



Weatherford®

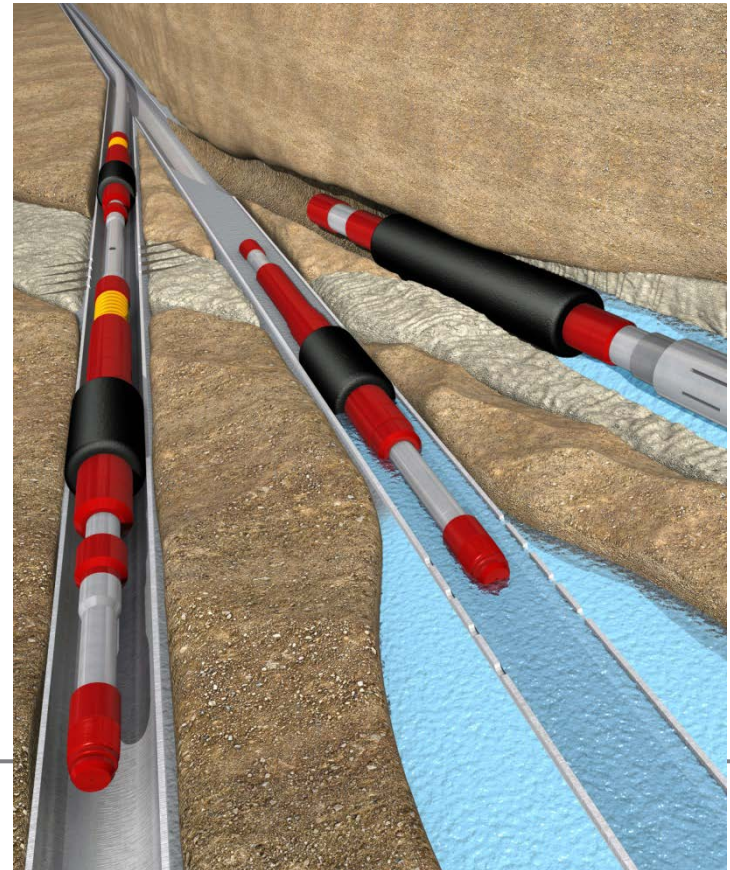


Society of Petroleum Engineers

Inflatable Packers

Assuring wellbore integrity, enhancing reservoir management options, and providing long-term value in drilling, completion, and remediation applications.

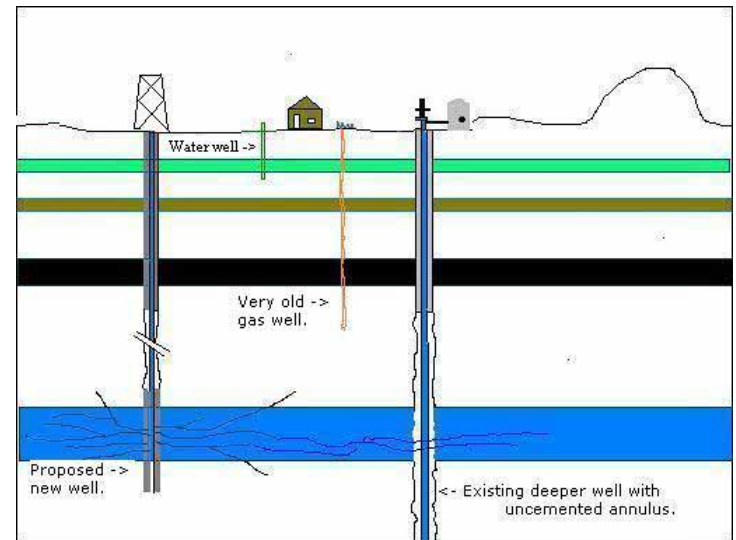
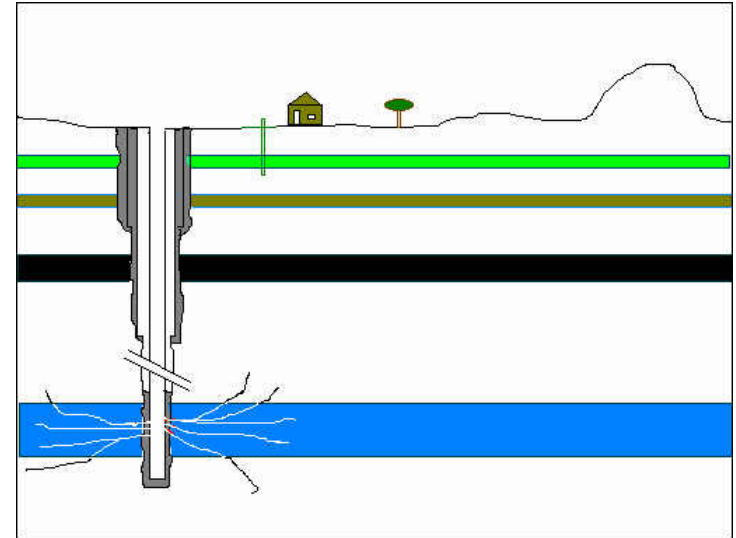
Tim Dunn
Product Line Manager – Well Construction





Why Isolation?

