressure 3,625 psi ball valve equalisation
- Mechanically operated ball valve

Case study: LOCK®

Solution

Archer was awarded the well suspension plugs contract for the multi-well, 3 year campaign based on the performance of our LOCK® series of well suspension plugs. The LOCK® series provides the assurance of an absolute seal, independently certified as gas tight and qualified as V0 under the ISO 14310 standard. Developed to withstand the harsh environmental conditions and stringent legislative demands of the North Sea, the LOCK® series has a proven track record of over 1,300 successful deployments underpinned by an unrivalled 100% retrievability record. The 13-5/8" TIMELOCK® utilized as the upper barrier is the only suspension plug in this size to come with V0 ISO 14310 qualification. The 9-5/8" TIMELOCK® is the operator's lower barrier of choice owing to its ability to be set under high well deviation, rapid deployment, and all-important V0 ISO 14310 qualification.

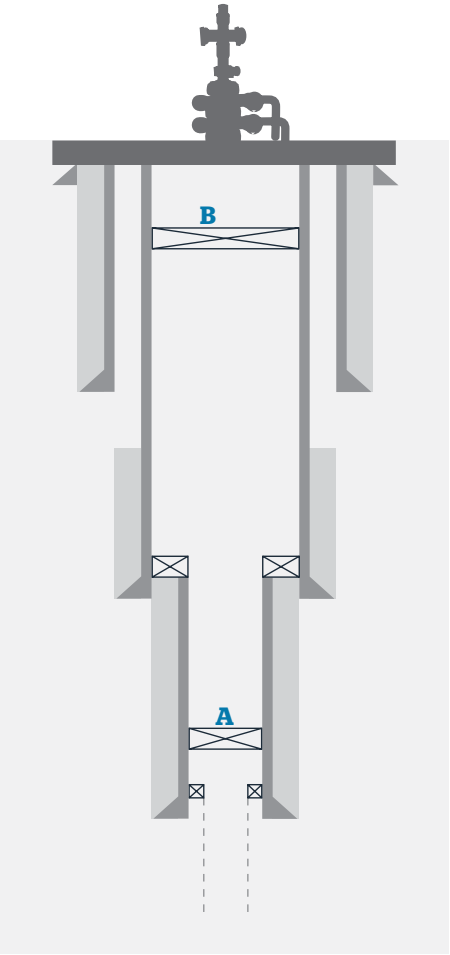
Results

All installed plugs were successfully pressure tested from above and below, enabling in-flow tests to be conducted as per the operator's stringent requirements. Furthermore, owing to LOCK's rotary locking system, the 9-5/8" plug were able to be set at optimal depths – deeper than would normally be possible using conventional technology – as no tail pipe is required.

Some of the plugs have since been retrieved – including two that were installed for over 14 months and another two that were installed for approximately 12 months. During the retrieval process, the operator was able to monitor and manage well pressure prior to un-setting the plug by functioning the ball valve.

Typical applications

- Planned temporary well suspension that requires the highest gas tight qualification – V0 ISO 14310
- Storm and contingency suspension that requires high hang off weight capability without sacrificing gas tight assurance
- Leak detection – multi set in one trip and not limited by depth or well deviation
- In-flow testing while maintaining full well control capability



Typical well schematic showing placement of TIMELOCK® suspension plugs:
a) Deep set 9 5/8" liner, ~3000 mMD, ~70 degrees deviation
b) Shallow set 13 5/8" casing, ~1500 mMD, zero deviation.

Archer


Cflex®

Cflex®

Improved annulus integrity

Multistage cementing system

Cflex® technology enables high-performance multistage cementing. Qualified “gas tight” equivalent to ISO 14998 V0: 2013 and with a permanent lock system, Cflex® performs to the highest integrity standards.

Despite advances in cement technology, annulus integrity is one of the biggest challenges facing the industry, both in terms of frequency and impact. The Cflex® cementing system improves annular seal integrity and overcomes the shortcomings of previous stage cementing technology. In designing Cflex®, our engineers focused on four key areas, integrity, flexibility, efficiency and performance.

Integrity

Cflex® is engineered to the highest possible integrity standards. In addition to its high tensile strength, burst and collapse ratings, Cflex® is V0 qualified through rigourous testing equivalent to the ISO 14998 standard, which means it provides an absolute “gas tight” seal. Locking Cflex® permanently closed following a successful operation adds further security.

Flexibility

Cflex® is available in a wide range of sizes and materials, and can be custom-built. Multiple Cflex® devices can be positioned within the casing string and accessed selectively for any number of cementing stages. Cflex® also accommodates different equivalent circulating density (ECD) and flow rate requirements. Four circulating ports provide a large flow area, expanding the envelope of possible flow rates. Taking flexibility one step further, because Cflex® provides secure controlled access to the casing annulus, it can be used for other applications that require this functionality.

Efficiency and performance

Operating Cflex® is straightforward, fast and precise. The multifunction operating tool is designed to both operate the Cflex® valve and inject fluids. And if multiple Cflex® devices are present, each can be accessed and controlled selectively according to the multistage program. Another key feature of Cflex® is its slim design. The full bore internal diameter (ID) matches the casing ID, offering unrestriced passage; and the outside diameter is no larger than the casing collar, thereby minimising ECD effects and reducing the risk of surge or swab. Finally, cementing performance is enhanced by the large flow area ports, which enable high circulation rates and a significantly improved cement job.

Cflex®

Specifications

Size, in	7 - 16
Temperature rating, degF [degC]	40 - 302 [4-150]
Standard material	Carbon steel
Elastomer material	HNBR
Permanent lock feature	YES
Max. flow BPM	14
Qualification	ISO 14310 and 14998 V0

Other grades, material and sizes available upon request

Applications
– Controlled, secure and selective access to casing annulus
– Multistage cementing
– Annulus cleanout
– Fracturing

Features
– Sealing system qualified to ISO 14998 V0 equivalent
– High burst, collapse, torque and tensile ratings
– Full bore ID matches casing ID and slim OD
– Closing utilising push/pull movement
– Permanent close function
– Unlimited number can be installed in liner or casing string
– Can be shifted with high differential pressure without damaging seal
– Large port flow area; 4.4 sq.in. minimum
– Inner sleeve hard coated to reduce wear; anti-rotation system
– Suits all type of premium casing threads
– Wide range of sizes, materials available

Benefits
– Improved annulus integrity and zonal isolation
– Security and confidence in gas tight sealing capability and mechanical integrity
– Easy installation and single-trip operation of multiple Cflex® devices
– Precise and conclusive operation for open, close and lock; no risk of accidental lock
– Improved operational efficiency and effectiveness
– Versatility and flexibility for multiple applications
– Slim design minimises ECD effects
– Large flow area ports maximise possible flow rate

Cflex® multifunction operating tool controls Cflex® selectively and precisely.

Cflex® dart catcher

Cflex® with annulus fundament

Enhanced well integrity

Multistage cementing system, cement placement control

Cflex® technology is now available with a flexible annulus cement base to deliver high-performance multistage cementing. It provides cement placement control and aims to enable a desired cementing height when performing a stage cementing job.

The Cflex® cementing system now includes a flexible annular cement base, which improves annular seal integrity and overcomes the shortcomings of previous stage cementing technology.

This particular Cflex®'s built-in fundament is activated during the opening of the cement ports, so it prevents a mixture of fluids and creates a solid base for the cement. Qualified "gas tight", tested according to ISO 14998, and with a permanent lock system, Cflex® performs to the highest integrity standards.

With this Cflex®, it is possible to activate permanent lock with hydraulic pressure. Its fundament prevents cement contamination and can hold differential pressure. It is mechanically activated, so there is no need to pressure the well to activate the fundament.

Integrity

Cflex® is engineered to the highest possible integrity standards. In addition to its high tensile strength, burst and collapse ratings, Cflex® is V0 qualified and tested according to ISO 14998 standard, which means it provides an absolute "gas tight" seal. Locking Cflex® permanently closed following a successful operation adds further security.

Flexibility

Cflex® is available in a wide range of sizes and materials, and can be custom-built. Multiple Cflex® devices can be positioned within the casing string and accessed selectively for any number of cementing stages. Cflex® also accommodates different equivalent circulating density (ECD) and flow rate requirements. Various circulating ports provide a large flow area, expanding the envelope of possible flow rates. Taking flexibility one step further, because Cflex® provides secure controlled access to the casing annulus, it can be used for other applications that require this functionality.

Cflex® MKII-F

Efficiency and performance

Operating Cflex® is straightforward, fast and precise. The multifunction operating tool is designed to both operate the Cflex® valve and inject fluids. And if multiple Cflex® devices are present, each can be accessed and controlled selectively according to the multistage program. Another key feature of Cflex® is its slim design. The full bore internal diameter (ID) matches the casing drift ID, offering unrestricted passage; and the outside diameter is no larger than the casing collar, thereby minimizing ECD effects and reducing the risk of surge or swab. Finally, cementing performance is enhanced by the large flow area ports, which enable high circulation rates and a significantly improved cement job.

Applications

- Controlled, secure and selective access to casing annulus
- Multistage cementing
- Annulus cleanout
- Fracturing

Features

- Cement valve included in an ISO 14310/14998 V0 Cflex stage cementing valve, which ensures no bubbles.
- Steel enforced rubber ring that is expanded to the ID of the next casing/open hole.
- The cement fundament eliminates the need to use additional equipment such as ICP or "basket type" to form a fundament for the cement.
- The fundament is fully mechanical, will always be activated when the valve is opened.

Benefits

- Provides cement direction control.
- Improved method of retaining cement.
- Minimizes cement contamination.
- No extra operation needed to activate the cement fundament.

Cflex®
Case Studies

Archer

Case study: The first Cflex® application in deepwater West Africa

Archer performs a successful cementing operation with the first Cflex® application in deepwater West Africa.

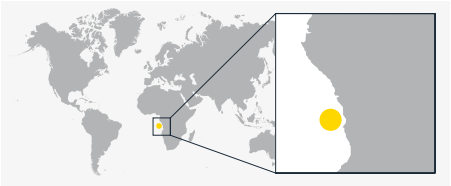
Challenge

A major international operator had experienced difficulties in cementing the annulus of a 10 3/4in production string due to the section beeing long (> 1500m), sub-horizontal (>80°) and throughout unconsolidated formation. The consequence was that intermediate reservoirs were not efficiently cemented leading to several days of remedial operations and therefore requiring the client to look for a contingency solution.

An additional challenge was that operator would accept only a metal to metal seal for the secondary cementing device.

Solution

After several technical clarifications, the operator agreed that V0 certification was the highest applicable standard for their application and decided to carry out a field trial using the Archer Cflex® on a water injector well. The Cflex® was run with the 10 3/4in casing string to 1750m measured depth (MD), 142m inside the 14in casing. The primary cement job was performed to isolate the lower reservoir; afterwards the Cflex® was operated to isolate 200m of annulus above the device.



Region: West Africa
Customer: Major Operator
Field: Angola Luanda
Well type: Water injector wells

Case benefits

- Controlled and selective access at desired depth and position
- Multistage cementing to secure cement operations
- Save on potential high-cost remedial work.

Key capabilities

- V0 rated
- Field proven
- Easy to operate
- Can be ran in combination with Tag-in collar in the same run
- Slim design minimises ECD effects
- Large flow area ports maximise possible flow rate

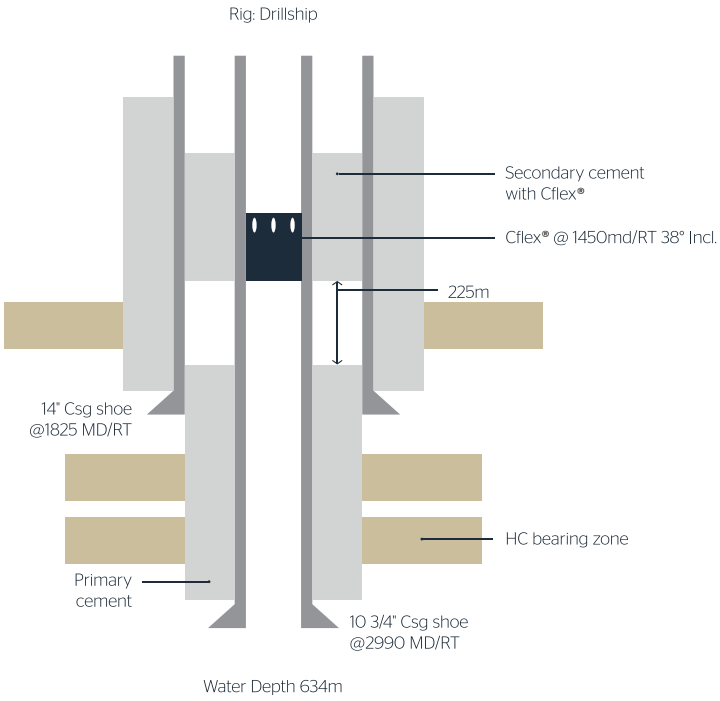
Case study: The first Cflex® application in deepwater West Africa

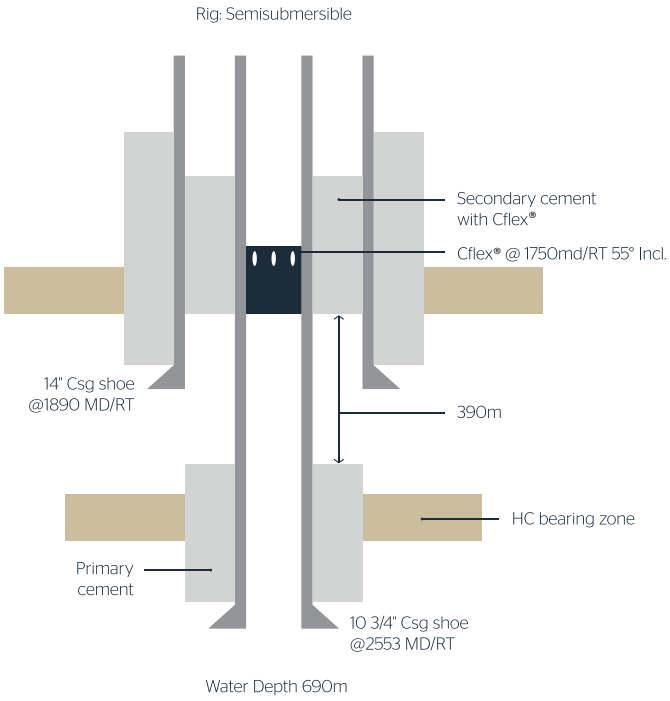
Result

The Cflex® worked as planned, but the cement bond logging showed a poor quality secondary cement. The operator suspected that this had been caused by cement contamination and decided to perform another trial on a second well. The cementing sequence was improved and by using this new procedure, the second trial was a complete success as confirmed by the cement bond log. Based on these results, the operator has decided to include a secondary stage device in the string of challenging producing wells.

