



JRGEnergy

Geothermal Well Services: Wellhead Change



Packer Wellhead Change Overview

The following presentation provides an overview of wellhead change out and repair services offered to Geothermal Production Companies. All procedures and examples demonstrate significant cost savings and operational advantages to the client for geothermal wellhead replacement or repair.

Background - JRG Energy



- **Joint Resource Geothermal** (JRG Energy) is an established group of personalized engineers, consultants, and technicians servicing the Upstream and Downstream Geothermal Industry.
- JRG Energy has assisted in the development of a Geothermal packer to be used in all types and sizes of casing. The hydraulic setting function has been modified to be used on either drill pipe, coil tubing or capillary tubing and can be retrieved on a conventional wireline set-up or any of the former methods.
- To provide an efficient and cost effective turn-key solution to wellhead changes, JRG Energy will partner with local well services companies to provide this packer solution to its' clients. Companies are chosen based on their ability in providing experienced personnel and quality equipment for wireline and well services to the geothermal industry.



Wellhead Change Proposal Summary

The service as described in the technical proposal document is a full wellhead change service package.

The general turn-key service includes:

- Pre-job well evaluation and setup
- Well gauging and scale removal (broaching) if necessary
- Setting of the packer
- Removal and service of the existing wellhead equipment
- Installation of new wellhead equipment
- Retrieval of the packer and welding or NDT services if necessary.

As each well will be unique, a separate pre-job plan for each well will be provided before each new well operation with any additional costs or risks highlighted.



Applications

- Wellhead Changes/Repairs
- Well Abandonments
- Zone Isolation

Features

- 340 bar max differential pressure ratings
- 150 degC Temperature ratings
- 4.5” to 12.75” casing range (Can be customized to suit casing ID)
- Double check valve for reliable operation and safety
- Can be set in surface casing, intermediate casing or slotted liners
- Can be set on Capillary, Coil Tubing, Drill Pipe and retrieved on Wireline/Slickline
- Shear pin equalization system to prevent premature deflation and recovery problems (anti-blowout system).



Benefits

- **No Quench** required (for most applications)
- **Efficient** process (Can be set and retrieved in same day)
- Much **less costs** compared to other options
- Much **safer** alternative than current geothermal wellhead change out system. **Less HSE risks.**
- **Reliable** operation using proven technology from the oil and gas industry (100% success rate guaranteed)
- Flexible Service – can be **combined** with other services such as broaching, gauge rings or PTS surveys
- Less set-up and prep work required for operation resulting in **less downtime** for wells



Wireline Packer Overview Cont..



Size and Dimensions				
Outer Diameter	2.75 in 70 mm	3.5 in 89 mm	4.5 in 114 mm	5.5 in* 140 mm
Inner Diameter	1.68 in 42.6 mm	1.77 in 45 mm	2.48 in 63 mm	2.60 in 66 mm
Overall Length	93.5 in 2375 mm	93.5 in 2375 mm	95.12 in 2416 mm	95.12 in 2416 mm
Sealing Element Length	63.0 in 1600 mm	63.0 in 1600 mm	63.0 in 1600 mm	63.0 in 1600 mm
Max Seal ID	6.9 in 175 mm	8.66 in 220 mm	11.0 in 280 mm	12.6 in 320 mm