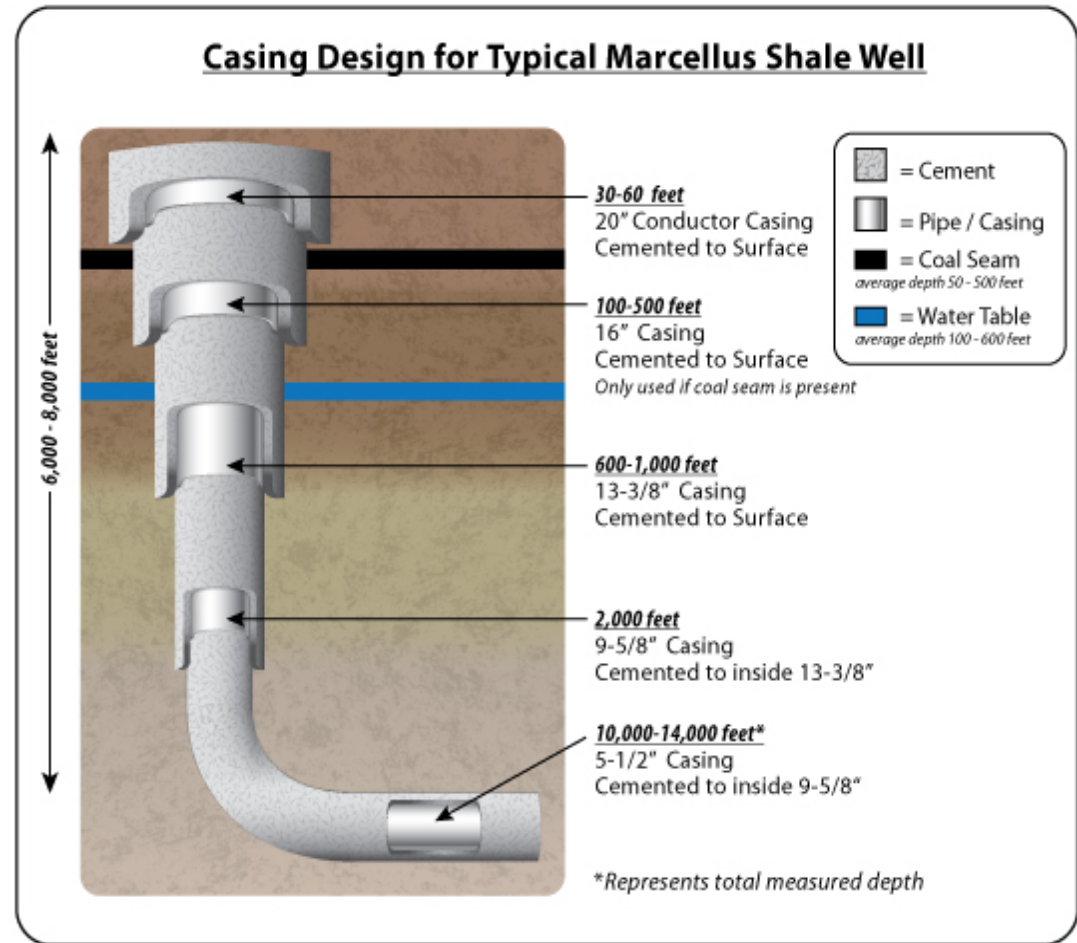
- The well design requires that the casing and cement programs be designed so that there is no gas/oil migration into annuli
- Cement placement does not always ensure an adequate barrier
- In many cases an additional barrier is required by local governance
- Additionally, reservoir heterogeneity poses challenges such as oil-water contact (OWC), gas-oil contact (GOC) and large permeability differences that introduce unwanted flow into the wellbore