Typical applications

- Controlled, secure and selective access to casing annulus
- Multistage cementing
- Annulus cleanout
- Fracturing





Stronghold™

Stronghold™ Barricade

Economical, Efficient and Effective Plug & Abandonment

Archer's field proven Barricade system is designed to wash and clean the annulus of a perforated casing or liner in a selected formation zone or between casings, then accurately place a permanent barrier. With the addition of the one-trip TCP (Tubing Conveyed Perforation) module, the Barricade system becomes a one-trip perforate, wash and cement placement. It provides a barrier that gives safer and better wells.

STRONGHOLD™

Benefits
- Field proven
- Significant time and cost savings
- Effective rock-to-rock sealing barrier
- No section milling and swarf handling
- No underreaming
- Efficient one-trip system with TCP
- No surge or swab effect
- Performs the fastest perforate, wash, and cement operations in the market

Applications
- Well abandonment
- Isolating Sustained Casing Pressure (SCP)
- Screen washing
- Slot recovery

Features
- High circulation rates
- Dual swab cup either side of washing ports
- Adjustable distance between swab cups
- Flow by-pass system
- Disconnect system available
- Ball or dart drop available

Contact your local Archer Oiltools representative for more information on the Stronghold™ family of tools suitable for your well needs.

www.archerwell.com

A one-trip operation with Barricade consists of:
- Perforating the section - at which point the guns drop automatically,
- Thoroughly washing the perforated annular section,
- Placing spacer fluid in the annulus using our calculated "Pump and Pull" method,
- Placing the barrier material using the same technique.

After the annular cleaning phase, high-circulation rates and pipe rotation enhance debris removal from the washed annulus and out of the well.

Specifications

Casing Size, in	6 5/8 - 7 5/8	9 5/8 - 16
Min ID, in	2.2	2.3
Circulation rate, lpm [bbl/m]	1,600 [10]	2,200 [14]
Pressure rating, psi [bar]	5,000 [344]	5,000 [344]

Adjustable distance between swab cups from 1 - 3 ft.

Archer

Stronghold™ Defender

Economical, Efficient and Effective Plug & Abandonment System

Archer's field proven Defender barrier test system enables operators to perforate and test an annular barrier. Together with the Barricade and Rampart, the Defender is part of a series of Stronghold™ perforating, washing, cleaning and cementing systems to deliver faster, safer and more economical solutions for operators worldwide.

STRONGHOLD™

Benefits
- Field proven
- Significant time and cost savings
- Efficient one-trip system with TCP
- No section milling and swarf handling
- Qualification of an effective barrier
- No surge or swab effect

Applications
- Well abandonment
- Formation integrity testing
- Annular solids integrity testing
- Circulation out of old, environmentally unfriendly, annular fluids

Features
- Primary and back-up swab cup design
- Adjustable distance between swab cups
- Flow by-pass system
- Disconnect system
- Ball or dart drop

Contact your local Archer Oiltools representative for more information on the Stronghold™ family of tools suitable for your well needs.

www.archerwell.com

The Defender system provides a safe, quick, economical and effective alternative to traditional plug and abandonment (P&A) techniques of casing recovery, milling and perforate, wash and cement.

Traditionally, several runs were required to test the annulus. Setting two plugs and perforating usually took up to 3 runs.

Archer's Defender system achieves this in just 1 trip by:
- Perforating the casing or liner.
- Verifying the integrity of the annulus.
- Placing barrier material in the casing and annulus.

The **result** is a permanent verified barrier that is achieved in a single trip – a simple, cost effective solution for annular remediation, bringing absolute protection and safety.

Together with Tubing Conveyed Perforating (TCP) products and new charge development, Archer's Stronghold™ systems support the safe and efficient execution of operations.

In designing the Stronghold Defender™ system, our engineers focused on 3 key areas – **Efficiency, Flexibility** and **Reliability** to produce a service that is economical, efficient and effective.

Specifications

Casing Size, in	6 5/8 – 8 5/8	9 5/8 – 16
Min ID, in	2.2	2.3
Pressure rating, psi [bar]	5,000 [344]	5,000 [344]

Archer

Tubing Conveyed Perforating (TCP)

Perforating for better wells

Archer's Tubing Conveyed Perforating (TCP) equipment delivers high performance charges for demanding perforating operations in plug and abandonment (P&A) and completions.

Benefits
- Deeper and cleaner perforation tunnels for increased well productivity
- Excellent track record
- High performance punchers and squeeze gun systems for controlled penetration length and casing hole size

Applications
- Plug & Abandonment (P&A)
- Well completions
- Formation testing
- Remedial work

Features
- Can deliver from 0 to 360 degree phasing
- Produce optimal casing entrance hole diameter
- Controlled perforation of single or multiple casings
- Can perforate between casings to remove sustained pressures
- Gun outer diameter (OD) range from 2" to 7", and shot density of 1 shot per foot (spf) to 36 spf

Perforating is essential in delivering wells, improving well performance, Plug and Abandonment (P&A), and remedial work during the lifetime of a well.

Archer provides various shaped charges including patented liner material technology, which ensures cleaner perforation tunnels for increased well productivity. Archer`s extensive P&A experience, combined with our tailor-made perforating systems, ensures time efficient and optimized P&A operations.

Associated TCP Services

In addition to standard and specialized Tubing Conveyed Perforating (TCP) services, we offer associated services, including:
- Punching
- Explosive and electro-mechanical pipe-cutting
- Pyrotechnic and plug setting horizontal pump-down "plug and shoot"
- Coil tubing perforating
- Wireline perforating
- Casing patch

Aligned with the Stronghold perforate wash cement systems, Archer's TCP services ensure an efficient and safe execution of operations, bringing time and cost savings to our customers.

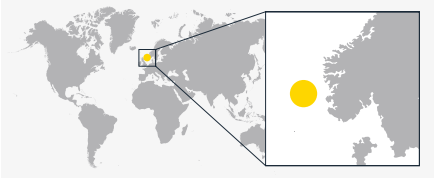
TCP is part of our portfolio of Oiltools products and services. Find your local contact at: http://archerwell.com/product-service/oiltools/

Archer

Stronghold™ Case Studies

Archer

Successful Barricade Job Sets New Benchmark in Perforate, Wash and Cement Efficiency



Region: North Sea
Customer: Major Operator
Field: UK Continental Shelf
Well Type: Oil and Gas

Case benefits
- Eliminates the need for mill casing.
- Ensures controlled direction of cement due to pumping cement out between cups
- No need of wait on cement (WOC) with squeeze pressure.
- Eliminates need to squeeze cement.

Key capabilities
- Field proven
- High circulation rates
- Dual swab cup design
- High performance swivel

Typical Applications
- Permanent plug and abandonment (P&A)
- Slot recovery
- Perforate wash, cut and pull
- Seal annular pressure

Challenge

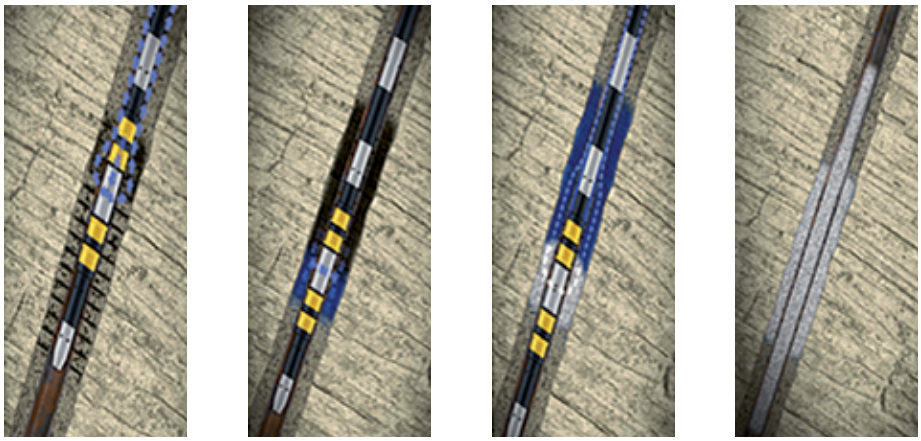
A major operator in the UK challenged Archer to create a rock to rock barrier and isolate pressure from the overburden.

The objective was to plug and abandon the well according to government and customer requirements. The customer required a time and cost efficient method of plugging and abandoning the well.

STRONGHOLD™

Solution

The solution was the Stronghold Barricade system. The field proven Barricade perforates, washes, and cements the annulus, creating a rock to rock barrier in just one trip.



One of the benefits of washing the perforations with the Barricade system is that the standpipe pressure is a key performance indicator. High pressure indicates a high amount of debris on the back side of the casing; low pressure indicates a low amount of debris on the back side of the casing.

On this job, using a flow rate of 420 gpm , a circulation pressure of only 200 psi was achieved constantly over the entire perforated area, indicating a low amount of debris.

The 168 ft long perforated interval was washed in only 2 hours. When using pressure as a performance indicator, the washing can be optimized and time spent can be minimized.

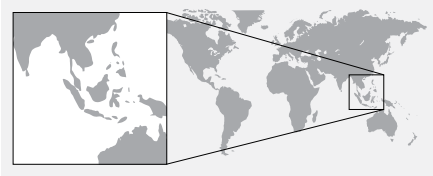
Result

The perforating, washing and cementing to achieve a 550 ft cement plug with a 168 ft solid lateral barrier was completed in only 5 hours. The total time from run in hole (RIH) until the tool was at surface was 15.5 hours from a depth of 2431 ft. The plug was verified by load and pressure testing.

A rock-to-rock barrier was achieved in 15.5 hours, which exceeded the customer's expectations and sets a new benchmark in perforate, wash and cement efficiency.

Archer

Stronghold™ Barricade Helps Customer Plug and Abandon Well From Workover Unit



Region: Asia Pacific

Case Benefits
- Eliminates the need for casing milling.
- Ensures controlled direction of cement placement
- No need of wait on cement (WOC) with squeeze pressure.
- Eliminates need to squeeze cement.

Key Capabilities
- Field proven
- High circulation rates
- Dual swab cup design
- High performance swivel

Typical Applications
- Permanent plug and abandonment (P&A)
- Slot recovery
- Workover
- Seal annular pressure

Challenge

A customer was challenged with plugging and abandoning (P&A) a well from a workover unit. There was insufficient casing annular cement and the tubing's condition prevented cement to be pumped into the perforations.

Through a collaborative engagement between the Customer and Archer to identify a fit for purpose solution for the challenge, Archer was required to mobilize the **Stronghold Barricade perforate, wash and cement system** to eliminate the need for section milling. Milling casing would be challenging due to limited swarf handling capabilities and surface equipment to handle metal swarf, including the need to mill at relatively shallower depth with potential eccentricity challenges due to decentralized casing. The objective was to plug and abandon the well by setting two cement plugs: the deep plug just below the 9 5/8" casing shoe into 12 1/4" open hole; and the second plug just inside the 13 3/8" casing shoe.

Solution

Based on the objective for the well, perforating, washing and cementing with Archer's Stronghold Barricade system was deemed more favorable, safer and cost effective, when compared with section milling.

