Tubeless Inflatable Packers
Howard Kenworthy – Commercial Director

www.Inflatable-Packers.com
www.IPIPackers.com
All shapes, sizes and applications

Only inflatables for open or cased hole
No swellables or mechanicals

<table>
<thead>
<tr>
<th>Type</th>
<th>Applications</th>
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</thead>
<tbody>
<tr>
<td>Casing Packers</td>
<td>Zonal Isolation, Cementing</td>
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<tr>
<td>Plugs</td>
<td>Plug and Abandon, Water Shut Off, Temporary Barrier, Cement (etc) Retainer</td>
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<tr>
<td>Straddles and other</td>
<td>Well and casing testing, Acid frac / Mini Frac</td>
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<tr>
<td>Other</td>
<td>Pump Anchors (ALS)</td>
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<tr>
<td>Custom Made / Replacement</td>
<td>Usually an OEM component</td>
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See this video and other IPI content at

https://www.youtube.com/watch?v=Mip_po1OsAk

Full deflation took 3 min 45 seconds
Benefits – “The most robust packer on the market”?

Slat Element Construction. Single set, up to 8,000 psi, 3x expansion, limited recovery

IPI Tubeless Construction
Controlled Failure Mechanism Test after 150 cycles above 10,000 psi. Up to 3x expansion, full recovery.

Cable/Wire Weave Element Construction. 5,000 psi / 2x max expansion, limited cycles with memory
Benefits of “Tubeless” Format

• Contrawound wire reinforcement layers
• Does not require an “Inner Tube”
• Main advantage is “full recovery”:
  • All elements tested before shipping
  • Custom sizing for through tubing operations
  • “Permanent plugs” in milled casing can be recovered
  • Running with tighter annular clearance, higher pressures (e.g. 10,000 psi, rather than 5,000 psi)
  • Last longer - more multi set cycles
• Manufacturing procedures enable rapid build / new designs
• Some Caveats
  • 95%
  • Temp>100>130>150C, better with larger diameter
“The most robust packer on the market”?

9” PIBP within 30” conductor at 1,000psi
Versatile

‘Tear-Drop’ Shaped Packers:
Aquifer storage recovery annular injection packer designed to control annular flow velocity around the packer by adjusting element expansion.

Inward Inflatable Packers:
Diverter insert utilized as replacement safety equipment for an offshore drilling rig applications.

Isolation in oval conditions
DuraGRIP  Metal to Metal Option

- DuraGRIP give bi-directional grip without compromising the packer
- A 23” OD Anchor Packer used to recover (“fish”) 30” conductor offshore Norway Dec 2016. Proof pull test of 165T
- Supplied to one of several oilfield decommissioning clients that use IPI technology, globally
- Conventional oilfield elements give one way grip by stripping off a section of the top cover to expose metal reinforcing, compromising the packer
Pushing the Performance Envelope – Hydraulic Fracturing example

Packer Technology Overview – example > IPI’s DuraFRAC elements:
• 33mm to 89mm OD systems for mining production, safety and formation characterisation
• Original High Pressure Straddle Packers up to 40MPa (6,000psi)
• Increased to 69MPa (10,000psi) as a standard
• 2018 burst test of 89mm (3.5”) at 100mm (3.94”) at >20,000psi
• Tests to 130degC up to 9,000psi testing conducted for projects in Europe
Manufacturing Facilities

• Proprietary packer performance modelling, SolidWorks and Sky Trust software for HSE
• In house machine shop with modern, off line programmed OKUMA CNC’s and large manual lathes
• Custom made Packer Elastomer Winding Machines, on site autoclave with monitoring
• Elastomer, pressure, hydraulic ram and temperature testing facilities
• Inventory held in Perth and Montana
IPI Perth Facilities
Many nationalities and professions. Apprentices to MBA’s & PhD’s
Inflatable Packers International “IPI”

A privately owned Western Australian designer and manufacturer of (only) inflatable packers and associated equipment. Main operations are located in Perth, Western Australia with inventory in Montana, USA.

