Octopoda™ Annulus Intervention

Extending the production cycle of your well stock and reducing the risks of well barrier envelope breach to ALARP.

From **diagnosis** of annulus integrity issues to delivery of the remediation **solution** and **securing** of the well, Expro can extend the production cycle of your well stock and reduce the risks of well barrier envelope breach to ALARP.

Integrity issues in the annulus are a growing concern, and affect an estimated 30% of wells globally - negatively impacting our environment and industry.

Operators and Duty Holders are continually seeking effective methods to manage annulus integrity issues, extend the production cycle of existing well stock and reducing plug and abandonment (P&A) costs.

To answer these challenges Expro has developed Octopoda™, a system that can access the annulus where others cannot. It is the go-to solution for the targeted remediation of annulus integrity issues.

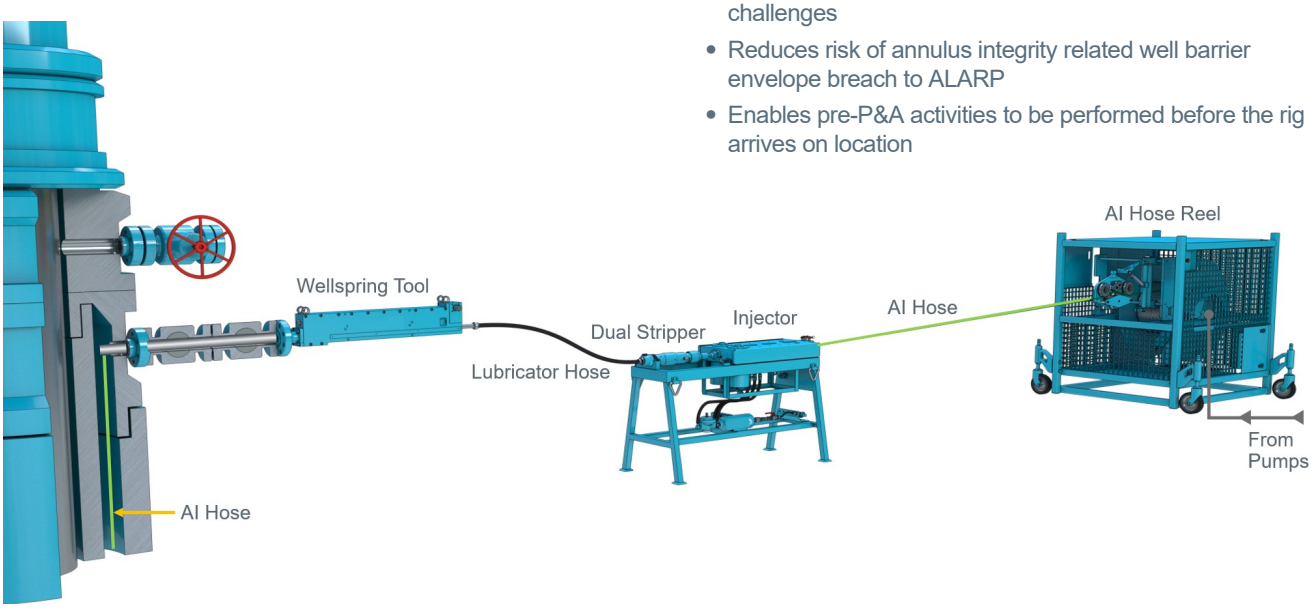
Octopoda™ is more than just a product; it's a strategic investment in the continued safe and reliable production of your well stock, delivering integrity, efficiency and sustainability

Key applications

- Diagnosis of annulus integrity issues
- SCP reduction and remediation through the restoration of kill weight fluid in the annulus
- Extending the production cycle of the well by swapping out degraded or corrosive fluids from the annulus
- Annulus fluid conditioning prior to the placement of resin barriers
- Rigless preparation for P&A by performing kill weight fluid swaps and setting environmental barriers in the B and C annuli

Features and benefits

- Brings shut-in and choked back wells back into optimal production
- Operationally efficient alternative to lengthy "Lube and Bleed" operations and expensive heavy duty wellwork
- Extends the production lifecycle of the well by implementing an engineered solution to well specific challenges
- Reduces risk of annulus integrity related well barrier envelope breach to ALARP
- Enables pre-P&A activities to be performed before the rig arrives on location