The Barricade provides full lateral isolation in a single run operation. However on this well, the **Tubing Conveyed Perforation (TCP)** runs were done separately. The first plug was set inside the 9 5/8" production casing against 12 1/4" open hole from 3773 ft – 4412 ft the first 100 ft lateral with 639 ft cement above. The washing performance was monitored from the standpipe pressure in combination with sand and dispersed shale coming over the shakers.

The cement job was performed using the pump and pull cementing technique. By directing the flow of cement with the Barricade's dual swab cups, the cement was placed into all the perforations making sure a full lateral isolation was achieved. The cement plug was verified and a pressure test was conducted.

The shallow plug was set from 3045 ft – 3707 ft the first 100 ft lateral with 662 ft cement above inside the 9 5/8" casing. The casing was perforated using a single casing perforation gun that perforated the 9 5/8" casing without compromising the integrity of the 13 3/8" casing. The annular space was washed, with similar positive indications as the first plug. The plug was verified and a pressure test was conducted.

A special charge was used with the second plug. The charge is a single casing perforating gun that penetrates the 9 5/8" casing without compromising the integrity of the 13 3/8" casing, which enables the customer to set the barrier inside the casing shoe and the well to be plugged & abandoned according to regulations.

Result

The Stronghold Barricade system provided full lateral isolation with positive verifications, meeting the customer's expectations and delivered on the objective for the well. This successful job was then marked as the Stronghold Barricade's first operation in Asia and proving the system's operational excellence from a workover unit.

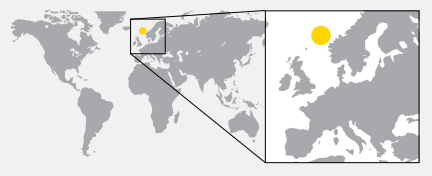
Archer

Case study: Stronghold™ Defender

Pressure test formation behind 13 3/8” casing through perforated 9 5/8” casing and cement.

Challenge
The main challenge was to locate the 6 ea perforated intervals of only 1 feet between 2078,2 m to 2160 m and pressure test them to 40 Bar.

STRONGHOLD™



Region: North Sea
Customer: Statoil
Field: Statfjord
Well type: A-36A
Reference: Thanong Hongdul and Jørgen Bugge-Mahrt

Key capabilities
– Effective rock-to-rock cement barrier
– Significant time and cost savings
– Efficient one-trip system
– Eliminates need for section milling and swarf handling
– No surge or swab effect

Typical applications
– Permanent abandonment
– Screen washing

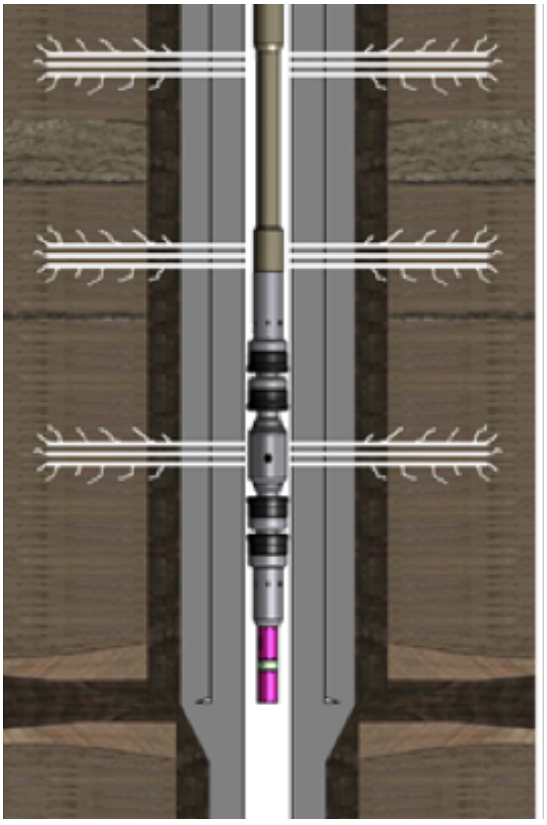
Case study: Stronghold™ Defender

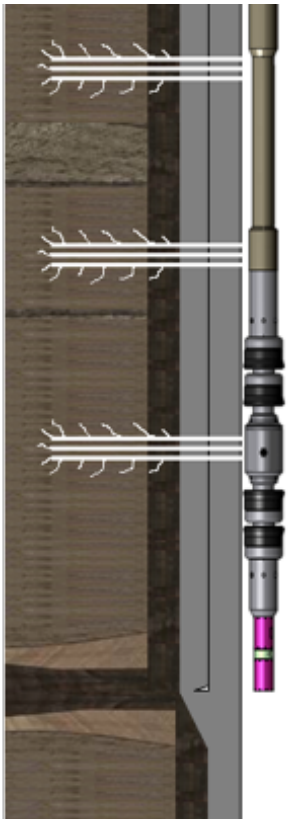
Solution

To resolve the issue we ran in hole (RIH) to below 2160 m and pressure up to 31 Bar and slowly pulled out of hole (POOH) to when we saw a pressure drop to 27 Bar. This confirmed that we had placed the perforated interval between our swab cups in the Defender. The next step was to pressure test the formation behind 13 3/8" casing and also test communication between the perforated interval. 40 Bar was applied after 70 litres was pumped. A leak into the formation was observed with no return to surface. 60 litres were bled back, confirming that the formation had taken 10 litres.

Results

The conclusion was that there was communication between perforations and formation behind 13 3/8" casing but not between perforated intervals. After each interval had been tested with same result a dart was dropped to disconnect the tool and place a cement plug on top of the tool and past the perforated interval.

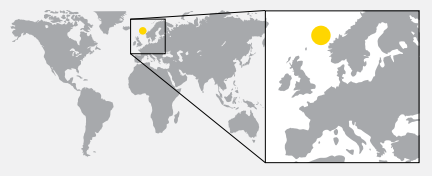




Archer

Case study: Stronghold™ Barricade

Reducing cost and improving effectiveness of P&A on Statfjord.



Region: North Sea
Customer: Statoil
Field: Statfjord
Well type: Oil and gas

Challenge

Statoil was seeking an efficient and reliable method to plug and abandon its well (P&A), whilst minimizing the use of rig time, and ensuring and effective, long-lasting seal.

Traditional P&A methods are often time consuming and costly—the need for milling and debris handling; perforating, and then preparation of the seal zone to receive cement; the deployment of a rock-to-rock cement seal; and the subsequent verification of the seal using logging techniques, can all add complexity and risk. Also, squeezing cement into perforations without washing and purging the perforated zone can reduce the chance of success.

STRONGHOLD™

Case benefits

- The Barricade eliminated the need to mill casing and provide more security when drilling out cement.
- Provided a clean and open annular space in which to place cement.
- Customer was able to set a balanced cement plug and squeezed cement into washed perforations.

Key capabilities

- Field proven
- High circulation rates
- Adjustable distance between swab cups
- Dual swab cup design
- Flow by-pass system

Case study: Stronghold™ Barricade

Solution

Archer's Barricade system is designed to perforate selected casing or liner sections; wash and clean the perforated zone completely; then enable permanent rockto rock cement plugging—all during a single trip.

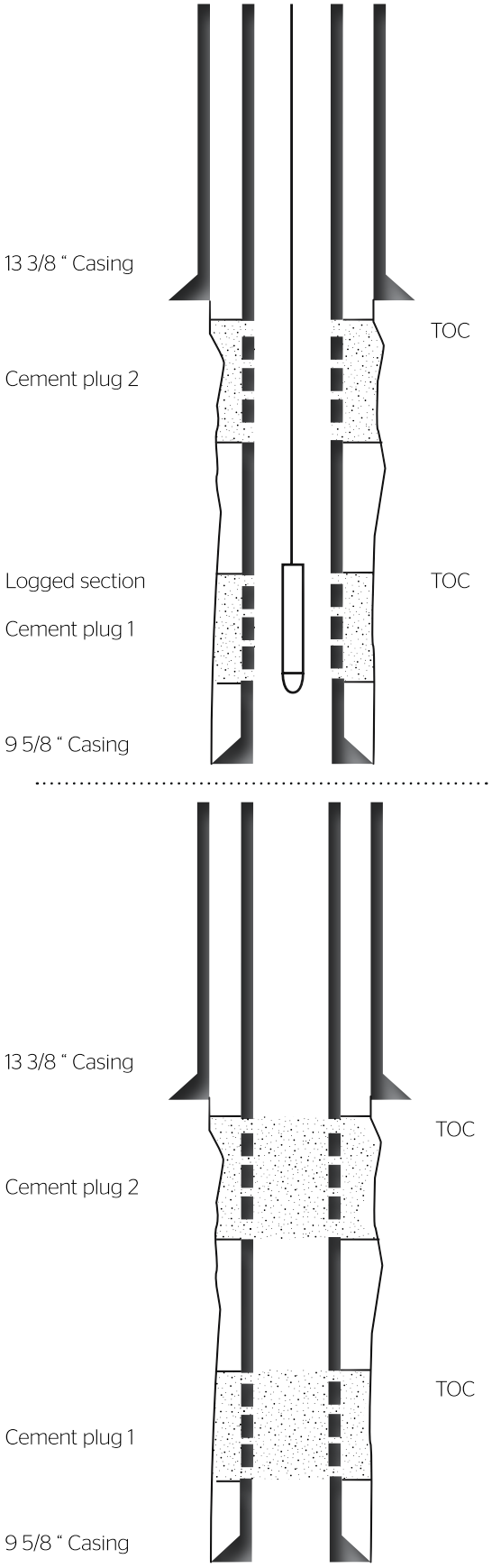
By eliminating the need for milling and debris handling, and preparing the seal zone to receive cement, the Barricade delivers a step change in P&A efficiency and effectiveness.

In this case, the Barricade was deployed after the initial perforations had been performed. The perforating program targeted two intervals at 2240–2303 m and 2108–2170 m respectively, and was configured to deliver 12 shots per foot with a hole size of 0.48 inches. After perforation, the Barricade was deployed to the top of the shallowest perforation interval and the washing sequence commenced as the Barricade was deployed further into the well. During washing, a flow rate of up to 2200 liters per minute with 40–45 bar circulation pressure was achieved. By visually examining the fluid returns over the shakers and monitoring the pressure points throughout the perforated intervals, it was possible to observe that debris was being successfully removed from the perforated zones. A spacer was pumped into the perforated zone before pulling out of hole. Then, after blowing out the solid ball seat, an open ended stinger was deployed, enabling a balanced cement plug to be set and cement to be squeezed into the pre-washed perforations. A cement evaluation log was deployed following the Barricade operation, in order to verify the quality of the cement seal.

Results

The Barricade eliminated the need to mill casing, and has provided a clean and open annular space in which to place cement, creating a secure and permanent seal of the well. High-circulation rates enabled improved efficiency and more effective removal of debris from the perforated zone. Eliminating the need for milling and debris handling, and preparing the seal zone to receive cement, has reduced overall complexity, risk and cost, whilst at the same time improving the integrity of the end result, as validated by a subsequent cement evaluation log.

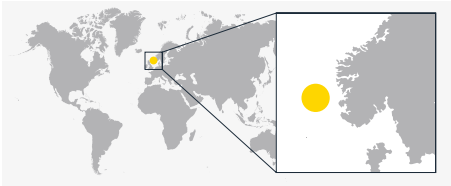
This Barricade job has been a great success for Statoil and has provided a robust blueprint for future operations.



Archer

Case study: Slot recovery in the North Sea

Stronghold™ Barricade reduces time and provides increased efficiency on slot recovery



Region: North Sea
Customer: Major Operator
Field: Norweigan Continental Shelf
Well type: Oil and gas

Challenge

A North Sea customer challenged Archer to plug and abandon a well to legislative requirements while increasing the efficiency of the process. Additionally, the challenge involved recovering the slot back to above the top of the 10" liner hanger to facilitate a new sidetrack.

STRONGHOLD™

Traditional plug and abandonment methods are often time consuming and costly. The compound complexity of milling, debris handling, perforating and squeezing cement can, and often do, reduce the chance of success.

Solution

This customer qualified Archer's Barricade as a method to perform the Plug & Abandonment, (P&A). The Barricade is designed to perforate selected casing or liner sections, wash and clean the perforated zone outside of the casing, then enable a permanent rock to rock cement plug—all during a single trip.

The first step of the process was to perforate, and after the guns were fired, to circulate bottoms up to handle any possible influx of gas. Once completed, washing of the annulus behind the casing started, firstly from top to bottom of the perforated interval—and by directing the flow into the annulus using swab cups Archer ensured the annular area was being fully washed and that the perforated interval was being properly cleaned. To verify the washing effectiveness, the perforated area was then washed a second time, now from bottom to top, and at a much lower pressure.