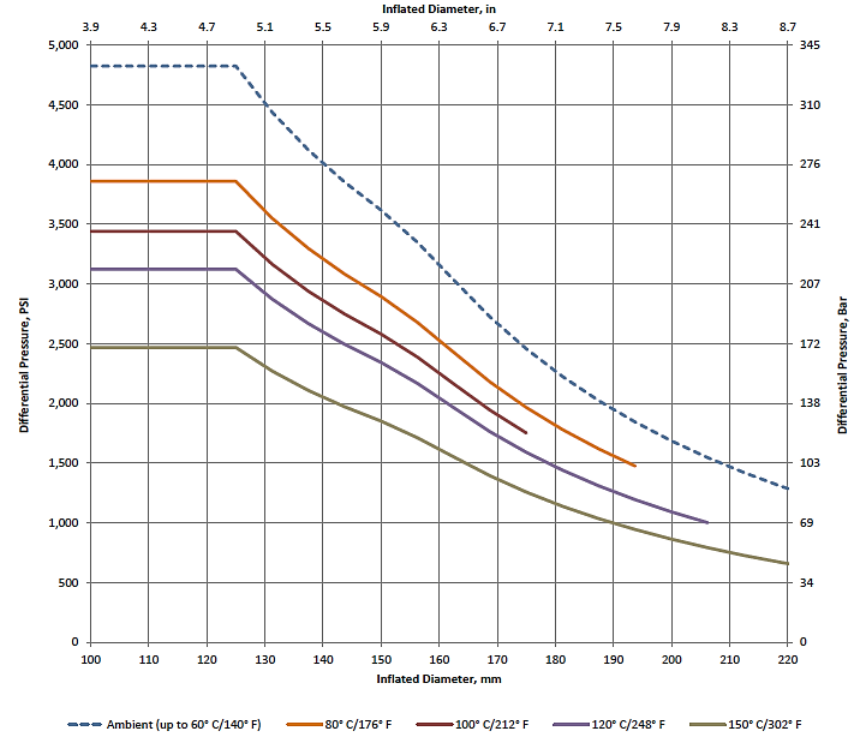
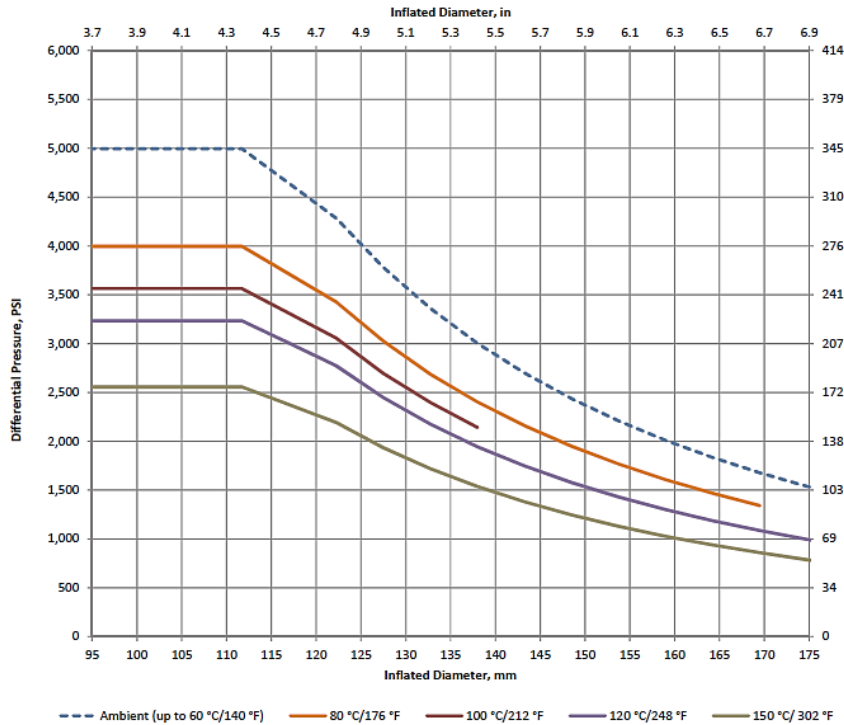
* Larger sizes available

Wireline Packer Overview Cont..



Packer Element O.D.	70mm	2.75"
Effective Rubber Length	1600mm	5.25ft
Rubber Type	HNBR	
SKU#	007066	
Cover Finish Type	STANDARD	

Packer Element O.D.	89mm	3.5"
Effective Rubber Length	1600mm	5.25ft
Rubber Type	HNBR	
SKU#	007067	
Cover Finish Type	STANDARD	



* Larger sizes pressure differential charts available

Wellhead Change Overview

- **Pre-Job Works:** Shut in well before start date. Well needs to be fully shut in (not on bleed). Scaffolding and permits secured.
- **Step 1:** Rig-Up slickline unit on site and perform gauge rings/dummy plug if necessary. This isn't necessary if performed ahead of time.
- **Step 2:** Run plug with capillary and set at 10 mCHF. Positive pressure test plug using air compressor. Inflow test by opening well to atmosphere to bleed down pressure. Close and monitor for set duration to ensure WHP is holding.
- **Step 3:** Remove wellhead/repair CHF and replace with new/refurbished wellhead. Perform NDT tests or weld integrity tests as required by Client.
- **Step 4:** Run in with wireline, latch fishneck and equalise through packer using shear down equalising assembly, monitor WHP. Pull plug by using shear deflation mechanism and return to recovery spool for rig down.