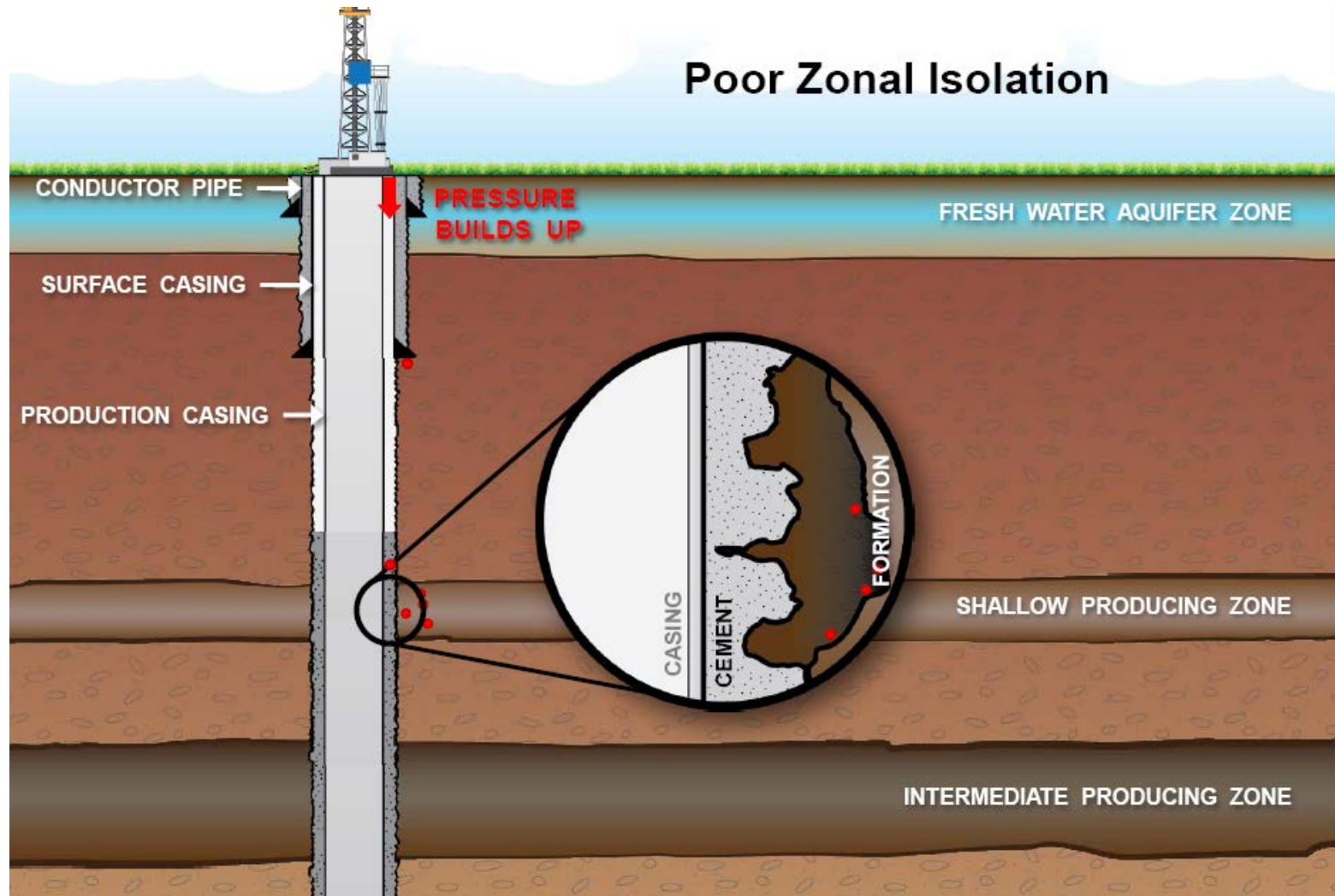
Annular Integrity

- Surface casing deep enough to protect freshwater aquifers
- Intermediate and production casing/cement/packers to prevent vertical migration of water & gas
- Cement bond log and pressure testing to ensure annular integrity





Zonal Isolation





Annulus Casing Packers

Delivering a permanent, reliable high-pressure seal that provides immediate results



Annulus Casing Packers

- Annulus casing packers are reinforced inflatable elements
- Once inflated, provide immediate zonal isolation
- Can be set inside casing and open hole
- Setting hole range is largest of any packer type