Case benefits

- The Barricade eliminated the need to mill casing
- Provided a clean and open annular space in which to place cement
- The Archer Barricade method ensured that the cement enters the perforations with the dual swab cups that directs the flow of cement
- No need to wait on cement with squeeze pressure
- The Barricade method eliminated the risk of squeezing cement

Key capabilities

- Field proven
- High Circulation rates
- Adjustable distance between swab cups
- Dual swab cup design
- Flow by-pass system
- High performance swivel with 120 rpm rotation

Typical Applications

- Permanent plug and abandon
- Slot recovery
- Formation integrity testing
- Perforate wash, cut and pull
- Seal of annulus pressure

This time, the observed pressure drop verified the quality of the washing. Bottoms up was circulated again to be certain that the well was free of debris before the cement job. The Barricade method uses the swab cups again to direct the cement flow into the annulus behind the casing. The risk when squeezing cement can always be that there is limited control of where it goes, and that can result in losses when the cement takes the path of least resistance. In this case, by directing the flow of cement through the perforations into the annulus and back again—using the dual swab cups—it is always ensured that the cement enters the annulus as required when the pump and pull cement job is performed.

On this well, three P&A plugs of 50 meters/165 feet each were completed using the Barricade. During the washing sequence a flow rate of 1600 lpm/420 gpm with a circulation pressure of approximately 110 bar/1600 psi was achieved. The perforated annular area was then cemented according to Archer's specifications which resulted in three, load and pressure tested, rock to rock P&A plugs that satisfied legislative and customer requirements.

A new application was added to the Barricade system. A new high performance swivel was used on the last plug while circulating bottoms up after the washing sequence. Rotation at 120 rpm increased the amount of debris coming over the shakers and the swivel also improved on the time needed to circulate the well clean before the cement job.

Result

The customer was impressed by the swivel's performance, agreeing that it further optimized the Barricade system. This system delivered a well free from debris before the cement job; the swivel was considered a great success, and a new milestone was achieved for the Barricade system.

Overall, the objective of plugging and abandoning the mother wellbore was completed in just seven days. One of two barriers across the main reservoir and two barriers across a secondary reservoir were completed at a rapid pace and with positive verifications. The introduction of the new high performance swivel improved and optimized the well cleaning before the cement job and this contributed to a flawless pump and pull cement job.

This Barricade job was a great success for the customer and has provided a robust blueprint for future operations.

Archer

Wellbore Cleanup

Tornar® Wellbore Cleaning Technology

Clean and solids-free wellbore

Features

- Superior annular velocity
- Balanced annular velocity in each wellbore
- Non-stop displacement
- Up to 150 rpm rotation speed
- Extra large bypass areas for eliminating flow restrictions
- Large ID to increase flow

Benefits

- Time saving non-stop displacement
- Superior wellbore debris removal
- Easy operation
- Enhanced chemical cleaning

Contact your local Archer representative for more information on Tornar® wellbore cleaning technology for your well needs.

www.archerwell.com

A clean well is essential prior to running expensive and sensitive completion strings or other debris sensitive equipment. Therefore, the removal, collection, and verification of debris are extremely important in a wellbore. Archer's Tornar® wellbore cleaning equipment optimizes these operations.

Superior annular velocity

The name Tornar® is derived from the word **Torn**ado and **Ar**cher. Like a vortex of a tornado, Tornar's wellbore cleaning technology swiftly draws in and expels debris from the wellbore.

Coincidentally Tornar® is also a Spanish word which means return to or give back, which is exactly what Tornar® technology does; it returns the wellbore to a pristine and clean condition.

Elements in efficient wellbore cleaning:

- **Balanced Annular Velocity** is essential to avoid debris settlings when there is a change in liner or casing ID. Through the use of innovative circulation valve technology, all sections of the wellbore will have a high annular velocity simultaneously.
- **Non-stop Displacement** is of the essence to enhance the chemical cleaning of a wellbore. Through the use of innovative circulation valve technology the wellbore can be displaced without stop in pumping. This saves time and optimizes the displacement process.
- **High Rotation speed** is important to create a turbulent flow and transport debris into the flow regime in the vertical section of a well.
- **High Annular Velocity** is important to transport debris out of the well. Each tool is designed to optimize and enhance annular velocity. The result is a constant superior annular velocity in all wellbore sections.
- **Fluid Rheology** is equally important to create a viscous coupling with the drillpipe and suspend debris in the flow regime.

All these elements together make Tornar wellbore cleaning technology the best option for a **Clean and Solids Free Wellbore.**

Archer

Tornar® BOP Cleaner

Clean and solids-free BOP

Advanced vortex cleaning technology for BOPs

The Tornar® BOP Cleaner removes wellbore debris from blow out preventer cavities safely, rapidly and reliably. Tornar® flow ports create a high-velocity fluid vortex which combines with powerful proprietary magnets to extract debris from ram and annular cavities—without harming the BOP.

TORNAR®

Benefits

- Rapid and effective BOP cleaning
- Reduced BOP maintenance and non productive time
- Higher success rate and efficiency of BOP performance testing
- Cleans even deep cavities

Applications

- Clearing debris from BOP rams and cavities

Features

- Tornar® technology creates powerful vortex suction effect
- Tornar® industrial magnets ensure maximum metallic debris extraction
- Configured to suit BOP requirements
- Standard drill pipe connection
- One piece mandrels
- Non-rotating stabilizer and magnet
- Fishing magnet can be fitted at the bottom of the string to add further cleaning assurance

Debris management is a serious oilfield challenge and is responsible for many of the operational difficulties and costs of maintaining BOPs.

Drilling debris and mud solids can accumulate within BOP cavities causing them to malfunction; and milling operations generate an abundance of metallic junk and other particles that can seriously hinder the correct operation of the BOP. Even small objects can jeopardize well control, with potentially hazardous consequences to people, the environment and surface assets.

Cleaning debris from BOP cavities is especially challenging, Traditional cleaning methods may force debris further in to the BOP workings, and it is critical that cleaning operations are performed safely and efficiently.

Archer's Tornar® BOP Cleaner combines Tornar® flow ports with powerful proprietary magnets to ensure the maximum extraction of harmful debris from BOP cavities and the well .

The Tornar® BOP Cleaner can be configured to suit operational requirements to maximize debris retrieval.

Specifications

Cleaner string size, inch [mm]	13.375 [339.7]	17.45 [443.2]
BOP size, inch [mm]	13.625 [346]	18.75 [476.3]
Recomended pumprate	6,500	6,500
Min. recommended pump rate, lpm	3,500	3,500
Material (main body)	AISI 4145M	AISI 4145M
Max. working temp, degC [degF]	150 [302]	150 [302]
Max. OD, inch [mm]	13.375 [339.7]	17.45 [443.2]
Drift ID, inch [mm]	2.83 [71.9]	3.5 [88.9]
Tool joint OD, inch [mm]	6.535 [166]	7.25 [184.2]
Connections	NC-50 b/p	5 1/2" FH b/p
Magnet rods	6pcs @ 360º	8pcs @ 360º

Specifications may be subject to change

Archer

Tornar® Sub Sea BOP Cleaner

Clean and solids-free BOP and riser

Advanced vortex cleaning technology for BOPs and risers

The Tornar® Sub Sea BOP Cleaner removes wellbore debris from blow out preventer and marine riser cavities safely, rapidly and reliably. Tornar® flow ports create a high-velocity fluid vortex, which combines with powerful proprietary magnets to extract debris — whilst maintaining full well control.

Benefits
- Rapid and effective single-trip BOP and riser cleaning
- Reduced BOP maintenance and non-productive time
- Higher success rate and efficiency of BOP performance testing
- Allows short tripping with wellbore clean-up string
- Cleans even deep cavities

Applications
- Clearing debris from BOP's and marine risers

Features
- Tornar® technology creates powerful vortex suction effect
- 3-stage circulation ports enable full well control
- Tornar® Extreme magnets ensure maximum metallic debris extraction
- Easily configured to suit BOP and riser requirements
- Premium drill pipe connection
- One piece mandrels
- Non-rotating stabilizer and magnet.
- Built-in junk basket; spring-loaded self-adjusting dual brush
- Optional fishing magnet can be fitted to bottom of string

Debris management is a serious oilfield challenge and is responsible for many of the operational difficulties and costs of maintaining BOPs, especially in a deep water environment. Drilling debris and solids can accumulate within BOP and riser cavities causing BOPs to malfunction; and milling operations generate an abundance of metallic junk and other particles that can seriously hinder the correct operation of the BOP. Even small objects can jeopardize well control, with potentially hazardous consequences to people, the environment and surface assets.

Archer's Tornar® Sub Sea BOP Cleaner ensures the maximum extraction of harmful debris from BOP cavities and marine risers—without harming the BOP.

The Tornar® Sub Sea BOP Cleaner can be configured to suit operational requirements, for example by adjusting the ratio of flow ports to magnets, in order to maximize debris retrieval.

Tornar® Sub Sea BOP Cleaner

Specifications

Cleaner string size, inch [mm]	17.45 [443.2]
BOP size, inch [mm]	18.75 [476.3]
Recomended pumprate	6,500
Min. recommended pump rate, lpm	3,500
Material (main body)	AISI 4145M
Max working temp, degC [degF]	150 [302]
Max. OD, inch [mm]	17.45 [443.2]
Drift ID, inch [mm]	2.637 [67]
Tool joint OD, inch [mm]	7.252 [184.2]
Connections	5 1/2" FH b/p or VX-57 b/p

BOP magnet

Max. OD, inch [mm]	17.45 [443.2]
Drift ID, inch [mm]	3.5 [88.9]
Tool joint OD, inch [mm]	7.252 [184.2]
Magnet rods	8pcs @ 360°

Riser magnet

Max. stabilizer OD, inch [mm]	17.45 [443.2]
Brush OD, inch [mm]	18.75 to 20 [476.3 to 508]
Brush segment	8 rows, dual brush strips
Bristle type	Straigh flat wire
Magnet rods	8 pcs @ 360°
Junk bucket OD, inch [mm]	16 [406.4]

Riser Brush Magnet

BOP Magnet

3-Stage Tornar® BOP Cleaner

Well Filter

Tornar® Wash Magnet

Archer

Tornar® Grab Magnet

Reliable well cleaning

High circulation fishing magnet

The Tornar® Grab Magnet retrieves magnetic object debris from the wellbore rapidly and reliably. With its combination of Tornar® flow ports and the most powerful magnetic elements, it can remove irregular shaped objects such as bearings, bit cones and lost tools simply and effectively.

Benefits
- Tornar® flow ports clear particle debris to ensure full contact
- Up to 1200 kg lifting capacity
- No limitations in running speed
- No run in hole restrictions

Applications
- Retrieval of magnetic objects from the wellbore
- Run as integral part of drillpipe toolstring to attract and retain magnetic debris

Features
- Tornar® flow ports
- One piece mandrel
- Stabilizer blades for support on low side
- Up to 150 rpm rotation
- Multi-magnet element
- Drill pipe connection

Magnetic debris is a serious oilfield challenge, and is responsible for many of the operational difficulties and costs of well production and maintenance, particularly in high deviations and hostile conditions. Even small objects can severely jeopardize well control and integrity, with potentially hazardous consequences to people, the environment and well components.

The Tornar® Grab Magnet is equipped with the strongest magnetic elements – with a lifting capacity of over 1000 kg with full contact. To ensure that full contact is established and maintained, its unique Tornar® flow ports create a powerful cyclone effect, clearing away cuttings and other debris that may interfere with or prevent contact with the magnet.

Specifications

Casing size, in	4 1/2	5 1/2	7	9 5/8
Casing range, lb/ft	9.5 – 21.6	13 – 28.4	17 – 38	32.3 – 58.4
Max running speed in casing	No limit	No limit	No limit	No limit
Nozzle diameter, mm	Ø9mm x 6	Ø9mm x 6	Ø14mm x 12	Ø20mm x 12
Max pump rate, LPM	2800	3200	3200	5500
Min recommended pump rate, LPM	1000	1500	2800	3200
Max set down weight on magnet, kg	500	500	2000	3000
Max magnet lift capacity, kg	100	150	up to 750	up to 1200
Max rotation speed, RPM	150	150	150	150
Max OD, in	3.30	4.40	5.787	8.300
Min OD, in	1	1	2.687	3.0
Connection	2 3/8" Reg box	2 3/8" Reg box	NC38 Boxup	NC50 Boxup
Temperture rating, °C	4 – 150	4 – 150	4 – 150	4 – 150

Specifications may be subject to change

Archer

Tornar® Circulation Magnet

Reliable well cleaning

High circulation magnetic wellbore cleaning

The Tornar® Circulation Magnet retrieves magnetic objects and particle debris from the wellbore rapidly and reliably. Its unique design utilizes the most powerful magnetic elements, combined with thru-magnet Tornar® flow ports, for fishing and wellbore cleaning operations.

Benefits
- Thru magnet Tornar® flow ports clear particle debris to ensure full contact
- Up to 1000 kg lifting capacity
- No limitations in running speed
- No run in hole restrictions

Applications
- Wellbore cleaning operations
- Retrieval of magnetic objects from the wellbore
- Run as integral part of drillpipe toolstring to attract and retain magnetic debris

Features
- Thru-magnet Tornar® flow ports
- One piece mandrel
- Stabilizer blades for support on low side
- Up to 75 rpm rotation
- Multi-magnet element
- Drill pipe connection

Magnetic debris is a serious oilfield challenge, and is responsible for many of the operational difficulties and costs of well production and maintenance, particularly in high deviations and hostile conditions. Even small objects can severely jeopardize well control and integrity, with potentially hazardous consequences to people, the environment and well components.

