



## EVOLUTIONARY FLAPPER PLUG (EFP)



### FEATURES

- Robust design allows for larger flow area by utilizing flapper and seat instead of ball and seat
- Design allows spring to keep flapper open once running tool is removed
- 10,000 psi differential
- Spring-loaded flapper is made of dissolvable material (dissolve rate dependent on salinity of completion fluid)
- Optional ball transfer system keeps the integrity of the slips and seals from damages
- Flapper design allows for flow back/production
- Optional ball transfer system lifts EFP off casing walls and “rolls” instead of drags by reducing friction

### BENEFITS

- Reduces time and saves money
- Reduces fluid consumption
- Faster initial production time for end users
- One run plug and perf system
- Helps with footprint of equipment on location by reducing amount of equipment needed
- Reduces potential incidents by streamlining personnel and equipment exposures

The Evolutionary Flapper Plug (EFP) has been designed with the customer’s focus in mind. Unlike traditional fracking plugs, the EFP reduces the need for coiled tubing milling by utilizing a flapper and seat. The flapper and the seat are respectively contoured to receive each other and form a seal or a plug. The flapper is dissolvable and can flap to the open position with pressure beneath overcoming the spring force, leaving a large flow area for flow back or production. Since the flapper is on a hinge and spring system, wellbore pressure can allow the well to flow or produce without milling or potentially having a ball flow up to the body of another plug assembly above – which could greatly reduce flow or even form a plug.

The EFP is run on a standard setting tool to allow proper placement and setting. The body of the EFP is made of a ductile material and can be milled by coiled tubing should the need arise. The EFP also has an optional ball transfer system at the lower end. This greatly reduces friction as it allows the plug to “roll” on the ball transfers rather than drag along the walls of the casing. Thus, the integrity of the slips and seals are not compromised and are protected from damages and cuts since the OD at the ball transfer is slightly larger than the OD of the plug.

The optional ball transfer housing is made of aluminum, and the small balls are stainless steel. The EFP does not have a ball drop system, so time and money are also saved by eliminating the need to drop and pump several balls on seat. Additional savings are gained from the reduced water amount necessary to pump the balls on seat *and* the trucking costs associated to bring the water to location. Since time is greatly reduced by this plug and perf system, the EFP allows the end user to bring the well to initial production as much as two to three days faster than traditional plug and perf systems. Ball transfers friction coefficients are 0.002 to 0.007 versus normal drag coefficients of 0.20 to 0.30. If your priorities include saving critical time and money, allow the EFP to lead the way.

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## Comparison (Composite Plug vs. Flapper Plug)

**EXAMPLE: 40 plugs per well ; 10 wells ; Rig day rate \$20,000 (\$850 per hour) ; Oil price of \$50 / bbl**

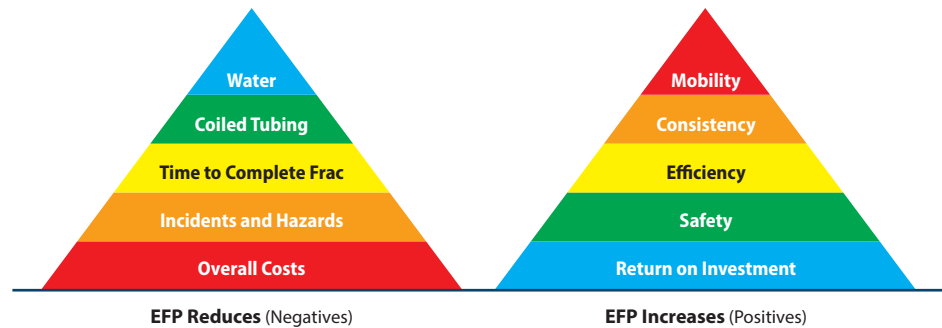
### Composite Plug and Coiled Tubing

- Composite plug purchase: 40 plugs for 10 wells = 400 plugs. 400 x \$1,000 (each) = \$400,000
  - Coiled tubing operations: 10 wells at \$150,000 per well = \$1,500,000
  - Rig time for coiled tubing operation: 3 days per well for 10 wells at \$20,000/day = \$600,000
  - Production difference: assume 500 bbl/day at \$50 each. 3 days per well at 10 wells= \$750,000
  - Time to pump ball on seat: 400 plug balls at 30 mins each = 200 hours at \$850/hour= \$170,000
  - Chemicals, water and trucking for frac balls pumping: \$4,000 per well at 10 wells = \$40,000
- Totals: \$3,460,000**

### Flapper Plug

- Flapper plugs: 40 per well at 10 wells = 400 plugs at \$4,200 per plug = \$1,680,000
- Totals: \$1,680,000**

### Cost savings of \$1,805,000 by utilizing Flapper Plug



Casing Dimension	Plug Size	PSI Rating	Temperature	Plug ID	Plug OD @ Balls	Dissolve Rate	Length
4 1/2" - 11.6#	3 3/4"	10,000	-40° F - 300° F	2 25/32"	3.80"	48 Hours	14.86"
4 1/2" - 13.5#	3 21/32"	10,000	-40° F - 300° F	2 25/32"	3.725"	48 Hours	14.86"
4 1/2" - 15.1#	3 1/16"	10,000	-40° F - 300° F	2 21/32"	3.630"	48 Hours	14.74"
5" - 18.0#	4.00"	10,000	-40° F - 300° F	3 1/8"	4.080"	50 Hours	14.51"
5 1/2" - 17.0#	4 5/8"	10,000	-40° F - 300° F	3 5/8"	4.700"	52 Hours	15.70"
5 1/2" - 20.0#	4 1/2"	10,000	-40° F - 300° F	3 5/8"	4.585"	52 Hours	15.70"
5 1/2" - 23.0#	4 1/4"	10,000	-40° F - 300° F	3 3/8"	4.475"	52 Hours	15.44"
5 1/2" - 26.0#	4 1/4"	10,000	-40° F - 300° F	3 3/8"	4.345"	52 Hours	15.44"

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