Annulus Casing Packers

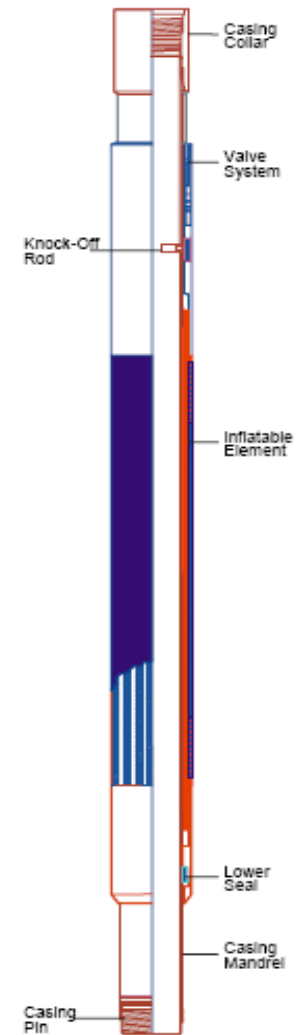
1. Single-piece mandrel (no welding or internal connections)
2. Protected, top-mounted valve system with patented seals and full redundant valve system
3. Steel ribs at the top and bottom of element provide strength and reinforcement during inflation
4. Shallow square threads machined on mandrel featured on discontinuous rib packer prevent element slipping or wadding during run-in
5. Unreinforced center section of element in discontinuous rib packers allows for maximum expansion capability, conforming to borehole shape and size
6. Application specific elastomers exhibit resistance to high temperature, corrosive fluids and gases (up to 375°F for standard applications plus geothermal applications up to 650°F)





Annulus Casing Packers

- Casing serves as the mandrel for the ACP with no restrictions thru the ID
- An inflatable packer element and valve system are mounted onto the casing joint.
- The valve system operates off of differential pressures
- Fluid enters the valve system from inside the casing & fills the packer until the closing valve differential pressure shifts the closing valve
- Full casing pressure integrity is re-established after bleeding off the remaining casing pressure



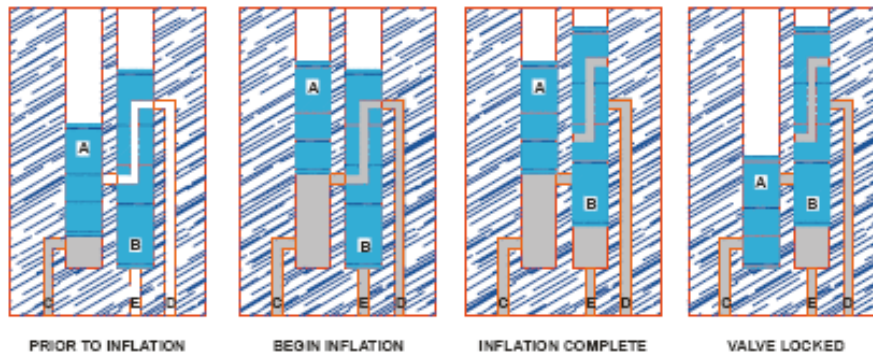
Annulus Casing Packer



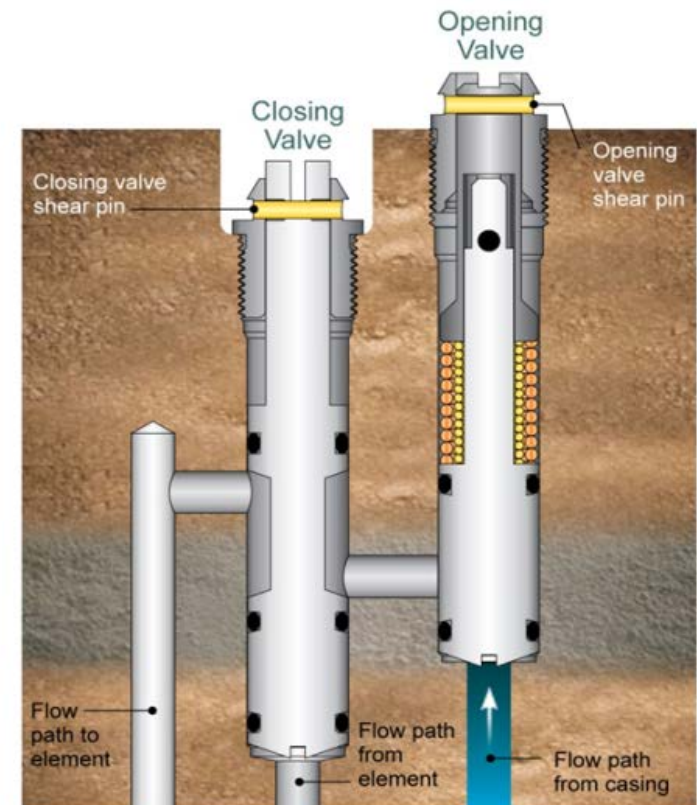
Annular Casing Packer Valve Operation

- Valves prevent flow into the packer until differential pressure is applied
- Opening valve shifts and fluid fills the element
- Differential pressure between the element and the annular hydrostatic pressure above the element shifts the closing valve
- Releasing surface pressure closes and locks the opening valve

