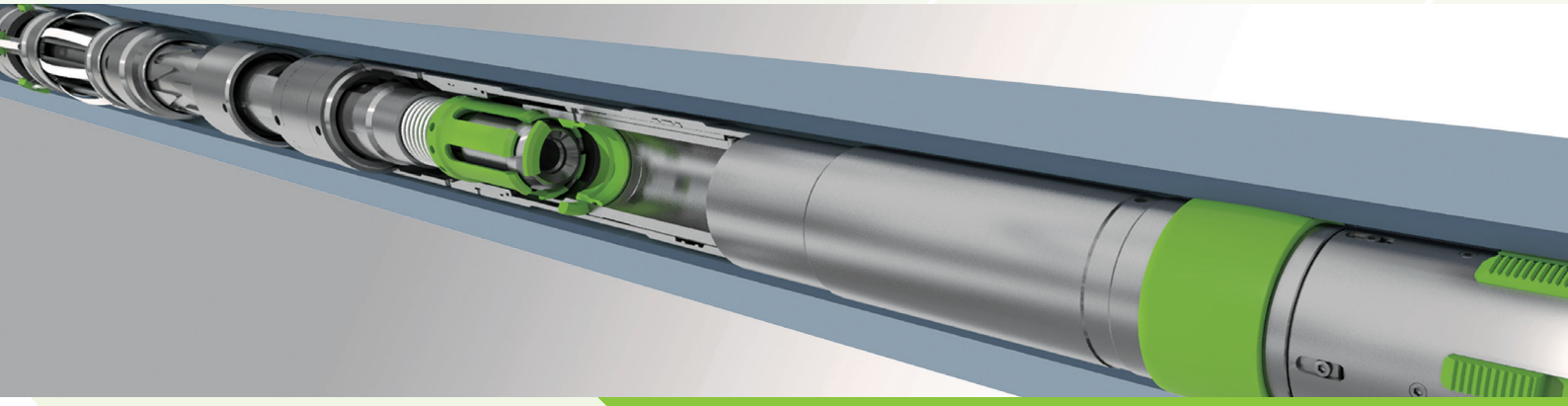
peak WELL SYSTEMS



SIM System for Flow Control

Improving the Performance of Wells through Advanced Downhole Technology

Peak Well Systems, a leading specialist in the design and manufacture of downhole products, brings you the SIM System, a range of superior, nipple-less flow control devices that can be deployed on slickline, covering most industry tubing sizes. First developed in 2005 for a major international oil company, the SIM System range has since been extended significantly and is rapidly becoming a flow control technology of choice by leading operators around the world.

SIM System for Flow Control

The SIM System from Peak Well Systems provides an extensive range of slickline-conveyed and recoverable devices for a broad array of well intervention and production enhancement purposes anywhere within the tubing.

The SIM System enables operators to deploy flow control devices, such as the highly successful SIM Retrievable Bridge Plug, that will deliver ultimate flexibility for well intervention, remediation and well integrity operations as well as helping to improve hydrocarbon production from multiple zone mono-bore completions. Its unique and patented design offers reduced operating costs and removes potential safety hazards inherent with other systems available today.

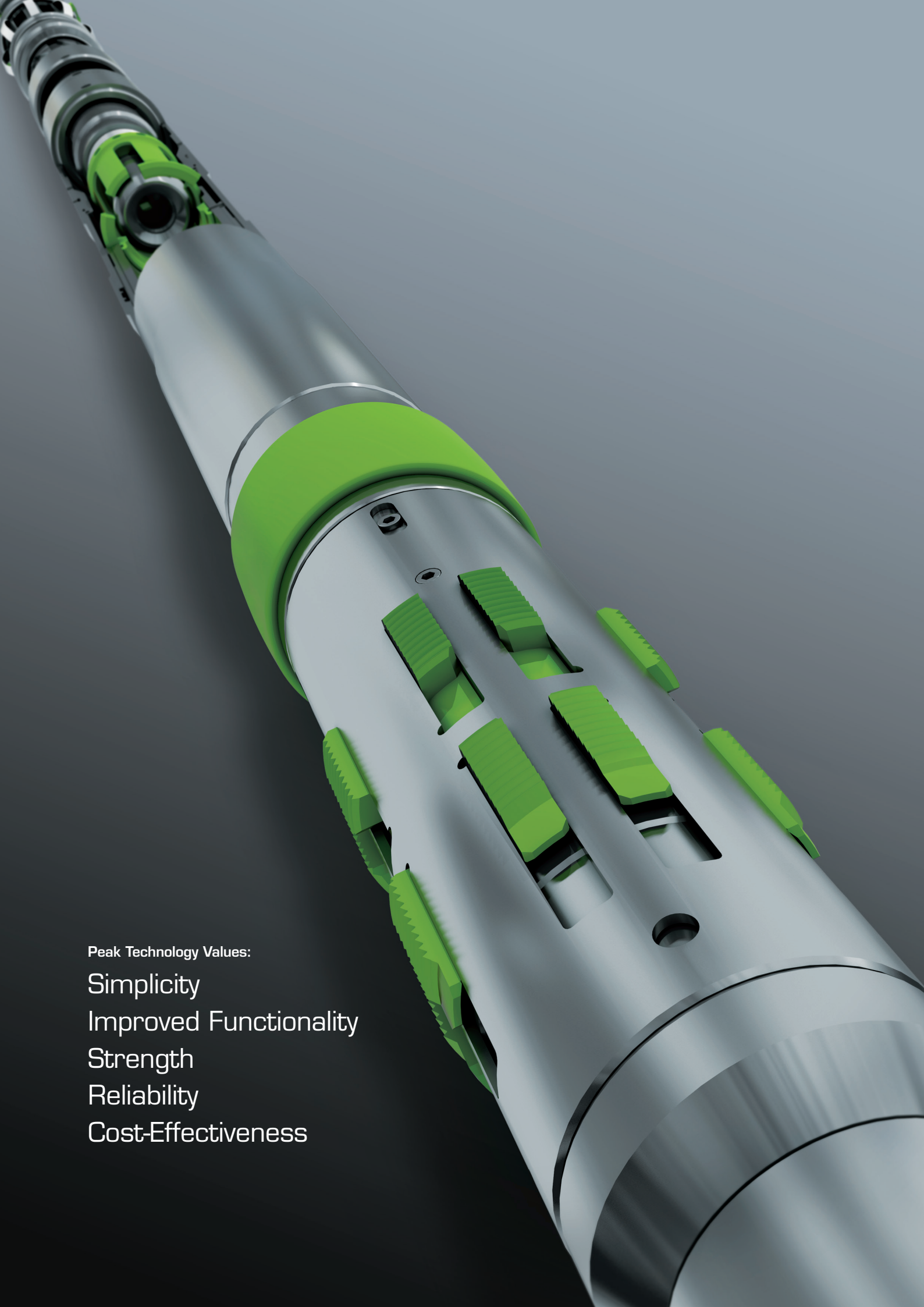
The product range includes a number of interchangeable modular components, all built around the SIM Running Tool as the primary means of deployment:

- Plug Systems – both permanent and retrievable options
- Mechanical Leak Detection Tool
- Gas Lift Straddle
- Straddle
- Interchangeable Choke
- Gauge Hangers
- FloWell™ – for the removal of formation damage

SIM System Range Highlights:

- SIM Plug System is designed to be set anywhere in the tubing string without the need for a nipple profile
- Advanced mechanical setting mechanism eliminates the need for complex setting tools, pyrotechnics, or explosives
- Standard slickline package deployment means easier logistics in remote locations
- Available for slim 2 3/8" wells to large 7" wells

Simple Safe Assured



Peak Technology Values:

Simplicity
Improved Functionality
Strength
Reliability
Cost-Effectiveness

Technology Overview

The implementation of the SIM System has meant nipple-less completions can be easily plugged by slickline operations. This offers operators a safe and cost-effective means of managing their producing zones.

The SIM Plug System comprises of a plug and expandable seal requiring no landing profile which can be set by mechanical toolstring manipulation. The system is facilitated by a slickline-conveyed SIM Running Tool that enables the user to land-off the toolstring at any desired depth within the tubing.

A radial indexing mechanism activates a set of slips to anchor the SIM Running Tool to the tubing wall. The device is then simply set by downward jarring which consequently activates and expands the sealing element. An overpull is applied to confirm that the deployed component has been fully set. Once set in place, the SIM Running Tool is released from the device by upwards jarring.

The user-friendly running and setting method makes the SIM System consistent with core skill sets of slickline personnel around the world, making it an ultra-reliable specialist tool for everyday operations.

Using a similar process, the SIM Running Tool is used to deploy Peak's Gauge Hangers which can carry data acquisition devices or which can be set as anchors to provide a platform for instruments that require suspension in the wellbore.

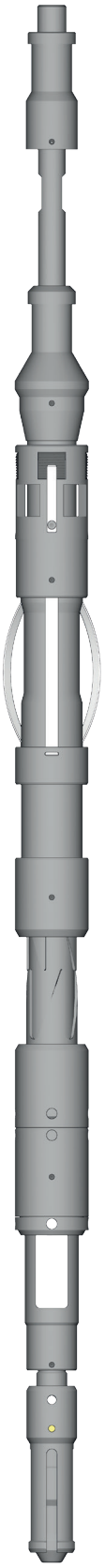
For applications where setting depth is critical, products within the SIM System can be deployed and set on Electric-Line using standard pyrotechnic setting tools.

The user-friendly running and setting method makes the SIM System consistent with core skill sets of slickline personnel around the world, making it an ultra-reliable specialist tool for everyday operations.

SIM System Applications

The SIM System has many different applications in the management and monitoring of producing zones through slickline intervention, and even as a permanent barrier in well abandonments. These are all based on and built up from the basic SIM Plug body:

- The simplest and most basic application is as a Gauge Hanger where no sealing mechanism is required
- When the SIM Plug body is fitted with an elastomeric element, it can be deployed as a barrier able to hold pressure differential from both directions. To ensure safe and reliable recovery, there is a selection of equalising devices to choose from including Melon, Prong or Pump-Open type options
- As a plug or flow through device, it can be used as a suspension mechanism for carrying other flow control tools. These may include sand screens, shut-in tools etc
- The SIM Plug can also be run as a flow through device and, when fitted with an interchangeable choke, may be used to choke back unwanted or excess gas production downhole
- The SIM System can then be run with an upper and lower plug body connected by a stackable SIM Straddle System to provide isolation over the a desired section to be straddled
- The straddle assembly can be fitted with an Integral Gas Lift device to provide downhole gas lift from an isolated gas producing sand or tubing punch
- SIM FloWell uses SIM Plugs to form a sealed zone which is then subjected to a rapid pressure drop, thereby inducing a surge flow through perforation tunnels. This surge within the perforation tunnel is designed to reduce any flow restriction created by crush zone damage and/or reduce 'skin factor' created by fluids during drilling and completion.