Designed to remove magnetic objects and accumulated debris from the wellbore rapidly and efficiently, the Tornar® Circulation Magnet is equipped with the strongest magnetic elements available – with a lifting capacity of over 1000 kg with full contact. Its unique thru-magnet Tornar® flow ports create a powerful cyclone effect around objects and the surrounding wellbore, ensuring full contact with the magnet and optimal debris extraction.

Specifications

Casing size, in [mm]	9 5/8 [244.5] and up
Max running speed in casing	No limit
Nozzle diameter, in [mm]	0.79 [20] x 12
Max pump rate, gal/min [l/min]	1,453 [5,500]
Min recommended pump rate, gal/min [l/min]	845 [3,200]
Max set down weight on magnet, lb [kg]	6,614 [3,000]
Max magnet lift capacity, lb [kg]	3086 [1400]
Max rotation speed, RPM	75
Max OD, in [mm]	8.30 [210.8]
Connection	NC50 Boxup
Temperture rating, °F [°C]	39 - 302 [4 - 150]

12 x 12 circulation ports in magnet nose sub

Archer

Tornar® Balanced Circulation Valve

Clean and solids-free wellbore

The Tornar® Balanced Circulation Valve is a circulating sub for wellbore clean-up and displacement applications, boosting the annular velocity in the wellbore casing and liner annulus. It can be part of a complete wellbore cleaning tool string used during the displacement process before running completion.

TORNAR®

Features & Benefits

- Fluid velocity balance in different size wellbores
- Operation at maximum parameters
- No external nuts or bolts
- Heavy duty clutch assembly
- High strength mandrel
- Simple to run
- Multiple run possible

The Tornar® Balanced Circulation Valve achieves a higher flow rate to be pumped up the production casing, circulating through the liner and the production casing. The result is a balanced fluid velocity in the wellbore annulus during displacement. The valve can isolate the lower drill string rotation during circulation. It is in first position when run in hole, allowing torque transmittal to upper and lower drill string while circulating 100% of the flow through the tool. In this position, the velocity booster ports are closed.

The Tornar® Balanced Circulation Valve can open velocity booster ports to the annulus, allowing a higher flow rate to be pumped up the production casing than normally possible in liner and production casing. This balances the fluid velocity in the different size wellbores during displacement. It is used for displacements, post-perforating, pre-fracturing, multi-zone completions, milling, burning, fishing, and smart completions.

Specifications

Casing size	9 5/8 and up
Comm. no	601-09-0001
Max OD	171.45 mm / 6.75"
Thread	NC 50 box/pin
ID	50,8 mm / 2"
Overall length	2020 mm / 79.53"

General Operating Parameters

Size	9 5/8"
Tensile Yield	460 tons / 1014684 lbs.
Torsional strength	51114 Nm / 37700 ft. lbs.
Max rotation RPM	150
Working temperature	150°C / 302°F
Max. trip speed in casing	45 m/min / 150 ft/min
Maximum operation pressure	345 bar - 5000 psi
Material (main body)	AISI 4145M 110 KSI / 125 KSI
Force to open	87 kN - 348 kN / 20 000 - 80 000 lbs.

Archer

Tornar® Circulation Valve

Clean and solids-free wellbore

The Tornar Circulation Valve removes debris from the wellbore rapidly and reliably. Its unique design utilizes Tornar® flow ports to create a powerful cyclone to clean and optimize well fluid velocity.

Benefits

- Secure wellbore integrity
- Reduced downtime
- One run BOP and wellhead cleaning
- Large flow areas
- Cyclone effect keeps solids afloat
- Increased fluid pressure for more effective cleaning
- No limitations on running speed
- No run in hole restrictions

Specifications

Size	8.30
Max OD, in	8.30
Drift ID, in	2.25
Tool Joint OD	6 5/8
Nozzle diameter, mm	Ø18mm x 12
Max tripping speed in casing	200 ft/min
Recommended cleaning speed in casing	0.5 ft/min
Recommended rotation speed while cleaning	15 rpm
Max pump rate	6,500 lpm
Min recommended pump rate	3,500 lpm
Max rotation speed	75 rpm
Max allowed Tensile (lbs)	1,175,450 lbs
Torsional Strength (ft. lbs)	116,206 ft. lbs
Pressure rating - shifting sleeve*	1200 - 1700 psi
Shifting method	2 3/4" steel ball
Max working temp	150°C
Material main body	AISI 4145M
Connection	NC-50 box/pin

* can be used without the shifting sleeve

Applications

- Cleaning debris from wellbores in any wellbore cleanup operations
- Cleaning wellheads in combination with BOP and riser cleaning
- Boosting annular velocity above plug
- When extra circulation is required

Features

- Optional flow split sleeve
- Tornar® flow ports
- Stabilizer blades for support on low side
- Drill pipe or premium connection
- One piece mandrels. No parts lost in hole
- Up to 75 rpm rotation
- Large flow by area
- High circulation rates (6500lpm)

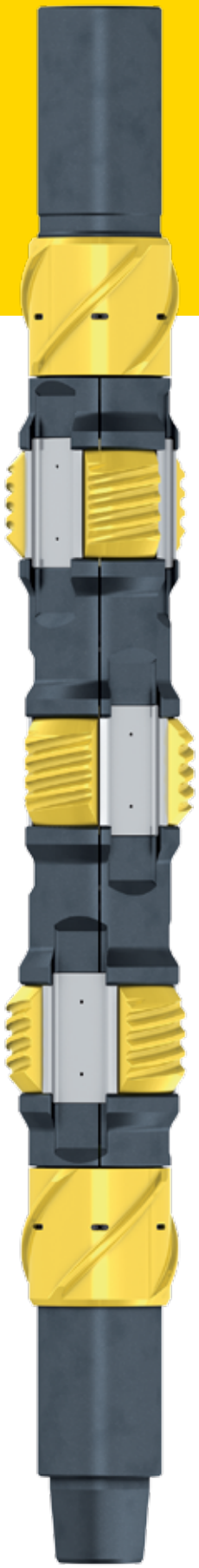
The Tornar® Circulation Valve can be integrated as a part of a complete wellbore cleaning string used during displacement process for optimum fluid velocity and cleaning. Improper cleaning can possibly damaging or plugging the productive zone, and impeding the running of the completion assembly. Proper cleaning contributes to a successful completion and reduces the potential for wellbore contamination.

The Tornar® Circulation Valve can also be integrated as a part of the Tornar® Sub Sea BOP cleaning string for cleaning Wellhead areas prior to cleaning BOP and Riser. The Tornar® Circulation Valve is then positioned bellow the Tornar® BOP Cleaner. You can now clean the Wellhead and BOP in one run.

Archer

Tornar® Casing Scraper (Non-Rotating)

Clean and solids-free wellbore



Tornar® Casing Scraper is a mechanical tool for cleaning and polishes the casing or liner ID to remove mud solids, cement sheath, scale and perforation burrs in any wellbore.

Benefits
- Clean 360 degrees without rotation
- Eliminates casing wear
- High strength mandrel
- Simple to run
- Multiple run possible
- Withstand drilling and milling operations
- Suitable for HP wells and can withstand chemical or acid attack

Applications
- Cleaning debris from wellbores in any wellbore cleanup operations
- Post perforation cleaning
- Cleaning after side track operations
- When cleaning is required in drilling operations

Features
- One piece mandrel
- Non rotating stabilizers
- Non rotating scraper sleeve
- No external nuts or bolts
- Standard drill pipe connections
- Extra Large bypass areas for eliminating flow restrictions

The Tornar® Casing Scraper can be integrated as a part of a complete wellbore cleaning tool string used during the displacement process prior to running completion. It can be rotated and reciprocated without fear of damage to casing or tool due to the rugged design and the fact that it doesn't contain external bolts that could work loose under extreme conditions.

A Tornar® Casing Scraper tool consists of a onepiece Body, non-rotating Stabiliser and Scraper assembly. The main mandrel rotates through the stabiliser and Scraper assembly to avoid wear or damage to the casing during drill string rotation.

The Scraper assembly is self-centralising inside the casing or liner to ensure equal cleaning at all well conditions. It's also rough, flexible and has the force needed remove and clean 360 degrees without rotation.

Specifications

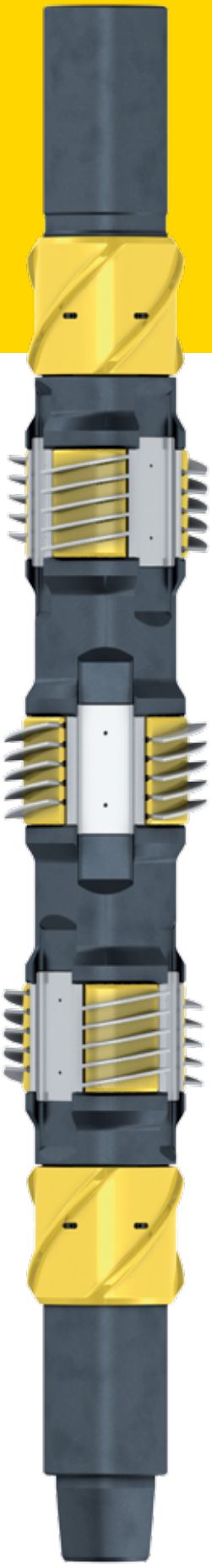
Casing sizes	4 1/2" to 14"
Thread	API and Premium
ID	1 3/4" to 4"
Maximum rotation speed	150 rpm
Working temperature	150°C / 302°F
Max. trip speed in casing	Limited by rig equipment
Max. pump rate	Limited only by surface equipment
Material (main body)	AISI 4145M 110 KSI
Burst pressure	690 bar - 10 000 psi

Specifications may be subject to change

Archer

Tornar® Casing Brush (Non-Rotating)

Clean and solids-free wellbore



Tornar® Casing Brush is a mechanical tool for clean and polishes the casing or liner ID to remove mud solids, cement sheath and scale in any wellbore.

TORNAR®

Benefits
- Clean 360 degrees without rotation
- Eliminates casing wear
- High strength mandrel
- Simple to run
- Multiple run possible
- Withstand drilling and milling operations

Applications
- Cleaning debris from wellbores in any wellbore cleanup operations
- Post perforation cleaning
- Cleaning after side track operations
- When cleaning is required in drilling operation

Features
- One piece mandrel
- Non rotating stabilizers
- Non rotating center sleeve
- No external nuts or bolts
- Extra large bypass areas for eliminating flow restriction
- Fluted spiral stabilizer sleeves for generous fluid and debris bypass

The Tornar® Casing Brush can be part of a complete wellbore cleaning tool string during the displacement process prior to running a completion. It can be rotated and reciprocated without damaging the casing or tool.

Rotation up to 150 rpm may be applied to create a turbulent flow and remove the cutting bed. The non-rotating stabilizers on the Tornar Brush provide a standoff and a generous flow area for fluid by-pass around the tool.

A Tornar® Casing Brush tool consists of a one-piece Body, non-rotating Stabiliser and Brush assembly. The main mandrel rotates through the stabiliser and Brush assembly to avoid wear or damage to the casing during drill string rotation. The Brush assembly is self-centralising inside the casing or liner to ensure equal cleaning at all well conditions. It's also rough, flexible and has the force needed remove and clean 360 degrees without rotation.

The tool is suitable for HPHT wells and can withstand chemical or acid attack.

Specifications

Casing sizes	4 1/2" to 14"
Thread	API and Premium
ID	1 3/4" to 4"
Maximum rotation speed	150 rpm
Working temperature	150°C / 302°F
Max. trip speed in casing	Limited by rig equipment
Max. pump rate	Limited only by surface equipment
Material (main body)	AISI 4145M 110 KSI
Burst pressure	690 bar - 10 000 psi

Specifications may be subject to change

Archer

Tornar® WellFilter

Clean and solids free wellbore

The Tornar® WellFilter validates effectiveness of the displacement operation by filtering well fluids while pulling out of hole. It is designed to remove debris from any wellbore.

TORNAR®

Benefits
- Easy to empty debris window
- Verification of a clean wellbore
- High strength mandrel
- Simple to run
- Large debris capacity
- One piece mandrel
- Multiple run possible
- Withstand drilling and milling operations

Applications
- Wellbore clean-up operations
- Shallow or deep wells operation
- Debris barrier for barriers plugs
- Junk basket when cleaning BOP and Riser
- Wells with any type of downhole fluids
- Allows running in combination with any LOCK® Plug for BOP testing, pipe hang off and well cleaning

Features
- Verification and capture of debris within any wellbore using proprietary in-house developed technologies
- Automatically close filter bypass valve
- Diverter cup for debris risk management
- Load bearing for supported diverter cup to manage wear of critical parts
- Rupture disk to prevent swabbing when pulling out of hole fully
- One piece mandrel for higher strength
- No external nuts or bolts
- Large bypass areas for limiting flow restrictions

The Tornar® WellFilter can be integrated as a part of a complete wellbore cleaning tool string used during displacement process prior to running completion.