Diagnose | Solve | Secure

Octopoda™ Annulus Intervention

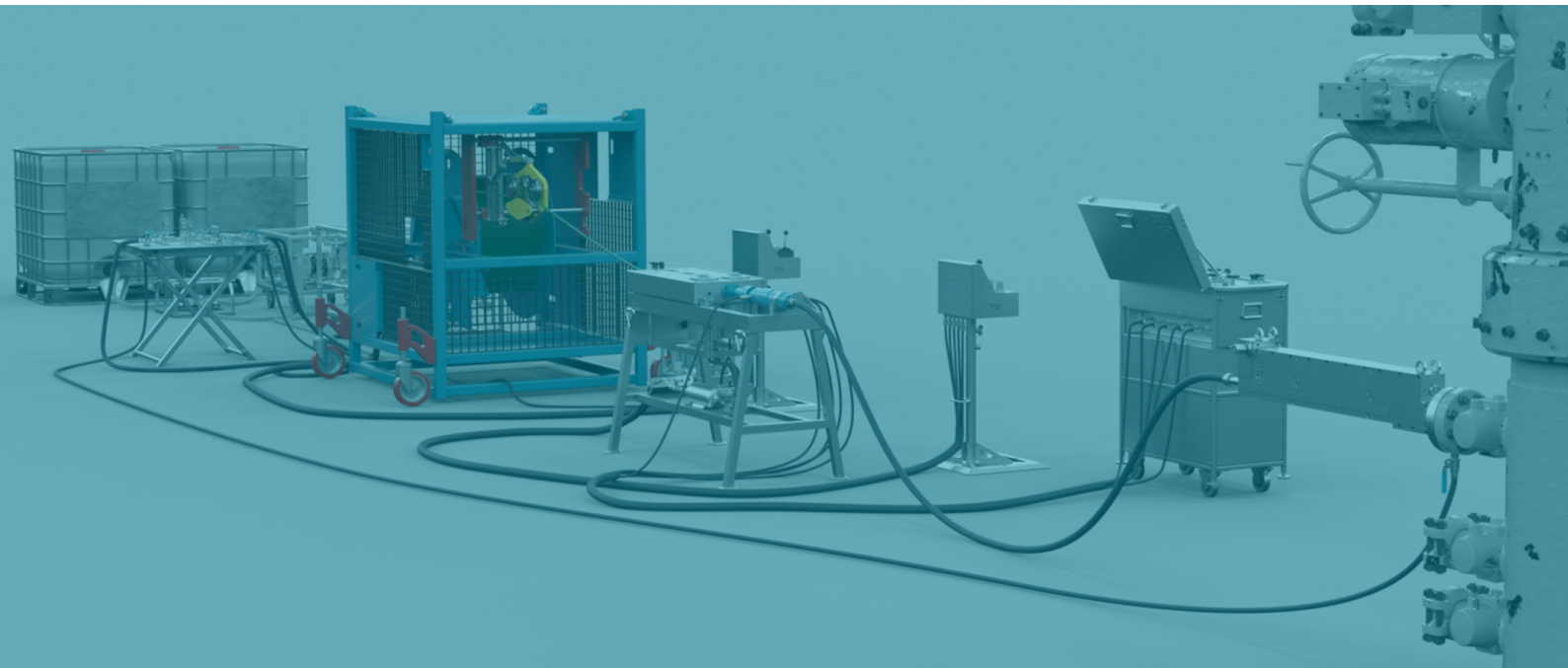
Main system

Specifications

Description	Footprint (W x D x H)	Weight	Max. Working Pressure	Operating temperature range
Reeler	1510 x 1300 x 1620 mm	1750 kg (inc water filled hose)	10,000 psi / 690 bar	1°C to 40°C
Reeler Control Panel	447 x 447 x 1012 mm	24 kg	90 psi (air)	-5°C to 40°C
Stripper & Injector Table	1380 x 640 x 820 mm	40 kg	N/A	-10°C to 40°C
Injector (mounted on frame)	890 x 390 x 390 mm	63 kg	90 psi (air)	-10°C to 50°C
Stripper (mounted on frame)	88.9 OD x 677 mm long	18.2 kg	5,000 psi / 345 bar	-18°C to 100°C
Stripper Control Panel	405 x 745 x 955 mm	88 kg	90 psi (air)	0°C to 50°C
Injector Control Panel	447 x 447 x 1012 mm	23 kg	90 psi (air)	-5°C to 40°C
WellSpring Tool (including front adaptor)	1000-1400 mm length	46-56 kg	2900 psi / 200 bar	-29°C to 121°C
Main Pumps	1040 x 560 x 720 mm	167 kg	5500 psi / 379 bar	-20°C to 60°C
Pump Manifold Table	828 x 825 x 918 mm	40 kg	10,000 psi / 690 bar	4°C to 50°C
Test Pump	340 x 290 x 390 mm	15 kg	10,000 psi / 690 bar	-40°C to 50°C