SIM Running Tool

SIM Running Tool with SIM Plug

SIM Plug Bomb Hanger

In its simplest form, the SIM Plug body is used as a carrier for downhole tools. In such applications, it may be used as a:

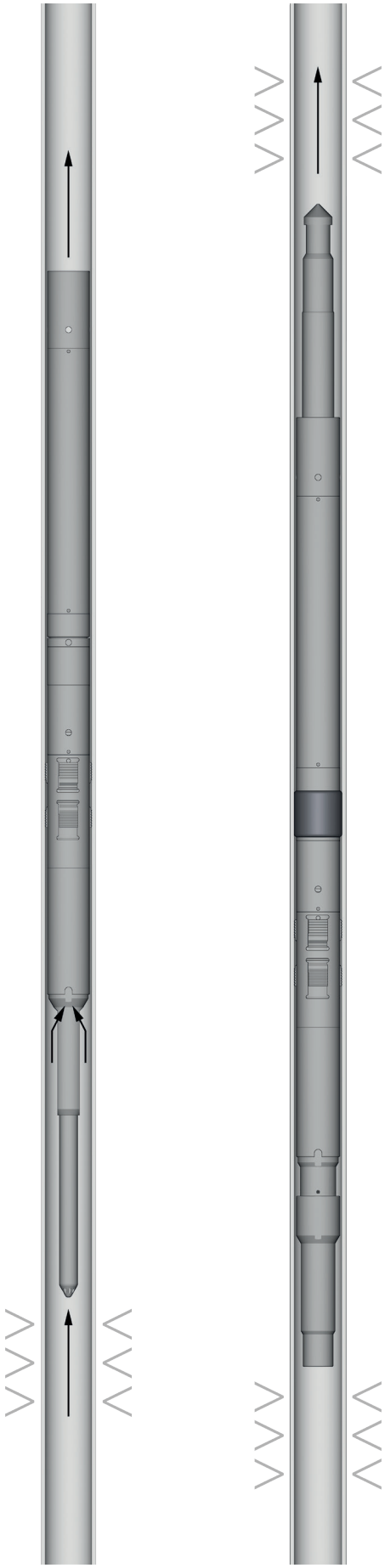
- Bomb Hanger for carrying downhole gauges. The advantage of the SIM Plug in all cases is that it allows the tool being conveyed by the SIM Plug to be placed as close as is desired to the area of interest for pin-point data acquisition

SIM Plug

When the SIM Plug is fitted with an elastomeric element and run with a melon or more commonly prong type equalising assembly, it will then act as a bidirectional plug.

Applications include:

- Collision barrier during drilling operations
- Wellhead isolation
- Zonal isolation for water shut-off
- Zonal isolation to prevent cross flow/co-mingling
- Packer setting and tubing tests during completions/workovers
- Tubing integrity testing
- SIM Plug can be set with a standing valve prior to re-perforating above existing sands. This allows the higher pressure upper zone to produce without cross flow to the 'old' lower zone. When pressure within the upper and lower sands equalises, the lower zone can produce freely without the need to recover the barrier.



SIM Plug Bomb Hanger SIM Plug

SIM Plug Carrier Device

With adapters added to the SIM Plug, the plug can be used as a carrier device:

- With Standing Valve to prevent cross-flow from newly perforated sand to lower depleted sand
- To suspend downhole screens
- To suspend storm chokes/velocity valves
- To deploy shut-in tools to monitor pressure build-up
- To carry any other device that needs to be suspended in tubing where there is no nipple profile or the profile is damaged. Can be set at precise depth within tubing where the tool needs to be positioned.

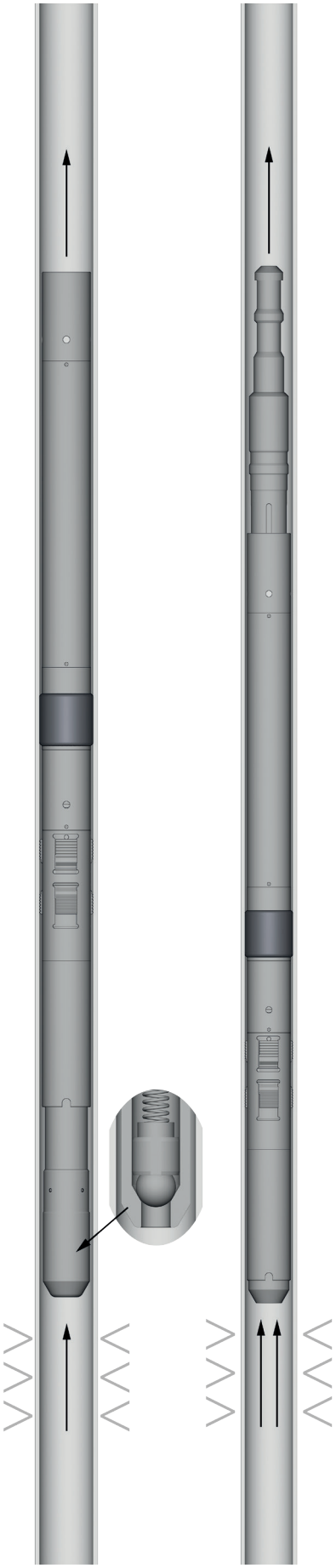
SIM Choke

The SIM Plug System can be fitted with an independently recoverable downhole choke thus allowing the SIM Plug to be used to choke back well fluids as desired. The SIM Plug System has a unique arrangement where the downhole choke can be recovered to surface without recovering the plug body. This means the choke can be recovered and re-sized to meet flow requirements without the added runs required to pull and re-set a plug – reducing further runs/time and also removing plug redress cost.

The SIM Choke can be used to:

- Control oil or gas flow between two or more sands to control cross flow and improve overall reservoir performance
- Control gas flow from a gas reservoir below an existing oil reservoir and thus provide natural gas lift
- Control gas flow from differing reservoirs to give a controlled mix from the well, for example to balance gas dilutions between high and low CO_2 content gases.