The WellFilter is positioned in the casing below the wellhead during BOP and Riser cleaning. This creates a wellbore debris barrier. The same applies for running a combination of Tornar® BOP Cleaner and LOCK where the WellFilter create a barrier for debris to fall on top of the LOCK.

As the wellbore cleanup string with the Tornar® WellFilter is run in hole, the wiper cup cleans and removes debris from the casing ID. The Tornar® WellFilter is equipped with an automatic by-pass valve for fluid by-pass when running in hole. This valve eliminates swab, surge and debris to bypass the filter.

Specifications

Casing sizes	9 5/8" to 14"
Max tripping speed	Limited by rig equipment
Flow area thru sliding valve	from 28 241 mm² - 43,77 in²
Flow area around tool	from 7292 mm² / 11.303 in²
Debris volume	30 liter
Burst discs	4 with 0,60 in² area each
Maximum operational rotation	120 rpm
Max working Temperature	120°C / 248°F
Material (main body)	AISI 4130 125 KSI
Connections	XT50 Box/pin

Specifications may be subject to change

Archer

Tornar® String Magnet (Non-Rotating)

Clean and solids-free wellbore

Tornar® String Magnet is a mechanical tool that collects metallic debris in the casing or liner IDs from any wellbore. It is designed to capture a large volume of metallic debris while maintaining large flow volumes.

TORNAR®

Benefits
- Large debris capacity
- High strength single pole magnets
- Eliminates casing wear
- High strength mandrel
- Simple to run
- Multiple run possible
- Withstand drilling and milling operations

Typical applications
- Cleaning debris from wellbores in any wellbore cleanup operations
- Post perforation cleaning
- Cleaning after side track operations
- When cleaning is required in drilling operations
- In combination with BOP and riser cleaning
- Allows running in combination with any LOCK® Plug for BOP testing, pipe hang off and well cleaning

Features
- One piece mandrel
- Non rotating stabilizers
- Non rotating magnet sleeve
- No external nuts or bolts
- Extra Large bypass areas for eliminating flow restrictions
- Fluted spiral stabilizer sleeves for generous fluid and debris bypass

The Tornar® String Magnet can be integrated as a part of a complete wellbore cleaning tool string during the displacement process prior to running completion. It can be rotated and reciprocated without damaging the casing or tool. This is due to its rugged design and the fact that it does not contain external bolts that could become loose under extreme conditions.

As the Tornar® String Magnet is run in hole the high capacity magnets remove debris from the casing ID and drilling fluid. The non-rotating stabilizers on the Tornar® String Magnet provide a standoff as well as a generous flow area for fluid by-pass around the tool. The non-rotating stabilizers also reduce any possible casing wear. The non-rotation magnet sleeve ensures no debris is washed away during rotation. Rotation up to 150 rpm may be applied to create turbulent flow and remove cutting bed.

The Tornar® String Magnet should be run when significant ferrous debris may potentially exist.

Specifications

Casing/liner sizes	4 1/2" to 14"
Thread	API and Premium
ID	1 3/4" to 4"
Maximum rotation speed	150 rpm
Working temperature	150°C / 302°F
Max. trip speed in casing	Limited by rig equipment
Max. pump rate	Limited only by surface equipment
Material (main body)	AISI 4145M 110 KSI
Burst pressure	690 bar - 10 000 psi
Debris capacity	Up to 94 kg / 207 lbs
Magnet force	Up to 1850 kg

Specifications may be subject to change

Archer

Tornar® Ditch Magnet

For a clean and solids-free wellbore

High Strength Ditch Magnet

The Tornar® Ditch Magnet is a leader in magnetic capture and hold power.

Applications
- Casing exits
- Section milling
- Packer and bridge plug milling
- PBR and tieback milling and reaming
- General wellbore milling operations
- BOP and riser cleaning
- Wellbore cleaning operations
- General drilling operations

Features
- Advanced magnetic circuit design
- High strength Rare Earth magnet technology
- Stainless Steel housing
- Large flow areas for unlimited flow restrictions
- Quick Look System®

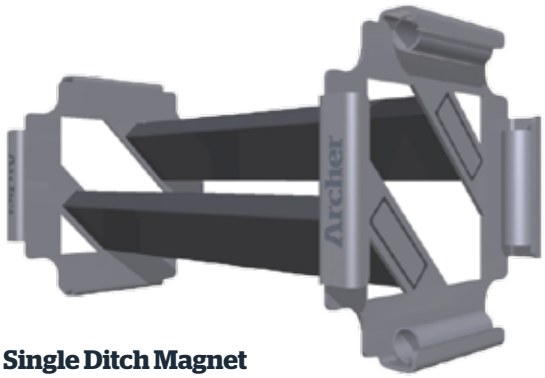
Benefits
- Light weight modules for better HS&E
- Fits any flow line
- Can be stacked or fitted stand alone
- Easy to clean

The Tornar® Ditch Magnet features a unique magnetic circuit that provides extremely high magnetic field strength in an optimum alignment. The magnet is designed to recover the maximum amount of ferrous contaminants from the fluid stream in all drilling and milling operations, yet remains easy to clean.

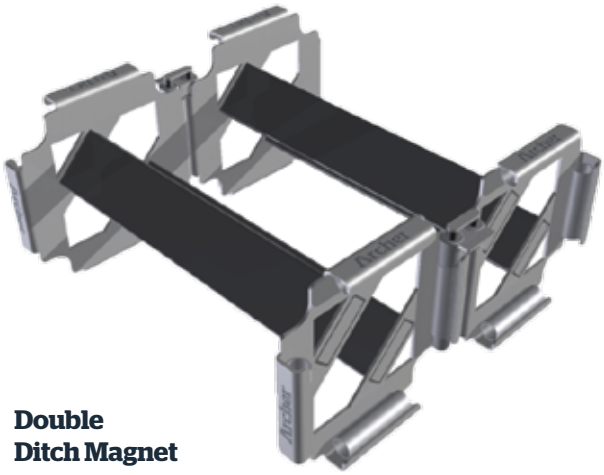
The Tornar® Ditch Magnets are a modular system that can be built together into many shapes for optimum alignment in the fluid stream, and no specialized or costly modification is required.

Each magnetic section is equipped with a quick look® system on all sides so that the magnets can be built to fit any flow line while still clearly showing debris build-up. Each of the Tornar® Ditch Magnets' sections has a small nonmagnetic area at the bottom that allows easier cleaning with a special design cleaning tool.

The light weight magnetic sections are built to comply with all HS&E manual handling requirements.



Single Ditch Magnet



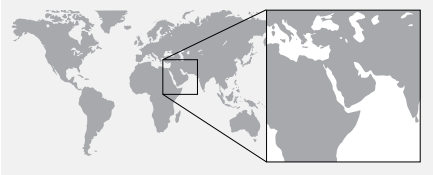
Double Ditch Magnet

Archer

Wellbore Cleanup Case Studies

Archer

Archer's Tornar® Wellbore Cleaning Can Save a Potential of 60 Hours' Rig Time



Region: Middle East
Customer: National Oil Company
Well Type: Tri Lateral Producer

Case benefits
- Saved 60 hours.
- Balanced annular velocity.
- Superior wellbore debris removal.
- Easy operation.
- Enhanced chemical cleaning.

Key capabilities
- Superior annular velocity.
- Balanced annular velocity in each wellbore section.
- Nonstop displacement.
- Extra large bypass areas for eliminating flow restrictions.
- Up to 150 rpm rotation speed.
- Large ID to increase flow.

Typical Applications
- Applied during displacement in the pre-completion phase of the well.
- Perforation jobs.
- Drilling applications.
- Frac jobs.
- Milling jobs (whipstocks, packers, junk removal).
- Applied when debris needs to be removed from the well that could affect normal operations.

Challenge

A customer in Middle East region wanted to reduce the number of clean-up runs on two wells prior to running expensive and sensitive completion strings. An average wellbore cleaning operation can take more than 70 hours to complete.

TORNAR®

Running multiple clean-up runs to clean a wellbore is a time consuming and costly operation. Reducing the numbers of runs without compromising an effective hole cleaning job is the key to ensuring a successful completion installation and providing maximum well returns.

Solution

Archer's Tornar® wellbore cleaning technology optimizes hole cleaning by saving time and costs. The Tornar® wellbore system rapidly and effectively cleans and displaces the wellbore, therefore reducing the number of clean-up runs. The Tornar® solution encompasses:

- **Balanced annular velocity**, which is essential to avoid debris settlements when there is a change in a liner or casing ID. By using innovative circulation valve technology, the entire wellbore had high annular velocity.

- **Nonstop displacement**, which is essential for handling the chemical cleaning of a wellbore. By using innovative circulation valve technology, the wellbore can be displaced without stop in pumping. This saves time and optimizes the displacement process.

- **Maximum annular velocity**, which is important to transport debris out of the wellbore. Each tool is designed to optimize and enhance annular velocity. The result is a superior annular velocity in all wellbore sections.

Result

Archer's superior Tornar® wellbore cleaning technology proved a potential savings of **60 hours' rig time** by giving a clean and solids-free wellbore for the customer.

Archer saved the customer 30 hours of rig time on each well.

As a result of effective wellbore cleaning, completions operations could continue without interference and zero hours' rig down time.

For more information, contact your **local Archer representative**.

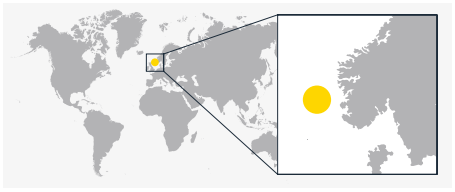
Archer

Case study: Tornar® BOP Cleaner

Tornar Sub Sea BOP cleaning eliminated BOP down time.

Challenge

During drilling operations swarf and magnetic debris accumulated in the BOP cavities as fluids were circulated and returned to surface. Operating a BOP in such environments can cause damage to the seals, which in turn can lead to expensive repair operation, or in worst case, malfunctioning BOP in a well control situation. However, cleaning debris from BOP cavities by traditional methods has proven to be especially challenging as the associated technologies have not been optimized for the task. The magnets are too weak, or too small, or both, and the jet subs tend to push debris in to the cavities rather than washing it out. Because of swarf in the 18.75" subsea BOP stack and Riser on COSL Innovator and Promotor semi-submersible drilling rig, it's been mandatory to carry out BOP stack cleaning prior to BOP performance test. Owing to the increased demands of operating in a deep water environment it was imperative for COSL to find an effective and efficient solution to safeguard operations without elevating operating costs.



Region: North Sea
Customer: COSL
Field: Troll
Rig: COSL Innovator & COSL Promotor
Well type: Oil & Gas

Case benefits

- Eliminated BOP downtime and maintenance
- Extended BOP operating performance
- Reduced safety and environmental operating risks

Key capabilities

The Tornar™ BOP Cleaner string removes wellbore debris from blow-out preventer (BOP) cavities rapidly and reliably. Its combination of Tornar™ flow ports and large outside diameter (OD) create a powerful cyclone effect that clears potentially hazardous debris from ram and annular cavities – without damaging the BOP.

- Effective BOP and Riser cleaning
- Configuration to suit any BOP requirements
- Drill pipe connection
- One piece mandrel
- Non-rotating stabilizer and magnet
- Most powerful magnets in the industry
- Proprietary Tornar™ flow port technology

Case study: Tornar® BOP Cleaner

Solution
The Tornar™ BOP cleaner proved to be the highly effective solution for the task, with a considerable amount of swarf recovered from the BOP stack. Over 100 kg of swarf was recovered from 1 job. Subsequently, the BOP test has been completed successfully and safely since beginning of 2013.

Designed to remove debris from the BOP rapidly and reliably, the Tornar™ BOP Cleaner string combines Tornar™ flow ports with a large OD to create a powerful cyclone of drilling fluid. When the cyclone passes any BOP cavity, the differential pressure engulfs any accumulated debris and retains it in the drilling fluid. Thus reducing problems that lead to equipment failures and downtime.

Result
COSL have eliminated BOP downtime related to swarf. COSL Promotor and Innovator have 0 hours BOP downtime since they started using Tornar™ BOP Cleaning beginning of 2013. Use of Tornar™ BOP Cleaning eliminates the need of pulling BOP's in milling operations.

After the first time use, COSL stated, "We should have a fair amount of respect for BOP operation in a swarf environment; operation of a BOP in this environment will have relatively large economic consequences."

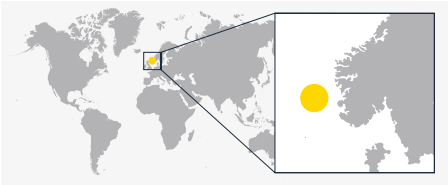
COSL have done video shoots to confirm that Annular and Rams are free from debris confirming that the Tornar™ preformed excellent and eliminated the need of BOP maintenance.

Tornar® Sub

17.45" BOP Magnet

Case study: Tornar® BOP Cleaner

Statoil, Troll Y-14 extensive milling operation done by Stena Don.