CLOSE UP OF VALVE OPERATION

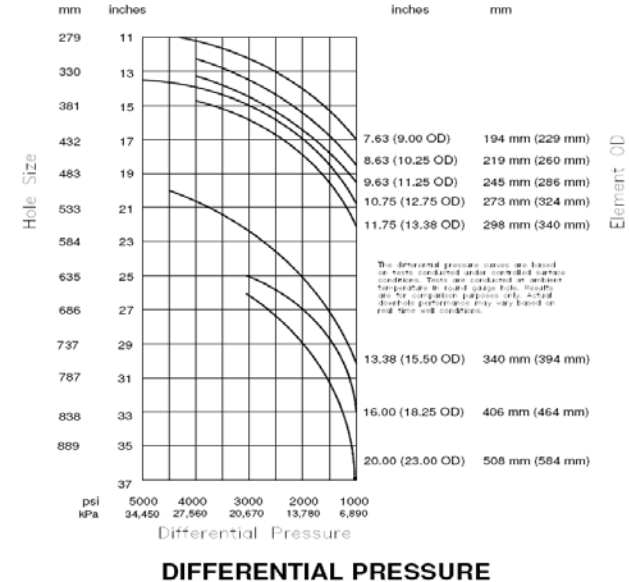
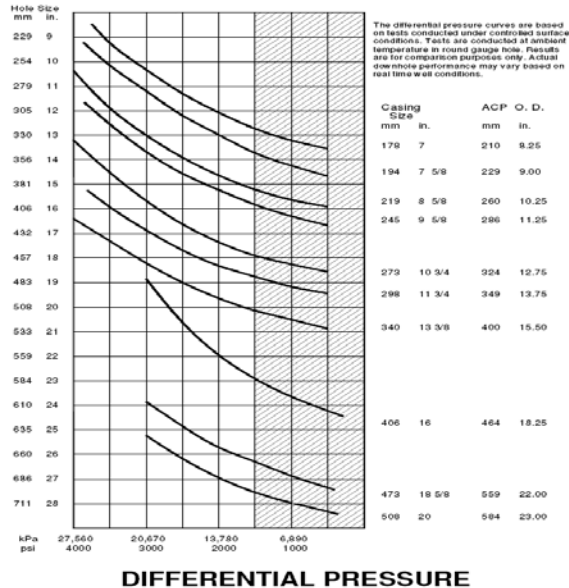


- A. OPENING VALVE
- B. CLOSING VALVE
- C. COMMUNICATION PATH FROM CASING I.D.
- D. FLOW PATH TO ELEMENT BELOW VALVES
- E. FLOW PATH FROM ELEMENT TO CLOSING VALVE





Continuous or Discontinuous



	Continuous Rib ACP	Discontinuous Rib ACP
Open Hole Setting	Good	Best
Cased Hole Setting	Best	Good
Washed Out Hole	Fair	Best
Rotation While RIH	Best	Good
Pressure Rating	Good	Best (function of length)



Solutions-Based Systems

Supporting Cement in Vertical Wells

Problem

- During drilling, a lost circulation zone cannot sustain a column of cement



Solution

- An annulus casing packer is run with a port collar or stage tool
- Once inflated, the packer acts as support for the cement above (for lower zone)
- Packer will provide immediate isolation while cement hardens
- Actuation will be either from an inner string or by use of a plug system
- Positive indication of collar closure ensures casing integrity



Solutions-Based Systems

Preventing Gas Migration

Problem

- Shallow gas zones typically make primary cementing difficult due to gas migration



Solution

- The annulus casing packer acts as a barrier while the cement hardens isolating gas influx
- Set an annulus casing packer just above the gas zone
- Perform primary cementing through the shoe
- Inflate annulus casing packer



Solutions-Based Systems

Problem

Multiple gas or gas/water zones



Solution

- Multiple annulus casing packers act as a barrier isolating gas or water influx to prevent comingling
- Run the annulus casing packers just above the gas zones
- Perform primary cementing through the shoe, stage tools or port collars
- Inflate both annulus casing packers



Solutions-Based Systems

Production Segmentation in Horizontal Wells

Problem

- Differences in permeability lead to non-uniform production and early water or gas inflow through high-permeable zones