The SIM Plug System has been shown to offer several benefits to the operator: it's easy to transport with no heavy lifting equipment required; and improves safety/cost by being able to set the plugs mechanically. The cost can be further reduced by removing the need for specialist personnel and minimising the equipment spread needed on the installation.



SIM Plug Carrier Device SIM Choke

SIM Straddle System

The SIM Plug System can be fitted with straddle tubes between an upper and lower packer to provide isolation across the straddled zone. There is no requirement for a different SIM device – all SIM System applications use the same base SIM Plug components.

The SIM Plug System has a unique selective latch mechanism on each straddle connector to allow the tubes to be recovered one at a time should the straddle need to be retrieved. This can be critical for safety purposes when trying to recover the straddle section back into the lubricator. If the recovered straddle system is longer than expected because more than one straddle tube has been recovered, it may not be possible to function the xmas tree valves, thus creating a safety hazard.

The SIM Straddle System can be used to:

- Isolate water zones
- Isolate unwanted gas flow
- Isolate a hole in tubing
- Isolate a leaking device within the tubing – SPM, SSD etc.

SIM Integral Gas Lift

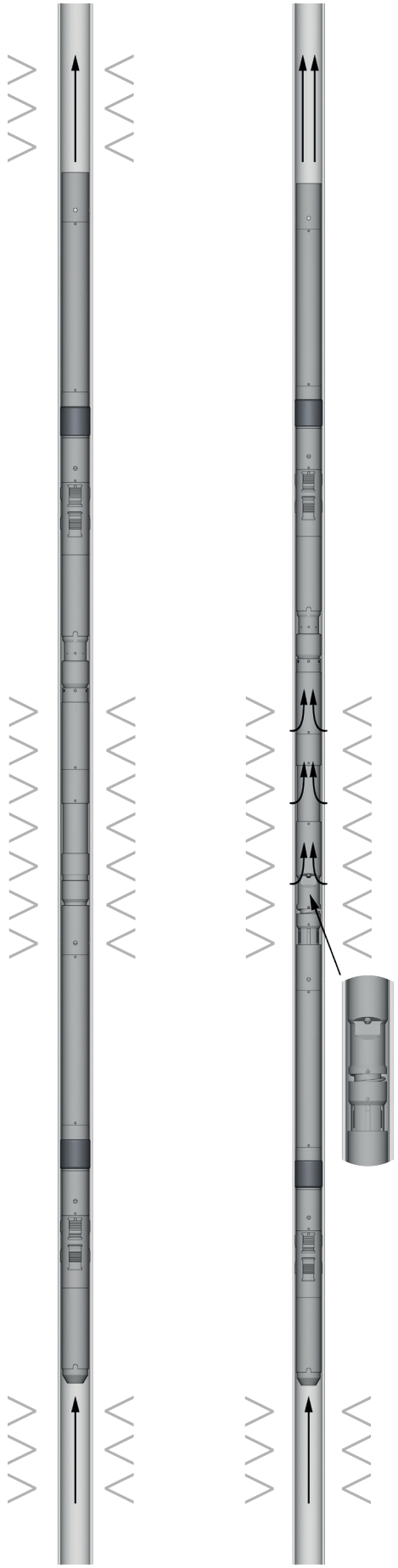
The SIM Integral Gas Lift System incorporates a Gas Lift Choke Sub/ Connector that is run within the straddle system providing controlled gas flow from a gas zone behind the straddled zone. If required, the choke can be resized by recovering the upper straddle tube.

SIM FloWell™

SIM FloWell is a simple and robust tool used to clean existing perforations by providing a rapid pressure drop across the face of the perforation tunnel and therefore inducing a surging flow through the perforation tunnel from the surrounding formation. The surging could also be used in other operations where a rapid negative pressure drop and surging could be of benefit e.g. unplugging ICDs.

SIM FloWell can be used to:

- Surge cased hole completed intervals to improve perforation tunnel productivity
- Surge completed intervals to overcome damage due to crush zone effects ,scale build-up, skin factor created by drilling / completion fluids.filter cake sticking, fines migration etc.
- Surge completed intervals prior to squeeze treatments
- Surge dowhole flow control devices (e.g. sleeves and valves) to free stuck mechanisms.



SIM Straddle System

SIM Integral Gas Lift

Products & Technical Specifications

All SIM System products are modular and, as such, they all have similarities in their design and capabilities:

- 100% mechanical
- Safe – no pyrotechnics or special setting tools required
- Simple to redress
- Robust design
- Interchangeable components resulting in reduced inventory
- Recoverable from wellbore using industry standard SIM Pulling Tool for GS-Type Fishing Neck

SIM Running Tool

Used to convey and selectively set all SIM System components at any chosen depth inside monobore type completions such as SIM Retrievable and Permanent Bridge Plugs, Large Bore Gauge Hanger and Mechanical Leak Detection Tool.

- Collet Fingers – latch into SIM device
- Continuous Radial Indexing Mechanism
- Variable Drag Spring configurations – interface with tubing to allow indexing
- Serrated Slips – bite into the tubing wall

User-friendly designs mean our products are easy to deploy as well as being field redressable

Nominal Tubing Size	Actual OD
2 3/8"	1.810"
2 7/8"	2.200"
3 1/2"	2.720"
4 1/2"	3.600"
5"	4.050"
5 1/2"	4.450"
7"	5.650"

Superior designs, coupled with the latest materials technology, enable Peak products to withstand the harshest environments

SIM Retrievable Bridge Plug

Used to provide a high quality, safe temporary barrier within the wellbore to enable isolation/remediation.

