Artificial Lift Services

Q2-FLOW 1-PIECE (INSERT GUIDED CAGE)

Q2-Flow 1-Piece insert guided cage was developed to provide the maximum service life in severe conditions.

Description

Q2 Artificial Lift Services' Q2-Flow 1-Piece Insert Guided Cages utilizes **Q2-Flow™ Inserts**. The Q2-Flow™ inserts allows the gas to remain in solution as its unique shape forces the fluid into a vortex spin. The Vortex flow from below causes a reverse seat, sealing the ball in place from underneath. The inner section of the insert can be "carved out" to handle larger amounts of solids, without the ball causing major vibrational damage. Alternative inserts also give more clearance to allow for solids to flow through the inserts with less restriction.

Features

Q2-Flow One-Piece insert guided cage is available in both travelling and standing cage configuration. The One-Piece insert guided cages are available in alloy steel, stainless steel and Monel. The patented insert is cast from hard, tough and wear resistant material.

Advantages

- Reduce pressure drop by up to 40%.
- Reduce cage failure by distributing ball impact forces evenly across upper three ribs and inner wall of the cage.
- Increase of pump efficiency in gas cut environment.
- Handle solids more efficiently than the conventional inserts.
- Scale and paraffin build up is minimized as lower pressure drop across valve occurs from vortex flow.
- Increasing the ID of Insert will not impact wear due to reduced ball vibration compared to conventional inserts.
- Alternative insert balls can be used as the uniform vortex flow from below helps control ball chatter. Good for handling higher solids and for increasing the flow.
- Balls wear uniformly due to the inside of the inserts spherical dimensions and have a longer lifespan.

Field Experiment Results from Mid 2017 to Early 2018

(Notes are from Operator after 8 months of operations)

History:
Operator has attempted to maximize flow from the Red River reservoir in Montana / North Dakota.
Fiberglass tubing with machined full flow cages have been utilized in this area.

Well Characteristics:
Well Depth is between 8,300 and 9,300 ft

Well Size is 2 1/4 " for Standing Cage and 1 3/4" for Traveling Cage.
Water Flood requires maximum flow rate to optimize oil production.

Field Experiment Details:

Dyno's are available on every well to measure specific details on changes of flow.

The TF Insert was the only variable that was modified in order to accurately measure it's pump efficiency.

TF (TangentFlow) inserts were installed in 50 + wells Red River Reservoir in North Dakota.

Numerical Results (Average)						
Stroke Length Inches		Pump Coefficient		Strokes/Min		
147	X	0.357	X	7.6	=	398.8 bbl/day
On Average Wells have additional 7" to 10" Stroke length with TF Insert in Standing Cage						
On Average Wells have3" additional Strok Length with Insert in Traveling Cage						
158.5	X	0.357	X	7.6	=	430.0 bbl/day
11.5 Stroke Difference						
On Average wells produce at a 90:10 Oil/Water Ratio						
Increase Flow of Water					90	28.1 bbl/day
Increase Flow of Oil					10	3.1 bbl/day
Increase Flow of Oil/Well *:						1,092.06 bbl/year
				* Based on 350 operating days/year		

Results:

Replacing the machined "Full Flow Cage" with the TF Insert cage has improved water & oil production on average by 31.2 bbl/day increase.

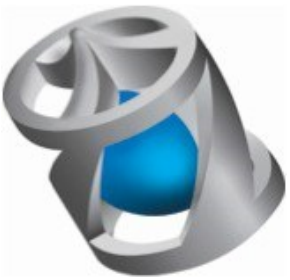
Conclusion:

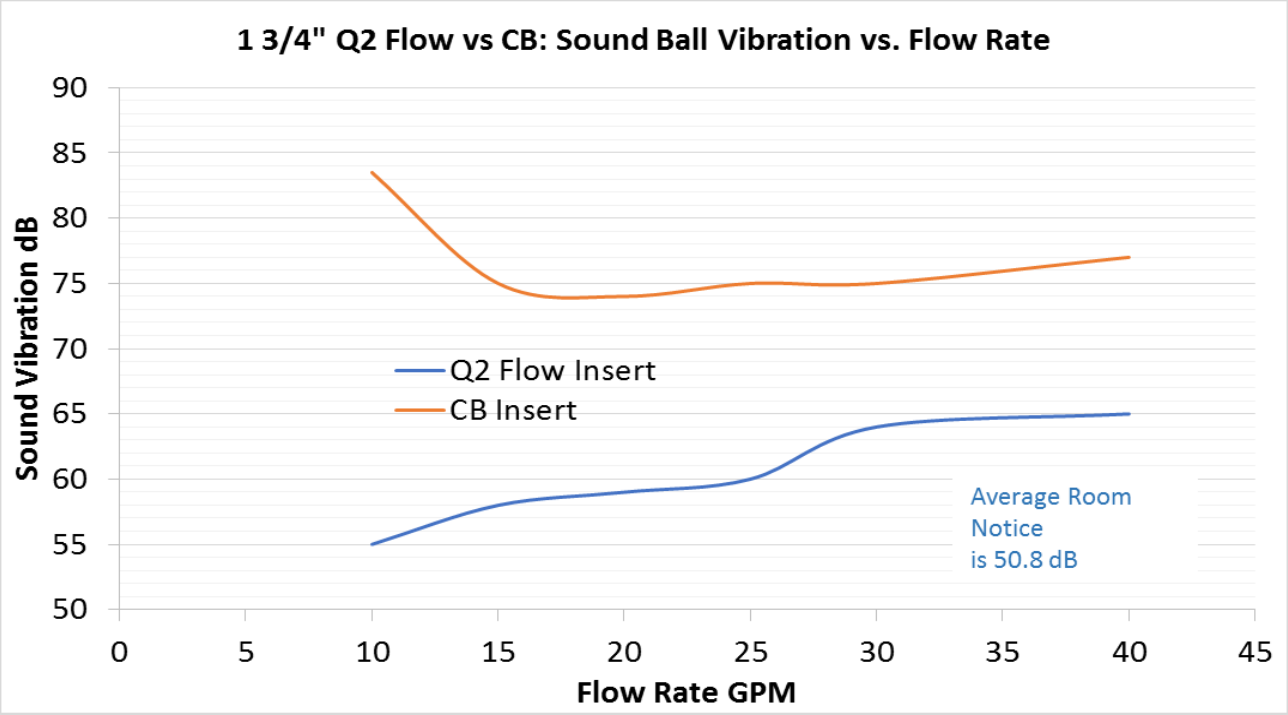
Pressure drop reduction across both the Standing and Traveling Valve has increased flow on surface for wells on average by: 8% bbl/day production increase

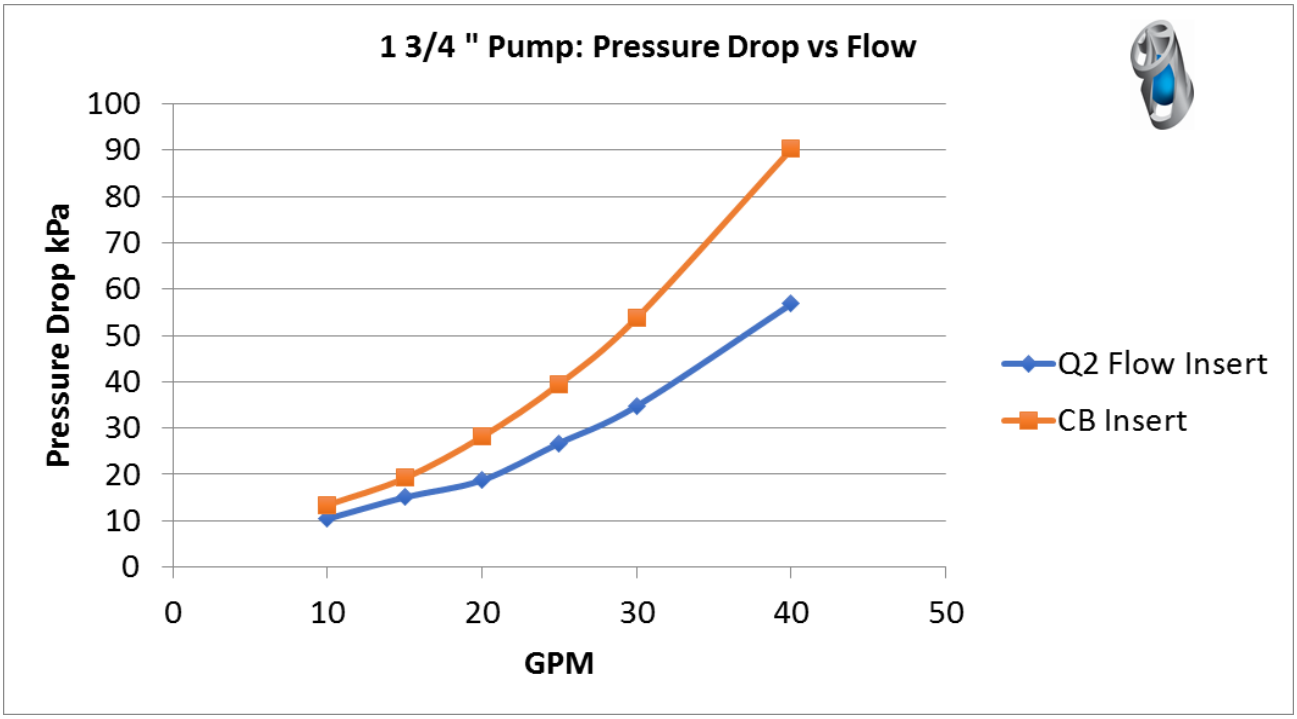
This increase applied to 50 wells in a field at todays oil prices ~ $3,330,792.15 additional revenue.