NOTE: This shows a very basic wellhead change only. The application from start to finish can be performed in a number of different ways based on the service required.

Wellhead Change Procedure: Packer

Tool Installation

Stage 1: Packer Initiation

1. By pumping fluid down the capillary line, the packer is activated under packer pressure of 2000psi.
2. Once packer element pressure is reached, a pressure test of well is performed, both positive and inflow tests.

Stage 2: Packer Setting

1. Head de-latches by adding pressure from capillary and taking overpull to shear pins and unlatch.
2. Packer can now stay in well for up to 3 months.*

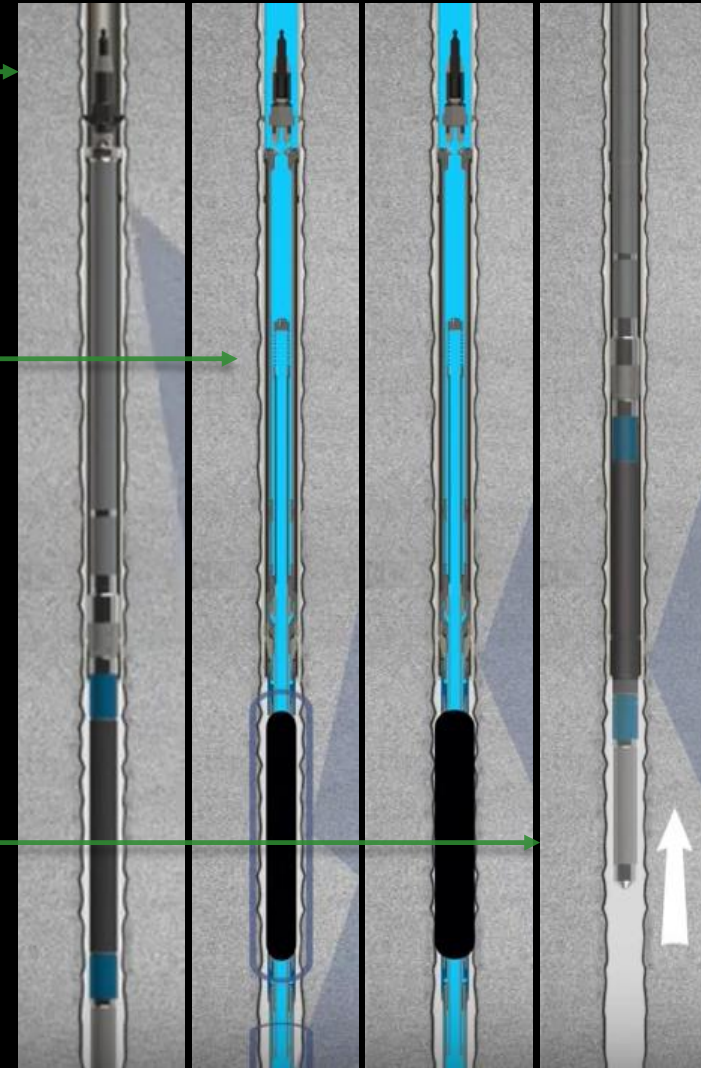
Tool Deflation

Stage 3: Latch and Equalise

1. RIH and latch on fishneck with conventional slickline set-up. Jar down on Ezy Latch spearhead to equalise pressure above and below packer

Stage 4: Deflate and Pull

1. Once pressure is equalised above and below packer element, activate shear pins using upward jarring or overpull.
2. Packer deflates slowly and brought back to surface inside recovery spool (PCE).



Wireline Unit

A self-contained wireline unit or slickline unit containing Slickline and shallow Capillary tubing functions will be needed for the pre-job wireline tasks (as required), as well as the setting and retrieval of the packer.