- Multiple setting options – mechanically on slickline, coil tubing or electric line
- Multiple Equalising Assembly options – Melon-type, Prong-type or Pump Open-type
- Debris Catcher Sub option for Sealing Plug version
- HTHP Sealing Element
- Sour Service components to NACE MR0175 specifications
- Maximised 'through bore' to reduce downhole 'choke' effect

Nominal Tubing Size	Tubing Weight	Actual OD	Pressure Rating	Maximum Temp	Length	Minimum ID
2 3/8"	4.6lbs/ft	1.810"	7,500psi	350°F	54"	0.314"
**2 7/8"	6.4lbs/ft	2.220"	7,500psi	See below	54"	0.781"
3 1/2"	9.2-10.2 lbs/ft	2.720"	*5,000psi	350°F	61"	1.259"
4 1/2"	11.6-15.1lbs/ft	3.600"/3.650"	*5,000psi	350°F	59"	2.000"
5"	15-18lbs/ft	4.050"	*5,000psi	350°F	57"	1.969"
5 1/2"	17-20lbs/ft	4.530"	*5,000psi	350°F	61"	2.362"

* Higher pressure ratings available on request
** 2 7/8" Standard Plug is rated 5,000psi @ 350°F or for 7,500psi @ 250°F

Large Bore Gauge Hanger

Used to carry data acquisition devices or as an anchor for instruments or equipment that require suspension in the wellbore.

- Extreme high load capacity – ideal for high flow rate wells or high weight stack-up applications
- Large through bore for increased flow rate
- Compact design making utilisation ideal in height restricted rig-ups
- Lower connection options available to suit customer requirements

Nominal Tubing Size	Tubing Weight	Actual Gauge Hanger OD	Flow Area* (square inches)	GS to recover
2 7/8"	6.4-7.8lbs/ft	2.200"	2.00	2 1/2"
3 1/2"	9.2-10.2lbs/ft	2.700"	3.54	3"
4 1/2"	10.5-15.1lbs/ft	3.600"	6.95	4"
5"	15-20.3lbs/ft	4.050"	7.61	4"
5 1/2"	17-23lbs/ft	4.450"	9.60	5"
7"	23-32lbs/ft	5.650"	15.10	6"

* Flow areas will vary slightly between different tubing weights for the same O.D. tubing

Products with more functionality and interchangeability reduce inventory whilst still improving well performance

Products & Technical Specifications

SIM Leak Detection Tool

Used to create a temporary sealing barrier to enable a surface pressure test to ascertain a potential leak path between the tubing and annulus.

- Can be reset a number of times without the need to pull back to surface
- Multiple setting capability reduces NPT by allowing the leak to be pinpointed quickly, minimising wireline runs
- The integral self-equalising device allows the pressure to equalise across the element before moving into the fully retracted position

Nominal Tubing Size	Tubing Weight	Actual OD	Pressure Rating	Temperature Rating
2 7/8"	6.4-7.8lbs/ft	2.220"	1,500psi	350°F
3 1/2"	9.2-10.2lbs/ft	2.720"	1,500psi	350°F
4 1/2"	10.5-17.1lbs/ft	3.650"	1,500psi	350°F

SIM Permanent Bridge Plug

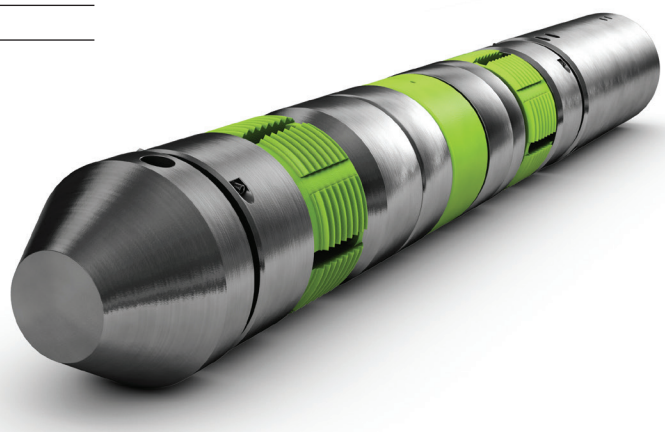
Used as a permanent barrier for permanent zonal isolation, plug and abandonment applications; also zonal isolation for fracture stimulation, acidizing or cementing operations.

- Premium, cast iron construction
- Cost-effective
- Rapid deployment with slickline spread requirement only – no need for Electric-Line package
- Compact design makes utilisation ideal in height restricted rig-ups

Nominal Tubing Size	Tubing Weight	Actual OD	Pressure Rating*	Temperature Rating
2 3/8"	4.6lbs/ft	1.810"	5,000psi	350°F
2 7/8"	6.4lbs/ft	2.200"	5,000psi	350°F
3 1/2"	9.2-10.2lbs/ft	2.720"	5,000psi	350°F
4 1/2"	11.6-15.1lbs/ft	3.600"	5,000psi	350°F

* Higher rating available upon request

Peak products have an unrivalled track record of dependability, even in the most challenging wells



SIM FloWell™

Used to induce a sudden pressure drawdown in a wellbore, and hence cause a surge of fluid inflow from the reservoir. SIM FloWell improves well productivity by removing certain types of formation damage (e.g. crushed zones in perforation tunnels, tenacious filter cakes and scales) from the surrounding formation.