IPI provides solutions for the oil & gas, mining, geotechnical and water resources industries.

IPI Inflatable Packers are made differently to conventional oilfield inflatable packers.

The company commenced as a custom made solution builder in 1999 and went on to develop its own unique products for the mining and geotech industries, where it is market leader.

It now offers a range of industry standard oilfield inflatable products together with a range of unique products for oilfield, plus an OEM and custom made capability for oilfield.
The 1980’s – pre IPI

• 1984 AGE Developments established and develops inflatable packers for water well applications
• 1986 Dave Knell joins as first apprentice – now IPI Operations Director
• 1987 Clem Rowe joins as Engineering Director
  • Significantly develops the core packer technology
  • Develops large testing packers for Woodside
  • Develops mining permeability testing packers

Dave Knell at 16
The 1990’s – developing “geotechnical”
Replacing oilfield packer technology

- 1993 – Worlds Largest Inflatables Packers designed by Clem and built by a team led by Dave
- Swiss geotechnical experts switch to Australian packers for rock stress testing – previously using oilfield inflatables
- Projects include Alpine Tunnels and nuclear waste site investigation
- CSIRO develops hydraulic fracturing for hard rock mining with Clem improving the inflatable packer rating to 6,000 psi
- 1999 – IPI founded by Clem under agreement/license with AGE – design and sell for the international market outside Australia.
The 2000’s – Mainly about Mining

• 2001 – Raises investment and establishes in house manufacturing
• 2005 – IPI commences marketing product lines from previous successful custom products – 4 lines most successful:
  • Mining
    • Wireline permeability testing tools (Diverse - Global)
    • Mining hydraulic fracturing tools (Mainly Chile)
  • Coal Bed Methane (Mining Technology)
    • Permeability testing tools (Mainly India and Indonesia)
  • Shallow Offshore Oil & Gas (Malaysia)
    • Control line set casing packers as used on the NW Shelf
• 2008 – Bulgarian office, establish Montana, Santiago and Singapore
• 2009 - Commence supply into QLD CSG (CBM)
El Teniente Mine – Codelco (Chilean state copper co)

- Worlds Largest Underground Copper Mine, est 1819.
- >3,000km underground roadways
- >140,000 tons copper ore per day
- Primary Production method – block caving enabled by **hydraulic fracturing** (“preconditioning”)
- Minimizes use of explosives
- 3.5” straddle packers in 3.75” open hole
- Up to 10,000 psi, clean water
- (Burst @ 20,000 psi @ 4”)
- Auto inflation valve
- Frac Radius typically 70ft
- Frac Interval usually 80” (can be 30”)
- IPI client (primary supplier) since 2007
- Same process now for rock burst mitigation (seismic events) to enable a new deep level of development
ST Range of Testing Tools

Applications:
- MiniFrac, Coalbed methane DST, IFO and DFIT testing for formation evaluation inc Caprock integrity analysis
- Casing and casing patch leak-off testing
- Acid stimulation
- 2.4”, 3.5” and 4.5” tools with a wider range of packer OD options working to 5,000 or 10,000 psi on tubing or CT

Features:
- Innovative design eliminates squeeze pressure during packer inflation – improves shut-in pressure accuracy
- Low-pressure-loss tool chassis. Very Modular!
- Ability to circulate while in the shut-in stage enables air/nitrogen induced hydrostatic head reduction for DST applications
- Backup pull-release emergency deflation mechanism available
- Available upgrades for real-time downhole measurement systems
Location: Illinois, USA (US Govt funded)

Objective: Formation evaluation in 8-1/2” open hole for CO₂ sequestration application

IPI Solution: ST 114 straddle assembly deployed on work-string
8 test zones successfully tested in a single trip without operational issues or lost time
2010 > further into conventional oil and gas