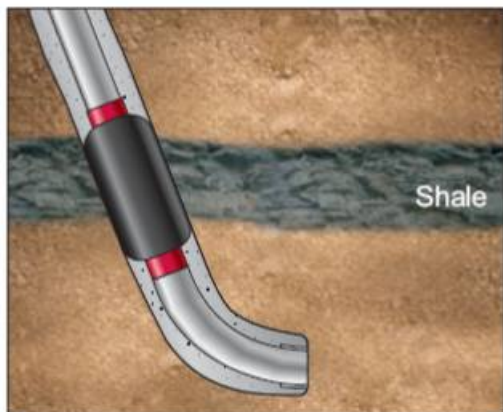


Solution

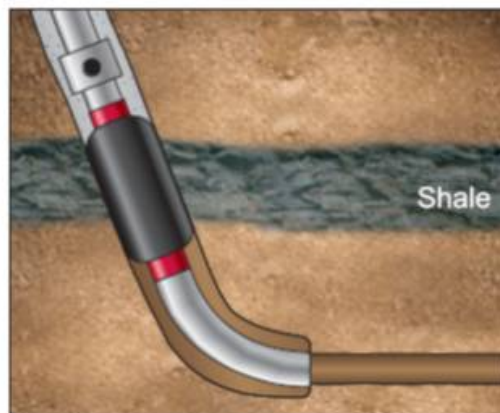
- Breaking the producing interval into segments using annular casing packers and Inflow Control Devices (ICD's)
- Annular casing packers are used to create barriers between two different zones
- ICD's create a uniform pressure drop across each zone allowing even production from heel to toe



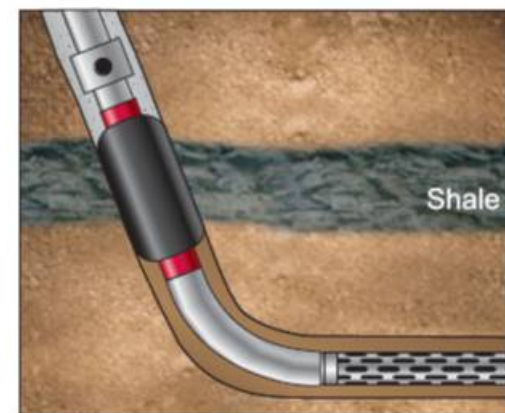
Horizontal Applications



Isolating the build section from the horizontal producing zone at the bottom of the intermediate casing string



Isolating the build section from a low-pressure horizontal producing zone at the bottom of the intermediate casing string



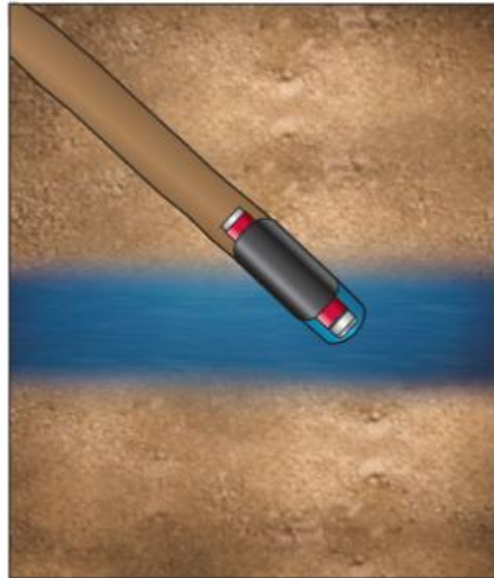
Isolating the build section from a horizontal producing zone



Horizontal Applications



Isolating production
zones or watered out
zones



Plugging and
abandoning



Plugging back



Injection Production Packers

Providing versatility for testing, remedial, or abandonment applications



Injection Production Packers

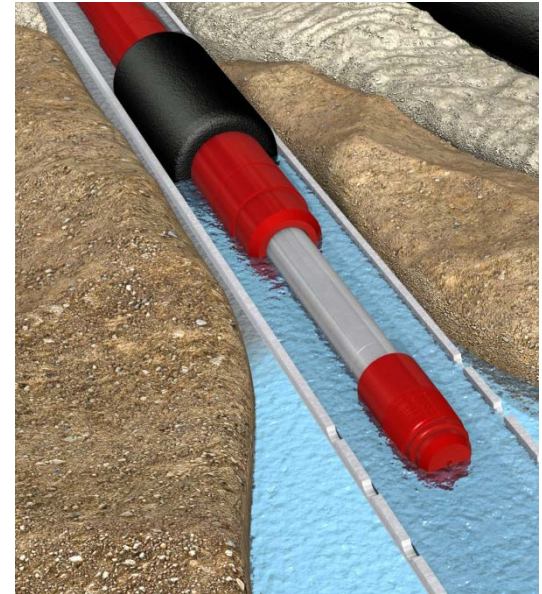
- Injection production packers can be run into completed or open-hole wellbores to perform testing, stimulation and/or temporary abandonment
- Due to the nature of the slim design, these packers can be run into wells with restrictions in the completion such as safety valves, wellheads, nipples, etc.
- The various setting/bleeding options allows for reliable performance in even the most challenging conditions
- No pipe movement needed to set packer
- Full ID with no restrictions through tool