SIM FloWell provides a very simple, safe, low cost and robust way to surge perforations where desired:

- Uses standard slickline tools and procedures to run and convey the tooling into the well
- Safe mechanical design which requires no pyrotechnics, no electronics, no pressure devices to activate the tool
- Can be deployed as a stackable system, allowing either short- or long-zones to be treated by stacking the tools on top of each other above a fixed anchor
- Ideal for remote platforms – long zones can be easily treated with only standard lubricator rig-up height
- In most circumstances, SIM FloWell would be used in conjunction with the SIM Plug System which is used to form a seal at the top and bottom of the zone to be treated, for maximum effectiveness.

Peak products consistently deliver the best long-term returns for customers

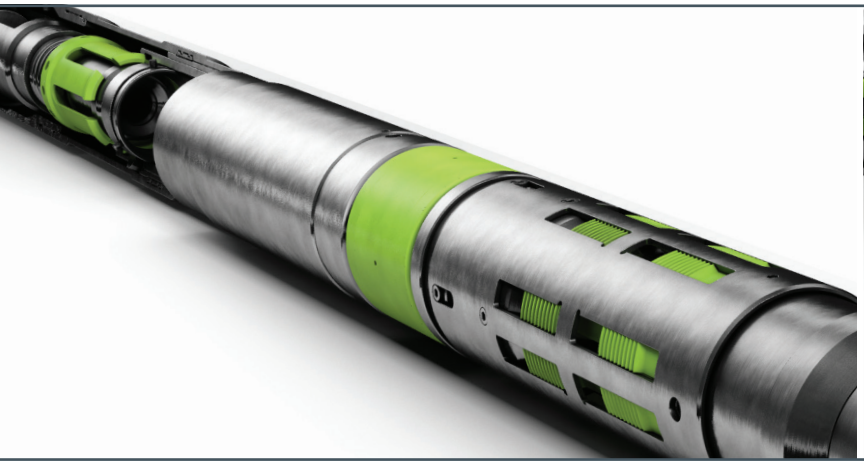
As part of the SIM System range, Peak Well Systems also designs and manufactures a number of tools regularly deployed as part of the downhole assembly. These are available in different sizes to suit the SIM System being deployed. Details on these products are not covered within this brochure; however they are available separately on request.

Success to Date

Since it was first developed in 2005, Peak Well Systems has successfully run the SIM System in varied applications, in different locations, over 1500 times. Its success has been proven in wide-ranging well conditions:

- Highly deviated wells (72°)
- Depths in excess of 14,000ft
- High concentrations of CO_2 (> 60%)
- High debris environments
- Differential pressures up to 7,500psi at 250°F or 5,000psi at 350° F

SIM System : Case Study 1



Independent Oil Company, North West Shelf, Australia

Well type:

4 ½" Oil Producer (57° deviation, 220°F)

Deployment:

4 ½" SIM Retrievable Bridge Plug and SIM Running Tool

The Challenge:

During plug and kill operations prior to a well workover, contingency steps were taken after several attempts to set a deep set plug failed. It was decided by the Customer that a slickline-set, nipple-less type plug was required to provide the critical well barrier. It was suspected that the nipple profiles had been damaged by sand production and wire tracking from multiple slickline runs through the nipple profiles.

Considerations:

The following key requirements and concerns were highlighted by the Customer:

- Debris expected after well kill and circulation
- High pick-up weights expected
- Small setting window – adequate depth control required
- Preference to utilise the onsite slickline crew
- E-Line setting option required as a back-up to slickline if excessive pick-up weights were encountered

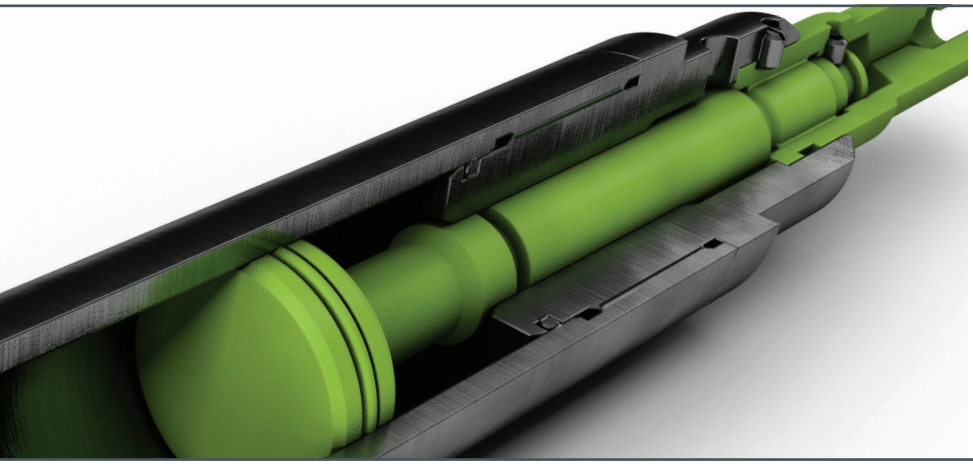
Summary:

- SIM Retrievable Bridge Plug drift simulation carried out
- Correlated against nipple profile and set 4 ½" SIM RBP and Prong
- SIM Retrievable Bridge Plug successfully tested and remained in the well for approximately seven days
- Bailing operations performed – significant amount of debris recovered
- SIM Retrievable Bridge Plug recovered on first attempt using SIM Pulling Tool

Value to Customer:

- Contingency option 1 successful
- All operations performed safely and efficiently
- SIM Plug successfully retrieved in high-debris environment
- The customer mitigated the potential risks and expense of the operation by opting for a 100% mechanical solution
- Short-term rental option preferred by the Customer avoiding further unnecessary expenditure
- Workover operations progressed and were completed successfully

SIM System : Case Study 2



National Oil Company, Offshore Malaysia

Well Type:

5 ½" Oil Producer (74° deviation, 250-330°F)

Deployment:

5 ½" Large Bore Gauge Hanger and SIM Running Tool

The Challenge:

A programmed platform shutdown was scheduled, providing an ideal opportunity to conduct valuable data acquisition operations. Six wells across the field were strategically selected for pressure transient analysis.