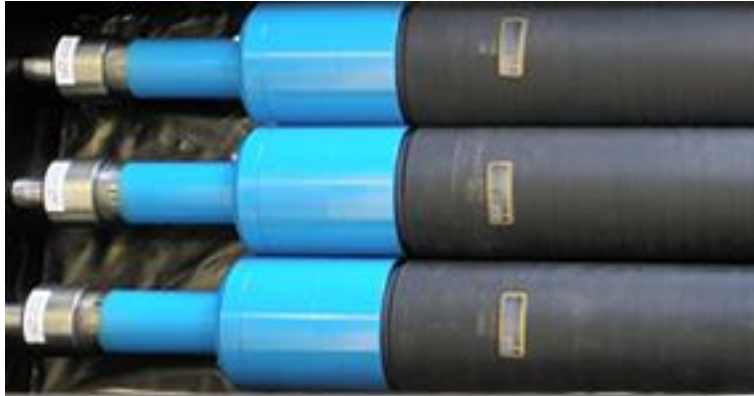
The unit must be capable of multi-service work and have the ability to perform Slickline, Capillary, and wireline services for various operations.

The unit will be chosen based on available local contractors and the clients recommendations are strongly encouraged.



Packer Equipment

Packers



Packer Inflation Pump



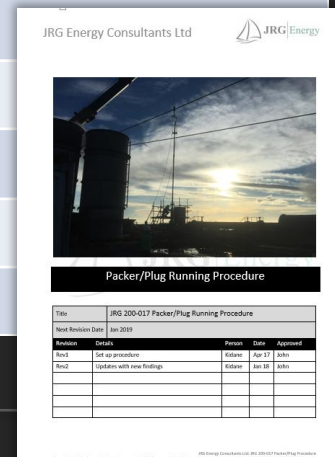
Packer Pulling tools for Slickline



Equipment/task Responsibilities

DESCRIPTION	RESPONSIBILITY
Complete set of Packer tools	JRG
Wireline Unit with PCE	Well Services Company
JHAs, SOPs and all other HSE documentations and site plan.	JRG
Generator	Well Services Company
Air compressor and rattle gun	Well Services Company
Scaffolding or EWP	Well Services Company
3/8" Capillary Tubing	Well Services Company
Consumables (Bolts and gaskets sets)	Client
Welding service	Well Services Company
NDT inspection	Client
New wellhead/surface equipment supply	Client
Water supply and water pump*	Client
Crane	Well Services Company

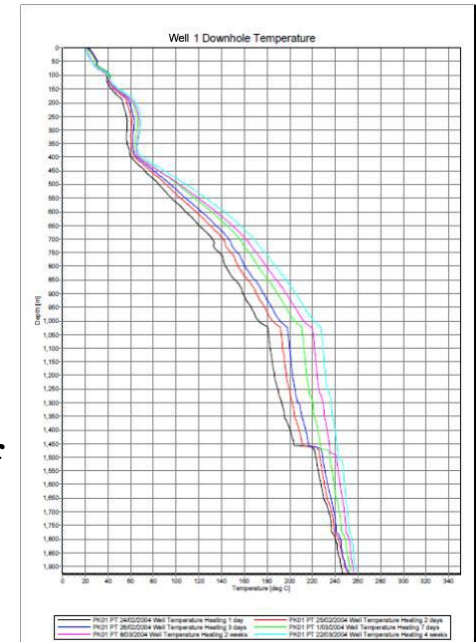
* If needed for pressure test or ancillary services



Equipment/task Responsibilities

Based on the standard service, the following items are the responsibility of the client before the packer service commences:

1. A gauge ring run, calliper or camera needs to be performed within 6 months of the operation unless well is unused.
2. Shut PT data needs to be provided within 6 months of performing operation.
3. Scaffolding or EWP and any pad/roadworks.
4. New wellhead or plan for refurbishment (if necessary)
5. A PTW holder/supervisor from the client to be onsite for all the wellhead change operations.





Pricing Considerations

Based on the current work scope, the following financial matters should be considered:

- JRG will team up with a local slickline company that meets specifications, experience, quality control and HSE standards.
- Option to offer full turn-key or separate services
- Bulk rate discounts apply
- Easily combined or adapted to other services such as well cleanouts, scale removal or well testing services.



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