Region: North Sea
Customer: Statoil
Field: Troll Y-14
Rig: Stena Don
Well type: Oil & Gas

Case benefits

- Effective well cleaning
- Reduced BOP maintenance
- Reduce BOP swarf that could cause failures

Key capabilities

The Tornar™ BOP Cleaner string removes wellbore debris from blow-out preventer (BOP) cavities rapidly and reliably. Its combination of Tornar™ flow ports and large outside diameter (OD) create a powerful cyclone effect that clears potentially hazardous debris from ram and annular cavities – without damaging the BOP.

- Tornar™ flow ports
- Can be easily configured to suit any BOP requirements
- Drillpipe connection
- One piece mandrel
- Non rotating stabilizer and magnet.
- Large one side magnet area

Effective Sub Sea BOP Cleaning for Stena Don

The Archer Tornar™ BOP Cleaner String is specially designed to clean BOP rams and annular cavities. Any steel or particles inside a cavity can damage or break down any BOP. The main purpose is to clean and collect debris without damaging the BOP. The Archer Tornar™ BOP Cleaner creates a rotating column of drilling fluid called a Tornado. When the closed pressure circulation passes any cavity it creates a lower pressure inside the cavity and pulls debris into the rotating column of drilling fluid. Any debris pulled into the tornado will circulate past cavities without leaving debris inside.

Challenge

Statoil was planning a standard P&A of existing well and reuse slot for new well construction. During this operation, necessary annulus barriers were not obtained. This resulted in extensive milling operations to get the required depth for obtaining annulus barrier. Due to the anticipated large amount of steel debris, Stena Don semi-submersible drilling rig requested a clean-up of the BOP systems. Running the Archer Tornar™ BOP Cleaner, they were able to remove large amounts of swarf from BOP Cavities. The Swarf removed was shavings and chippings of metal from milling operations. Utilizing the Tornar™ BOP Cleaner was essential to eliminate damage and downtime on BOP stack.

Case study: Tornar® BOP Cleaner

Solution

Designed to remove debris from the BOP rapidly and reliably, the Tornar™ BOP Cleaner string combines Tornar flow ports with a large OD to create a powerful cyclone of drilling fluid. When the cyclone passes any BOP cavity, the differential pressure engulfs any accumulated debris and retains it in the drilling fluid. Reducing problems that lead to equipment failures and downtime. By running the Archer Tornar™ BOP Cleaner they were able to remove large amounts of swarf from the BOP Cavities. The swarf removed were shavings and chippings of metal from the milling operations. Utilizing the Tornar™ BOP Cleaner was essential to eliminate damage and downtime on the BOP stack.

Operation

During milling operation Tornar™ BOP cleaner was used several times. On the first run after milling Seal-stem, PBR and packer 141 kg of metal was cleaned off the magnets. On the second run 92 kg of metal was cleaned off the magnets. On the third run 12 kg of metal was cleaned off the magnets. Operations continued by milling ZXP packer, followed by BOP cleaning recovering 130 kg of metal from magnets. The last operation was cutting and pulling 10 ¾" liner, followed by BOP cleaning. Two BOP Cleaning runs were performed with 16 kg and 17 kg of metal recovered. A positive BOP function and pressure test was performed, proving a job well done with Tornar™. After suitable barriers were obtained, operations continued with setting whipstock and milling the window. Two new BOP cleaning runs was preformed after milling, recovering 112 kg in first run and 22 kg in second run.

Result

The Tornar™ BOP Cleaner operation resulted in total a of 542 kg metal recovered from BOP and Riser and positive function and pressure tests of the BOP. Due to the positive result of BOP test, operations continued without pulling the BOP for maintenance, thus saving on rig downtime.

Tornar® Sub

17.45" BOP Magnet

Archer

Case study: Success Story Tornar® Well Isolation Tool

Tornar® Well Isolation Tool's Success in the North Sea

Challenge

Statoil turned to Archer looking for a solution to displace the upper part of the wellbore prior to running the upper completion. The scope of work was to displace the 9 5/8" & 10 3/4" casing, from the 7" PBR and up, from 1,05sg low solids oil based mud (LSOBM) to 1,03sg Packer Fluid on Statoil's Grane well G-2 in the North Sea.

Solution

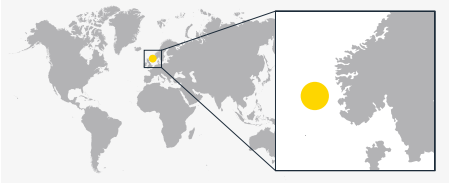
Archer looked at several options, and landed on a combination of existing well proven products. Archer built the Tornar® Well Isolation Tool by using the Tornar® technology, Swivel and Perforate & Wash Tool (PWT) swab cups.

Result

Archer's Tornar® Well Isolation Tool was used for the displacement of the well from 1,05sg LSOBM to 1,03sg Packer Fluid, and it was considered a success.

The well had only small losses of LSOBM before the start of the job. It was statically stable before starting the clean-up/ displacement operation prior to running the top completion.

The Tornar® Well Isolation Tool was run in the hole and entered 2 meters/6ft into the 7" PBR. A no-go was part of the BHA, ensuring correct space-out. While keeping five tons/10Klbs on the PBR, a combination of wellbore cleaning fluids was pumped with 2000LPM/12,6bbls, and was displaced with seawater.



Region: North Sea
Customer: Statoil
Field: Grane G-2
Well type: Production

Case benefits

- Highly effective and rapid well cleaning/ displacement before running top completion
- Effective isolation of lower completion avoiding contamination
- Simple and robust tool design
- Reduced downtime
- Isolation of the lower completion without the use of a mechanical plug in the well
- The cleaning assembly did not have any slips
- The assembly did not rotate inside the PBR

Key capabilities

- Heavy duty swivel, which can sustain 120 RPM for 24 hours
- Swivel will ensure integrity of the swab cups while rotating the Drill String above the BHA
- Easy to configure to fit various well compositions
- High flow rate capacity
- 10 ton set down weight limitation on BHA

Case study: Success Story Tornar® Well Isolation Tool

When the wash train reached the surface, the rates were ramped up to 4500LPM/28,3bbls and 60 RPM. The incorporated swivel has the capacity of 120rpm and as such the RPM can be increased if needed after pumping the wash train, the well was displaced to1,03sg brine.

When pulling out of hole (POOH), no swab or overpull was seen. When BHA was at surface, no visible damage on the tool was seen, and there was only insignificant wear on the swab cups.

Archer

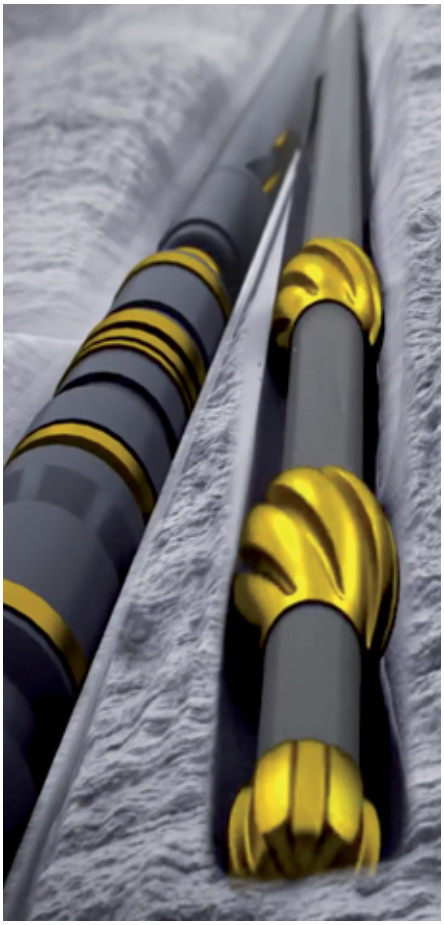

X-it™

X-it™

Reliable sidetracks; first time

Hydraulic & mechanical set single-trip casing exit system

Proven in over 300 successful operations, X-it's unique multiramp whipstock geometry and fourth generation mill provide a step change in sidetrack drilling performance. With X-it technology, sidetracks are delivered efficiently, reliably and with far greater accuracy.



The X-it system is the result of decades of hard-won experience in deploying and delivering sidetrack technology. In refining X-it, our specialists have maintained a clear focus on efficiency, reliability, and accuracy as fundamental requirements of our sidetrack solutions. The X-it system consists of two main components, each with its own combination of unique features and benefits; each working in harmony with the other.

Deployment and anchoring

Once oriented using MWD or Gyro, the X-it whipstock is firmly anchored in place using tri-directional slips, eliminating the risk of rotation and improving exit accuracy. Critically, the fulcrum lug anchor ensures that the top of the whipstock is always held firmly against the casing wall, regardless of orientation or deviation. This improves efficiency because the mill-string will not hang up at the whipstock. And it means that X-it provides full 360 degree exit capability, making it the perfect choice for multilateral drilling and low side exits.

Milling and exiting

The X-it whipstock features a unique 3-step ramp profile leading to the whipstock face. The precision geometry of the carbide coated ramps and the X-it mill work together to maintain a progressive cutting force against the casing wall. This consistently improves mill efficiency; delivers a clean exit window; and ensures low dog-leg severity through the exit.

The fourth generation mill combines high-performance geometry and cutting technology to complement the whipstock design. Custom-blended Predator and Sharkstooth inserts are Quicktip welded to spiral cutting blades, maximising strength and penetration rates. The integral pilot bit adds cutting force during casing exit but its main advantage is drilling formation. The pilot bit ensures a straight and true course off the whipstock face, eliminating the need for directional compensation and reducing dog-leg severity at a critical point in the new well. Overall, X-it delivers a smooth transition through and beyond the exit point to help streamline completion of the new wellbore.

X-it™ Single Trip Whipstock System

Unique Multiramp Whipstock; carbide coated ramps

The X-it Single Trip Mill design includes a Pilot mill, Follow mill and a Dress Mill. All three mills providing advanced window milling capabilities.

The X-it Retrievable Anchor is a mechanical weight set slip anchor design for full contact with tri-directional wickers. Anti-rotation and high axial load slip-design. Fulcrum Lug allows for low side exits.

The X-it Hydraulic Anchor is a hydraulic set (Mechanical with hydraulic actuation cylinder) Slip anchor design for full contact with tri-directional wickers. Anit-rotation and high axial load slip-design. Fully retrievable.

The Retrievable Packer Anchor. Pressure containment to 7.500 psi. Fully retrievable with adjustable shear values.

Benefits
- Single-trip reliable, effective and efficient sidetracks
- Pilot bit precision delivers accurate, straight sidetrack with reduced dog-leg and tortuosity
- 360 degree and low side exits improve target accuracy and reduce drilling time
- Positive anchoring in high deviation eliminates hang-up risk on whipstock
- Confidence in system due to 300+ wells track record

Features
- Fully retrievable; single-trip system
- Unique multiramp whipstock; carbide coated ramps
- Unique geometry combination mill; integrated pilot mill
- Quicktip applied Predator and Sharkstooth inserts improve strength and penetration
- Tri-directional anchor slips provide positive anchoring
- Fulcrum lug anchor forces whipstock against casing in all deviations
- 360 degree exit including low side
- Dual string and horizontal well exit capability
- Two-piece whipstock
- Multiple anchor mechanisms

Applications
- Sidetracks
- Multilaterals
- Controlled casing exit

Hydraulic set options
- Hydraulic set retrievable anchor
- Low side exit capabilities
- Hydraulic set retrievable packers
- Hydraulic set permanent packers
- SSV valve for MWD orientation
- Fluid reservoir

The X-it Whistock incorporates two field proven methods for retrieval - the X-it retrieval die collar and retrieval hook.

Archer

Other Oiltools Products

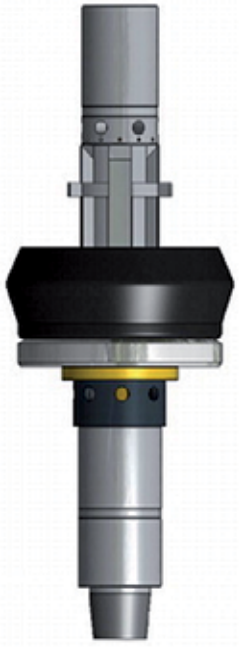
Multi Test Tool

Multi-purpose
Saves operational time for well operations

The Multi Test Tool allows operators to combine several well operations in just one run.

By running the Multi Test Tool combined with a Mill/Bit and Clean Out / Drift Assemblies following operations can be achieved:

- Pressure test casing
- Tag and dress a cement plug
- Scrape and drift a wellbore for future operations, eg. setting a whipstock



Benefits
– Can be executed from Archer's Integrated Operation (IO) center
– Cost efficient multi-purpose solution
– Can be combined with cement plug dressing and tagging
– Drifting and scraping to prepare for setting Whipstock
– Reduces Personnel on Board (POB) and provides 24-hour coverage of operations
– Saves additional runs for tagging and dressing cement plugs, and for drifting and scraping casing

Features
– Swab cups for all common casing sizes
– Integrated pressure relief system (PRS)
– High pressure ratings
– Flexible solutions
– Allows higher tripping speed
– High pressure ratings depending on swab cup size and specifications

Solutions
– Casing liner lap pressure testing
– Dressing and tagging cement plugs
– Drift and scrape casing for whipstock or packers
– Available in all common casing sizes. Used as an alternative to equipment with high costs.
– Enables operators to tag and dress cement plugs in one run
– Saves additional runs for scraping and drifting casing.