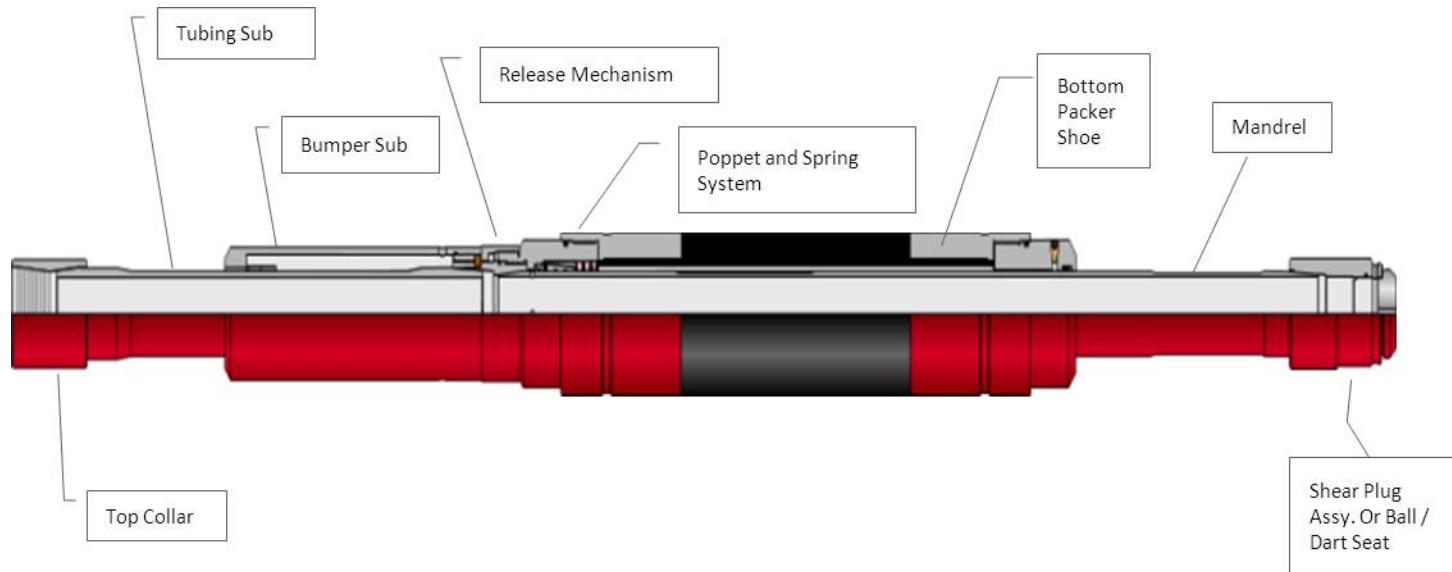
Injection Production Packers

- Injection production packers are reinforced inflatable elements
- Once inflated, provide immediate zonal isolation
- Can be set inside casing and open hole
- Can be set multiple times during the same run
- Stimulation and treating below the packer without hindering seal





Injection Production Packers



Chassis

- Available with 1-1/4, 2 or 2-1/2 in. ID
- Compatible with various element sizes

Elements

- Available with steel rib reinforcing or cable reinforcing
- Sizes from 3-1/2 to 15-in. OD



Inflatable Straddle Packer Assembly

- Consists of dual inflatable packers
- Can be set multiple times per run
- Used for selective treating, testing or production evaluation
- Distance between the elements can be adjusted as needed
- Memory gauges can be run above, between and below the elements
- Operated by axial workstring movement



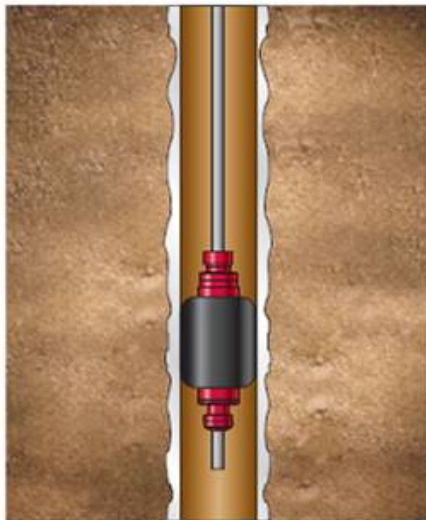


Solution-Based Systems

Casing Integrity Testing

Problem

- There has been various instances of casing failure in a given field and finding the leak is top priority



Solution

- Running an inflatable multi-set packer on drillpipe to pressure test the casing in sections to determine the leak location
- The packer is inflated using workstring pressure to provide a point of isolation in the casing
- Pressure can then be applied above or below the packer to test integrity
- Can be run with a J-Circulating Valve which can be actuated to communicate flow from tubing to annulus