Considerations:

The campaign offered some difficult working conditions; logistically and operationally. The following key requirements and concerns were highlighted by the Customer:

- Pinpoint data acquisition
- Flow through capability
- Restricted rig-up height
- Heightened safety concerns with use of explosives and nitrogen
- Temperature limits on two of the six wells
- POB capacity

Summary:

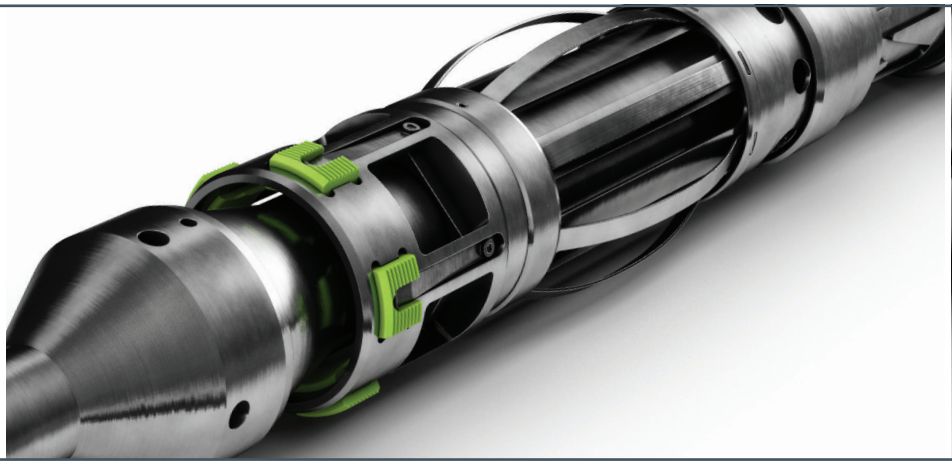
- Six 5 ½" Large Bore Gauge Hangers set on slickline at varying depths
- Three gauges were connected to each Gauge Hanger
- All Gauge Hangers successfully set for approx. four weeks duration
- All Gauge Hangers successfully recovered on standard GS
- All data recovered from gauges

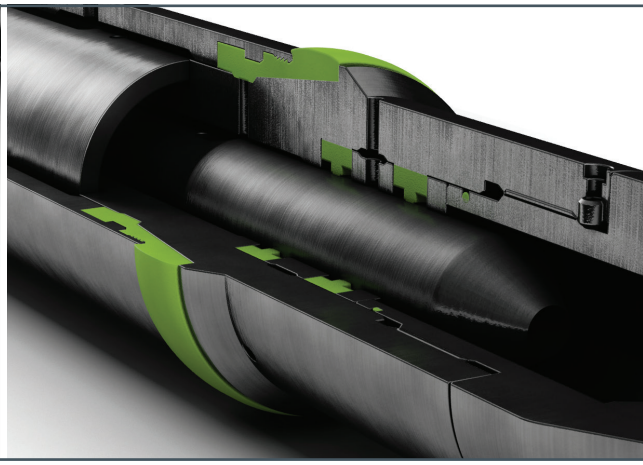
Value to Customer:

- Valuable data recovered for pressure transient analysis
- Zero NPT
- Zero harm to personnel
- Significant cost savings

Peak's SIM Plug System does not require a positive profile to trip or set and utilises any point on the tubing wall to index

SIM System : Case Study 3





Major International Oil Company, Offshore West Africa

Well type:

Various 4 ½" Oil Producers (52-69° deviation, 180-280°F)

Deployment:

4 ½" SIM Retrievable Bridge Plug and SIM Running Tool

The Challenge:

When accessing high value subsea wells with the latest generation deepwater semi, the Customer required a contingency option for tubing test and packer setting during the completion phase of a multiple well development. The Customer chose Peak's SIM Retrievable Bridge Plug as a contingency mechanical barrier to be employed if the nipple profile within the completion was unusable, to avoid costly and unnecessary additional rig costs.

Considerations:

The following key conditions and requirements were highlighted by the Customer:

- The SIM Plug would only be deployed if the traditional lock was unable to be set and therefore operational success of the SIM Plug was vital
- The SIM Plug must be able to pass and be cleanly recovered through 3.688" ID after set
- E-Line setting option required as a secondary setting option

Summary:

The Customer experienced major difficulties attempting to access the nipple profile within the completion when attempting to set a locking device for a dedicated profile. Given these difficulties in passing the upper nipple to selectively set in the lower profile, the decision was made to use the SIM Retrievable Bridge Plug.

Peak's SIM Plug System does not require a positive profile to trip or set and utilises any point on the tubing wall to index. The slick nature of the SIM Retrievable Bridge Plug allows it to easily pass through the troublesome upper nipple with ease.

- SIM Retrievable Bridge Plug passed the nipple profile, set and tested successfully on the first attempt
- Upon successful testing of the completion and surface equipment, the SIM Retrievable Bridge Plug was recovered on the first attempt using the SIM Pulling Tool

Value to Customer:

- Significant rig costs were avoided by being able to use the SIM Retrievable Bridge Plug
- The SIM Plug System was successfully deployed mechanically on slickline
- All operations performed safely and efficiently
- The SIM Plug System is now the primary well barrier option and the plug of choice for this Customer

The Customer experienced issues with the same nipple (in different wells) during subsequent well installations so the SIM Retrievable Bridge Plug was utilised and performed faultlessly. Due to the problems encountered on the initial wells and the immediate success of the SIM System, all following completion programmes were changed. As a direct result of its reliability and performance, the Customer chose the SIM Retrievable Bridge Plug as the primary deployment option and, furthermore, will be deployed in horizontal well sections with a Tractor/Stroker tool.