Specifications

	11.5 mm OD WellSpring Hose	6.9 mm OD WellSpring Hose
Outer diameter	11.5 mm	6.9 mm
Inner diameter	6.3 mm	3.4 mm
Collapse pressure	3,263 psi / 225 bar	5,438 psi / 375 bar
Working pressure	8,700 psi / 600 bar	10,000 psi / 690 bar
Temperature rating	-30°C to 100°C	-30°C to 100°C
Weight	0.175 kg/m	0.072 kg/m
Pressure support	2 layers of high tensile steel wire	2 layers of high tensile steel wire



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Frequently asked questions

What are the advantages of an Octopoda™ Annulus Intervention over the Lube-and-Bleed methodology?

An Annulus Intervention offers several advantages over Lube-and-Bleed, these include:

- Operational efficiency: Requires less kill fluid and doesn't rely on formation injectability
- Reduces risk: Avoids high-pressure cycling, and reduces exacerbation of existing micro-annulus issues
- Faster: Completes in the operation in 7-28 days compared to several months to a year for Lube-and-Bleed.

How does the Annulus Intervention system work?

The Annulus Intervention system works by restoring a kill weight fluid or placing a resin barrier within the annulus by:

- Deploying a flexible hose into the annulus via the Annulus Gate Valves and Wellhead.
- Creation of a circulating system within the annulus, using the AI Hose and Fluid Pumping Package to displace the in-situ annulus fluids.
- Return of displaced fluids via the passive side of the Wellhead or a port on the Annulus Intervention side

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What fluids can you pump and what do you recommend for annulus remediation?

If the SCP can be removed or reduced to acceptable limits by using a fluid swap this would be the recommended solution. The fluids that we can pump are:

- Solids-free Brines - preferred for most cases, composition tailored to well conditions. Solids free brines are the preferred fluids due to their low rheology, long term stability, wide density range, logistical ease and the ability to continue to monitor annulus pressure after treatment
- Polymer resins - used when the required kill weight to overbalance the SCP is close to or exceeds MAWOP/MAASP, or insufficient annular space is available to place a kill weight fluid. It should be noted that Resin does not seal the leak itself and does not eliminate the source of the SCP but instead isolates it from surface.

What is the pumping rate of the system?

In-well pump rates are typically in the order of 2 - 8 litres/minute. The achievable pump rate for a solids free brine fluid swap is a function of annulus contents to be displaced, AI Hose size and AI Hose depth. A trade-off between AI Hose depth vs pump rate is often exercised to optimize fluid swap efficiency, kill fluid volume and job timings. For example, when the annulus content is oil-based an immiscible gravity displacement occurs, 100% swap efficiency should be achieved with a AI Hose depth of ~50m, therefore, running the AI Hose to a deeper depth only serves to reduce pumping rates and increase job timings

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What are the factors that determine the depth that the AI Hose can be run into the well?

Well features such as casing collars/clamps, gelled mud, cement stringers and drilling solids can all result in a hold-up depth and inability to pass. On the bottom of the AI Hose there is a coiled spring assembly, this provides weight and flexibility the hose to aid navigation past obstruction. Hose size has an impact on achieved depth, with the larger 11.5mm providing more rigidity and higher flow rates allowing the hose to achieve greater annulus depths. In some instances, the target depth may not be achievable and fluid swap must be performed from a shallower depth.

What depth does the AI Hose need to reach in order to circulate out the entire contents of the annulus?

The Annulus Intervention system does not circulate the well contents “bottoms up” in the traditional sense. Instead, it relies on gravity displacement and diffusive mixing from the depth of injection. This technique enables the in-situ annulus contents to be swapped with a higher density fluid with the AI Hose positioned part way into the annulus.
A fundamental principle of the Octopoda™ system is that a higher-density fluid is injected via the AI Hose relative to the density of the in-situ annulus fluid. The higher-density fluid gravitates to the annulus TD, with returns being taken simultaneously at surface, this process continues until the lower density in-situ annulus fluid are fully displaced.