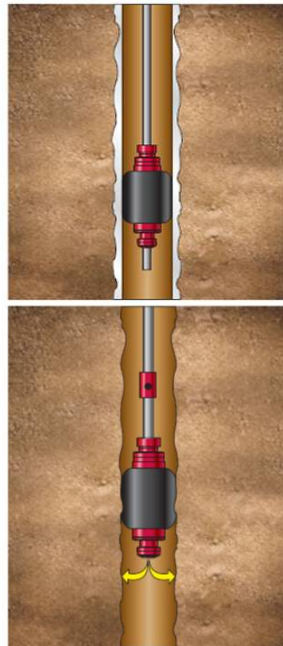
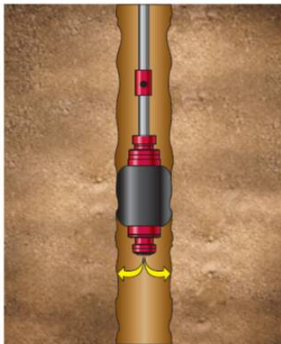


Solution-Based Systems

Treatment in Open Hole

Problem

- Selectively perform leak-off tests in various sections of open hole prior to running casing



Solution

- Running one or two packers (to straddle) along with a hydraulic circulating valve
- Each packer is inflated and set inside the open hole
- Circulating valve is then opened and test is performed between packers

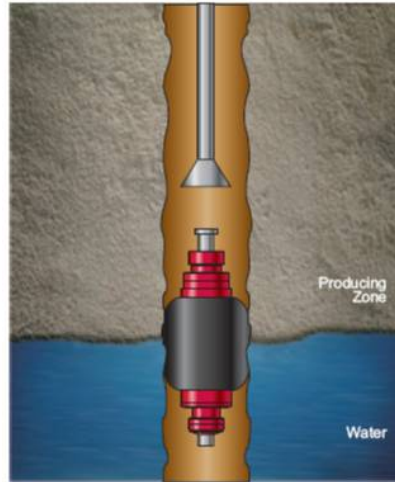
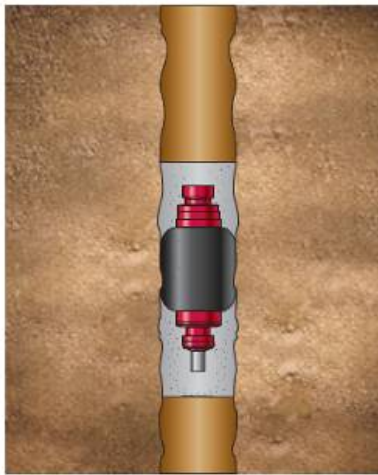


Solution-Based Systems

Zone Shut-Off or Permanent Plug

Problem

- Shutting off a lower section that has started to produce water or production has become economically unviable



Solution

- Running a packer with a hydraulic or mechanical disconnect to leave plug in the well
- Set packer above desired shut-off zone
- Disconnect from the packer using either a hydraulic or mechanical disconnect
- Optionally pump cement on top of packer for a permanent plug

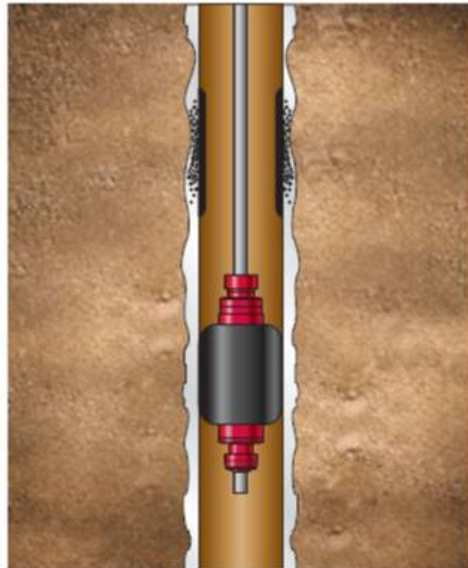


Solution-Based Systems

Producing Below a Casing Patch or Damaged Casing

Problem

- Bypass damaged, corroded, parted, split casing or casing patched areas to isolate above the producing section



Solution

- The reduced OD of the packer allows it to be drifted through the damaged section and past the casing patches until it can be set inside good casing
- Set the packer below the damaged sections
- Production can continue through the work string without needing to kill the well



Solution-Based Systems

Temporary Scab Liner with Mechanical Packer

Problem

- After a period of time, openhole production has seen unwanted flow coming from the heel of the well



Solution

- Running a packer and mechanical packer with a section of tubing connecting the two
- Packer is set below the heel (in the horizontal zone)
- Mechanical packer is set inside the casing
- Solid tubing between both packers will prevent any flow from the heel



Weatherford®

Thank you

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