- Progressively develop a full range of standard oilfield products
  - Standard casing packers (ECP) – challenges of WA!
  - Inflatable bridge plugs
  - Testing and treatment straddles
  - etc
- Plus innovative products (ALS anchors, eg I-PCPs)
- QLD CBM moves to oilfield standards and use of IPI inflates for DST is mandated by clients
- Further developing synthetic elastomer packer technology
- ISO 9001 QMS
- Systems upgrades (SolidWorks, Skytrust)
- Several engineers and BDMs with oilfield background
- BD presence in Houston, Dubai and Singapore
- Non oilfield business continues to develop – eg USA water well “frac”
- Now team <50 globally, 35+ in Perth
IPI supplies clients on all continents including Antarctica.
• Also know as ECP’s (Baker), ACP’s (Weatherford) or CAP’s (TAM)
• All other suppliers offer slat reinforced with longer elements having no reinforcement in the centre
• IPI versions offer:
  • A valving system that is potentially VO rated
  • Can assemble on to client supplied pups ( eg premium threads)
  • All elements ( up to 20ft ) fully reinforced
  • Other formats, eg surface inflate via control line on clients casing
Permanent Inflatable Bridge Plug (PIBP)

- Plug and abandonment (P&A’s) with cement squeeze option
- Milled out casing applications
- Zonal isolation and shutoff in open or cased hole conditions (Vertical/Horizontal wells)
- Since 2016 used in Gulf of Mexico. Western Australian from 2017.
- Although a seal is more likely, it can deflate, POOH, redress and rerun if required.
- Partial length DuraGRIP™ metal to metal anchoring without compromising the seal integrity

P&A in the
Gulf of Mexico
Anchor Packer for Artificial Lift – new product

Application and Benefits:
- Mounting system for Insert Progressing Cavity Pumps and Rod Pumps
  - Run in without pulling the tubing
  - Rigless operation – on shore or offshore
  - Tubing can be pressure tested while run in
  - Set anywhere in the tubing – no PSN’s required
  - Set in deep and deviated wells by pressurisation of tubing
  - Trip out requires significant overpull

Features:
- Combines a pressure activated inflatable seal and mechanical anchor (axial and torque)
- Set below the IPCP,
- Set by pressurizing the annulus between the rods and the tubing
- Setting and deflate pressures varied by shear pins
- Sizes to suit tubing from 2 3/8” to 5.5” for most pump brands

See SPE Paper and JPT “New Technology” Nov 2018
Custom-Made Solutions

A 18.5” OD Subsea swivel test packer rated to 5,000 psi for a Singapore client – not everything goes down hole!

Unusual shaped packer with sampling ports
Quality & Recognition

MANAGEMENT SYSTEM CERTIFICATE

Certificate No: 00000887-106-040-135-064

Date: 25 March 2015 - 25 March 2016

This is to certify that the management system of

Inflatable Packers International Pty Ltd

1 Rhino Court, Osborne Park WA 6017 Australia

has been found to conform to the Quality Management System standard:

ISO 9001:2015

This certificate is valid for the following scope:

Design and Manufacture of Inflatable Packers, Casing packers and its associated equipment and tools.

Certificate of Membership

This is to certify that

Inflatable Packers International Pty Ltd

is a supplier member of Achilles FPS Oil & Gas Asia Pacific Community, and that company information related to the following criteria has been checked and validated by Achilles Information (Australia) Pty Ltd, an independent third party:

- Supply Chain Management
- Corporate Social Responsibility
- Health & Safety Management
- Quality Management
- Environmental Management
- Carbon Management
- Financial & Insurance

Supplier ID: 242831
Expiration Date: 05 October 2019

Issued By:

New Cappy
Regional Director Asia Pacific - Achilles

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Achilles is a leading provider of global supply chain management solutions and services to some of the world’s leading companies.

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Our Vision...

To be the world’s first choice inflatable packer company