Archer

Remote Controlled Cement Head

Safe and efficient well cementing

Designed to the highest standards of safety, consistency and reliability, Archer's Remote Controlled Cement Head (RCCH) allows the controlled release of setting balls and drillpipe darts without the need to stop circulation or rotation, or break connections.

Controlled entirely from the rig floor using rig air, the RCCH has the flexibility to operate safely and effectively with both drilling/cementing kelly and top drive systems. Casing cementing, expandable screen deployment, perforating and squeezing, and cement injection operations are completed without the need for manriding above drill floor.

The RCCH is pre-loaded with the drillpipe dart(s) or setting ball(s) and can be stored in the derrick. No redress is required between operations. Utilizing hydraulically controlled valve actuators, the RCCH is able to drop balls and/or drillpipe darts while circulating and/or rotating, saving valuable rig time. Upon completion of the operation, controlled flushing eliminates all cement residues.

The smooth outside diameter eliminates externally mounted manifolds and valves while the unique activating sequence prevents incorrect opening. No welding on the head ensures that components will not fail due to metal fatigue or incomplete weld penetration.

The RCCH has a 1500 klbs load capacity and delivers 50 kft/lbs of torque, exceeding the capacity of most drill pipe and casing connections, whilst its maximum operating pressure of 10 k psi meets the demands of longer, deeper completions.

Remote Controlled Cement Head

Specifications

Tool size		2 Valve	3 Valve
Nominal OD, in [mm]		13 [330]	13 [330]
Minimal OD, in [mm]		4 [102]	4 [102]
OAL, in [mm]		98.74 [2508]	130.61 [3,317]
Rated torque, ft lbs [N.m]		50,000 [67,791]	50,000 [67,791]
Max. Hook load, lbs [kg]		1,594,000 [723,026]	1,594,000 [723,026]
Max. Hook load at rated torque, lbs [kg]		1,496,000 [678,574]	1,496,000 [678,574]
Working pressure, psi [bar]		10,000 [689]	10,000 [689]
Test pressure, psi [bar]		15,000 [1,034]	15,000 [1034]
Chamber sizes, in [mm]		15 [381] 25 [635]	15 [381] 24 [610] 25 [635]
Make-up torque, ft lbs [N.m]	Upper connection	50,000 [67,791]	50,000 [67,791]
	Lower connection	50,000 [67,791]	50,000 [67,791]

Applications
- Casing and liner cementing
- Expandable screen deployment
- Perforating and squeezing cement
- Cement injection

Features
- 10 kpsi maximum operating pressure
- 1500 klbs load capacity and 50 kft/lbs torque
- Large 4 in internal diameter

Benefits
- Fully compatible with drilling/cementing kelly and top drive systems
- No man riding
- Controlled flushing eliminates any cement residues in all areas
- Multiple operations can be completed without the need for redress
- High pump rate during washing and clean-up
- No externally mounted valves and manifolds
- Large plug holder I.D. minimizes plug wadding
- Can be stored safely in the derrick

Archer

Wireless Controlled Cement Head

Safe and efficient well cementing

Designed to the highest standards of safety, consistency and reliability, Archer's Wireless Controlled Cement Head (WCCH) allows the controlled release of setting balls and drillpipe darts without the need to stop circulation, rotation, or break connections.

Controlled entirely from the rig floor, the WCCH has been specifically designed for use with top drive cementing systems. The WCCH can be shipped pressurized or de-pressurized either with breathing air or nitrogen according to customer requirements. Casing cementing, expandable screen deployment, perforating and squeezing, and cement injection operations are completed without the need for manriding above drill floor.

The WCCH is pre-loaded with the drillpipe dart(s) or setting ball(s) and can be stored in the derrick. No redress is required between operations. Utilizing hydraulically controlled valve actuators, the WCCH is able to drop balls and/or drillpipe darts while circulating and/or rotating, saving valuable rig time. Upon completion of the operation, controlled flushing eliminates all cement residues.

The smooth outside diameter eliminates externally mounted manifolds and valves while the unique activating sequence prevents incorrect opening. No welding on the head ensures that components will not fail due to metal fatigue or incomplete weld penetration.

The WCCH has a 1500 klbs load capacity and delivers 50 kft/lbs of torque, exceeding the capacity of most drill pipe and casing connections, whilst its maximum operating pressure of 10 k psi meets the demands of longer, deeper completions.

Supplied with offshore support kit including

- Three-phase 16A/400 V compressor for refill of breathing air; or an air-driven Nitrogen booster for refill of nitrogen.
- High pressure quick connector with gauge and bleed of valve
- 24 V charger for internal battery pack
- Remote control unit with 4.8 V charger
- Equipment for reloading of darts

Remote control includes indicators for

- Tank pressure
- Working pressure
- Battery status cement unit
- Battery status handheld unit
- Radio link
- Valve status

Wireless controlled cement head

Specifications

Tool system		2 Valve	3 Valve
Nominal OD, in [mm]		13 [330]	13 [330]
Minimal OD, in [mm]		4 [102]	4 [102]
OAL, in [mm]		98.74 [2508]	130.61 [3,317]
Rated torque, ft lbs [N.m]		50,000 [67,791]	50,000 [67,791]
Max. Hook load, lbs [kg]		1,594,000 [723,026]	1,594,000 [723,026]
Max. Hook load at rated torque, lbs [kg]		1,496,000 [678,574]	1,496,000 [678,574]
Working pressure, psi [bar]		10,000 [689]	10,000 [689]
Test pressure, psi [bar]		15,000 [1,034]	15,000 [1034]
Chamber sizes, in [mm]		15 [381] 25 [635]	15 [381] 24 [610] 25 [635]
Make-up torque, ft lbs [N.m]	Upper connection	50,000 [67,791]	50,000 [67,791]
	Lower connection	50,000 [67,791]	50,000 [67,791]

Technical Specifications

Operating temperature, ºC [ºF]	20 - 50 [68 – 122]
Radio frequency, Mhz	434,375 – 434,400
Digital communication distance, m [ft]	50 [164]
Battery type	24 V NiCD / 4.8 V NiMH
Battery standby time	3 weeks
Actuator drive medium	Breathing air or nitrogen
Medium vessels	3 x 2.9 ltr 300 bars composite
Complete cycles on one gas filling	10 (3 valve and flag)

Applications
- Casing and liner cementing
- Expandable screen deployment
- Perforating and squeezing cement
- Cement injection

Features
- Wireless control through digital radio communication
- Injection control ⟨Ex⟩ flameproof certified
- Remote control ⟨Ex⟩ intrinsically safe certified
- Self-contained compressed non-flammable gas power source
- No separate cement hose connected to the head
- No tugger lines to arrest rotation of the head
- No control umbilical to the head
- 10 kpsi maximum operating pressure
- 1500 klbs load capacity and 50 kft/lbs torque
- Large 4 in internal diameter

Benefits
- No personnel in the red zone
- No man riding
- Controlled flushing eliminates any cement residues in all areas
- Multiple operations can be completed without the need for redress
- High pump rate during washing and clean-up
- No externally mounted valves and manifolds
- Large plug holder I.D. minimizes plug wadding
- Can be stored safely in the derrick

Archer

Greenlight™

Consistently accurate integrity testing

Digital pressure testing system

Regular pressure testing of well barriers is a vital contributor to well integrity and safety. Greenlight employs digital technology in a compact user-friendly platform to consistently approve or reject pressure tests against predetermined test criteria — objectively and accurately.

Benefits
- Improved integrity management
- Accurate and precise testing; unambiguous results
- Eliminates interpretation and subjectivity
- Easy to configure, install and operate
- Provides auditable proof of compliance

Applications
- Pressure testing of wells, well systems and well components
- Integrity verification of pressure bearing components or barriers

Features
- High precision ATEX-approved, EEx certified pressure transducer;
- 20 kpsi working pressure; 5-year calibration interval
- Autoclave 9/16 medium pressure connection; HART digital signal
- Ex certified communications module; USB interface
- Software configurable pressure test criteria
- Automatic acceptance or rejection of test criteria

The integrity of a well relies on the collective integrity of a large number of components and sub-systems. Regular and accurate pressure testing is a critical industry requirement that helps to ensure the integrity and safety of barriers and wells.

Traditional testing methods utilize equipment that can be cumbersome to install and operate, but crucially may rely on devices such as rotating chart recorders. First patented in the late 19th century, chart recorders have several drawbacks—the recording range is restricted by the fixed diameter of the paper chart, but more importantly, resolution and sensitivity restrictions limit the precision and effective accuracy of displayed results. The need to visually interpret the chart compounds this issue—bringing an element of subjectivity in determining if the test criteria have been fully met. This can result in uncertainty and the risk of undetected failures.

In contrast, Greenlight seamlessly integrates modern technology in a portable platform to provide a much improved alternative to conventional pressure testing systems. Greenlight combines three main elements—an EEx certified high-precision pressure sensor; a compact Ex certified communications module; and in-house developed PC-based algorithms and user interface. In designing Greenlight, our engineers focused on four key areas—accuracy, precision, flexibility, and ease of use.

Greenlight™

Accuracy and precision

Given the criticality of confirming the integrity of well components, accuracy and precision are fundamental requirements of any pressure certification system. With Greenlight, accuracy and precision are assured. Firstly, signals from the calibrated pressure sensor are transmitted digitally to the communication module using Highway Addressable Remote Transducer (HART) technology. This ensures signals are transmitted to the monitoring station without error and without interference from noise. Then pressure information is automatically analyzed and compared to predetermined test criteria in the digital domain. And finally the results are displayed with digital precision using detailed graphics. The elimination of visual interpretation removes any subjectivity and provides an accurate, unambiguous test result.

EEx certified pressure sensor with digital link to Ex certified communications panel

Flexibility

Greenlight's pressure sensor is EEx certified so pressure testing can be performed on in-situ barriers and in close proximity to wellheads or other EEx-restricted zones. And its 20,000 psi (1,379 bar) working pressure means it can accommodate a wide range of pressure test envelopes. The Ex certified communications module is small and light, and provides the interface between the sensor and PC-based monitoring platform. The sensor connection utilizes the HART digital communications protocol which enables the module to be placed remotely from the sensor without loss of signal integrity, thereby contributing further to ease of installation.

High-precision EEx certified pressure sensor

Ease of use

Setting up Greenlight is made easy by its intuitive user interface. The monitoring software can be configured to cater for a variety of acceptance criteria, and will automatically flag a successful or failed test. This means that test criteria can be performed over extended periods without continuous human interaction. As soon as the test begins, the system displays a dashboard consisting of test parameters, a real-time pressure graph, and the status of acceptance criteria. As soon as the test is complete, Greenlight outputs the test results, which can be annotated, and an historical record of previous tests is updated.

Compared to conventional pressure testing systems, the combined advantages of Greenlight provide a step-change improvement to well integrity management procedures.

Test results arer displayed with digital precision using detailed graphics, including clear and objective Pass or Fail status

Archer

Contact

North America

GOM and US Land
Archer Oiltools
5510 Clara Rd
Houston, TX 77041
United States
Phone: +1 281 301 2600
Email: AOTSalesUS@archerwell.com

Canada
Archer Oiltools
67-69 Bremigen's Blvd
Paradise, Newfoundland
Email: AOTSalesCanada@archerwell.com

South America

Brazil
Archer Oiltools
Av. Republica do Chile
N230-23° andar
Rio de Janeiro-RJ
CEP:20031-170, Brazil
Email: AOTSalesSA@archerwell.com

Mexico
Archer Oiltools
Email: AOTSalesMexico@archerwell.com

Asia Pacific

Phone:
+60 321668800

Email:
Australia: AOTsalesAustralia@archerwell.com
Malaysia: AOTsalesMalaysia@archerwell.com
Indonesia: AOTsalesIndonesia@archerwell.com

Europe & West Africa

Norway and Continental Europe
Archer Oiltools AS
PO Box 8037
4068 Stavanger
Norway
Phone: +47 5130 8800
Email: AOTSalesNorway@archerwell.com

UK & Azerbaijan
Kenny Bertram
Manager Country
Phone: +44 (0) 1224 767677
Email: kenny.bertram@archerwell.com

Africa
Nordine Benyahia
Phone: +244 943 254 58 / +33 658742730
Email: Nordine.Benyahia@archerwell.com

Middle East

Phone:
+966 55 527 7615 (Saudi Arabia)
+971 52 689 9993 (United Arab Emirates)

Email:
Saudi Arabia: Email: AOTSalesSaudiArabia@archerwell.com
United Arab Emirates (UAE): Email: AOTSalesUAE@archerwell.com

Archer