Rental Option

If, for any reason, you don't wish to purchase equipment, there are many reasons to consider renting our SIM System technologies: immediate mobilisation, reduced CAPEX, increased flexibility, and the option of either short or long-term rental packages.

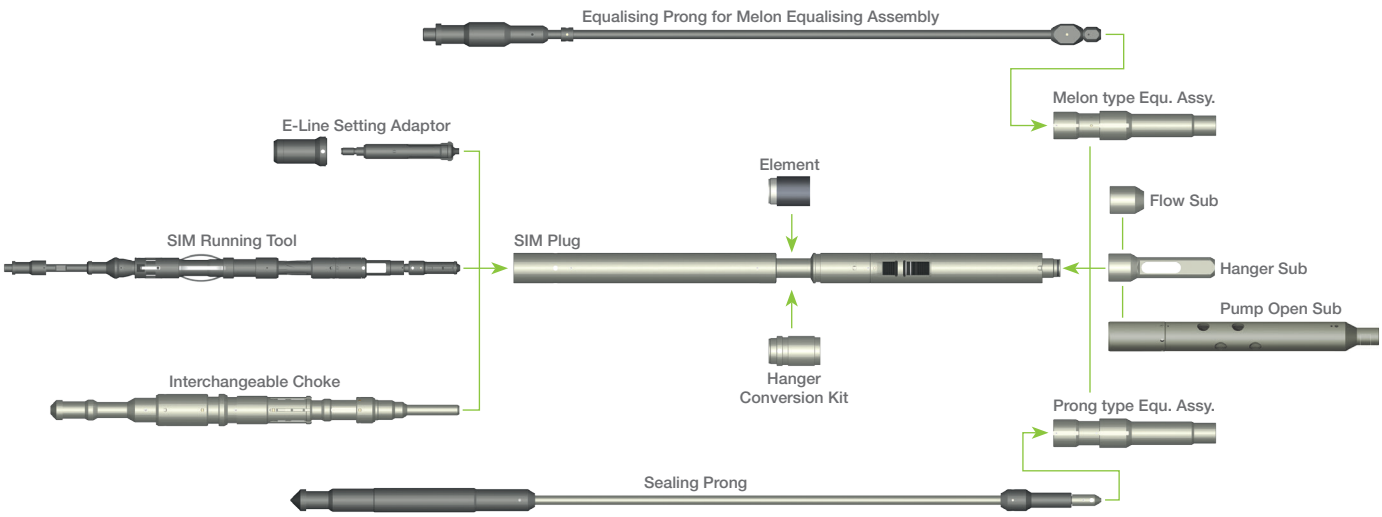
At Peak Well Systems, we manufacture and maintain a large inventory of both standard and specialist tooling, including SIM Systems, Fishing Tools & Toolstrings for rental. We have rental tools available for a wide range of tubing sizes, and for all connection types, including those compatible with industry quick connections.

Our rentals are supplied with technical data manuals, full certification documentation and redress kits to ensure that our equipment is easily deployed and maintained. Should our customers require support on site, Peak also has a team of specialist operational personnel who can work alongside your crew.

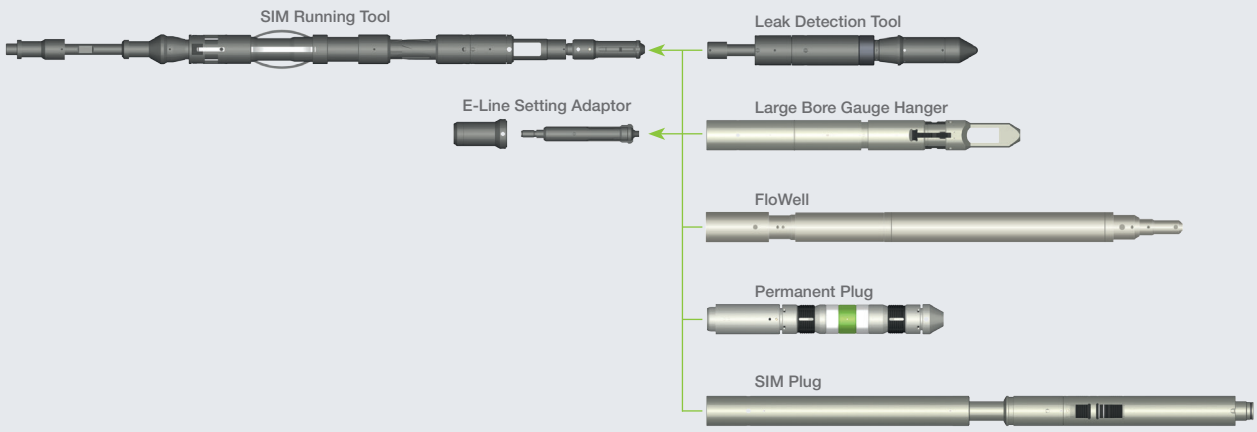
For all your rental enquiries, please contact us at **info@peakwellsystems.com**

We have rental tools available for a wide range of tubing sizes, and for all connection types, including those compatible with industry quick connections

SIM System:
Interchangeable Modular Components



SIM System Variants



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peak WELL SYSTEMS

info@peakwellsystems.com | www.peakwellsystems.com

MANAGEMENT SYSTEM CERTIFICATION
ISO 9001 = ISO 14001 = OHSAS 18001
DNV

Perth, Australia