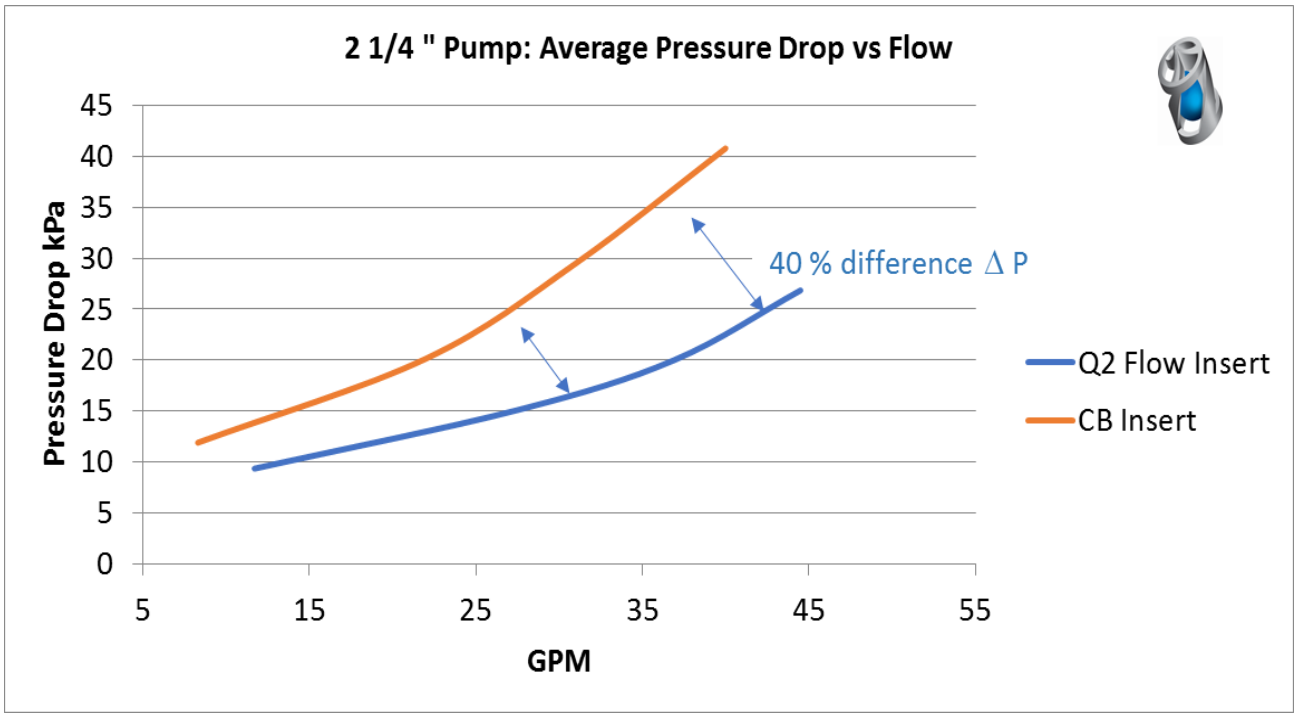
Questions that would help with field test applicability, in comparison to other areas & reservoirs:

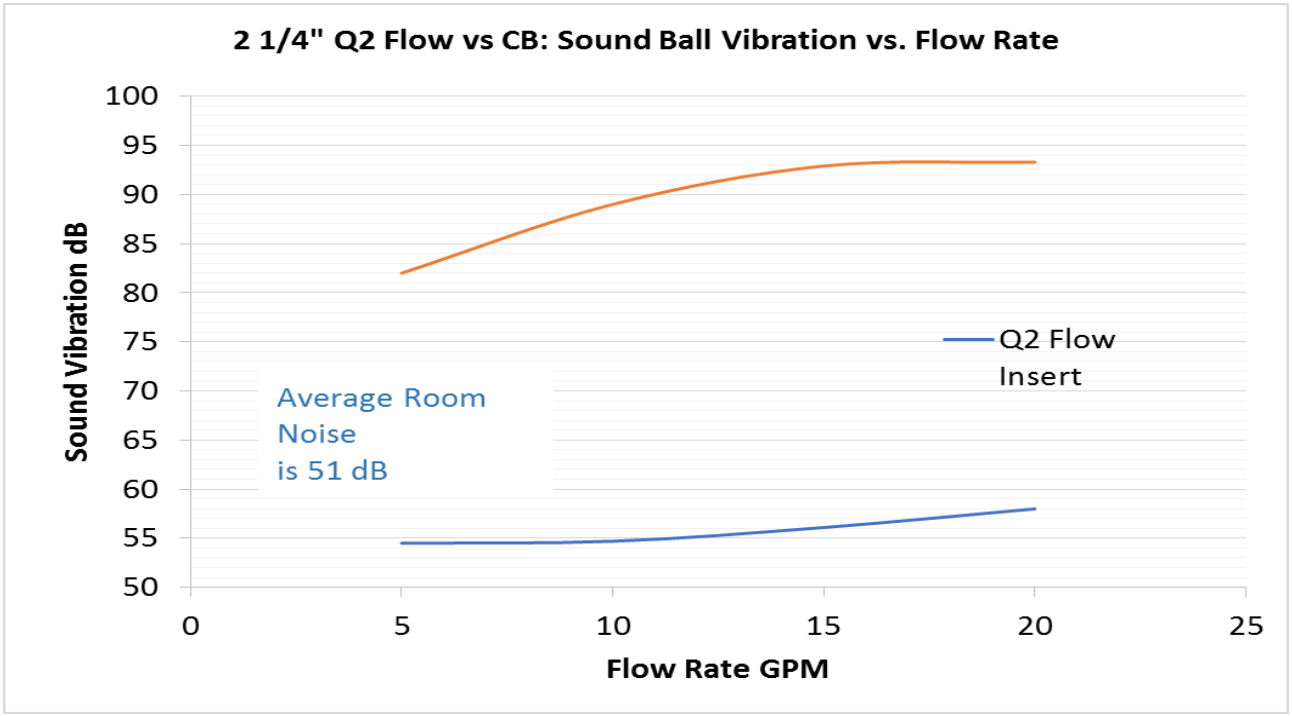
API of Oil?	API 29 to 41 Oil.
Formation?	Red River Dolomite
Permeability?	1-97
Ave Temp?	220 to 250 F
H2S?	Yes, 25 - 400,000 ppm
CO2?	Yes, 3 to 33%
AIR?	Injecting Air Converts to N and CO2
Corrosion?	CL (9,000 to 72,000 mg/L)
Inhibitor?	Yes, Cap rings to inject Wide range of Corrosion Inhibitors
Gear Box Size?	640, 912, 1120 all sizes.
Injection?	Air and Water.
Plunger Size?	Short 3 to 4 foot grooved. Lots of fines.
Deviation?	Yes, 60 Degrees into Horizontals.
Gas Separator?	Yes, downhole.
Ball Type?	Tungsten Carbide
Compression?	Yes, lots of Compression on String Design.
Fines?	Yes, fines are an issue in most areas.
TF Insert?	Now going in ALL wells both traveling & standing cages.




1 3/4" Q2 Flow vs CB: Sound Ball Vibration vs. Flow Rate
Sound Vibration dB
90
85
80
75
70
65
60
55
50
0
5
10
15
20
25
30
35
40
45
Flow Rate GPM
Q2 Flow Insert
CB Insert
Average Room
Notice
is 50.8 dB


1 3/4 " Pump: Pressure Drop vs Flow
Pressure Drop kPa
100
90
80
70
60
50
40
30
20
10
0
0
10
20
30
40
50
GPM
Q2 Flow Insert
CB Insert


2 1/4 " Pump: Average Pressure Drop vs Flow
Pressure Drop kPa
45
40
35
30
25
20
15
10
5
0
5
15
25
35
45
55
GPM
40 % difference Δ P
Q2 Flow Insert
CB Insert


2 1/4" Q2 Flow vs CB: Sound Ball Vibration vs. Flow Rate
Sound Vibration dB
100
95
90
85
80
75
70
65
60
55
50
0
5
10
15
20
25
Flow Rate GPM
Q2 Flow Insert
Average Room Noise is 51 dB

Q2-FLOW 1-PIECE

Specifications

Cage, Closed, Barrel, Insert Guided, 1-Piece, Insert

Tubing Size		2-3/8"			2-7/8"
Cage OD (in.)		1.750"		1.875"	2.25"
Thread Size	Upper Pin	1.3330-16	1.5730-16	1.5730-16	2.0870-16
	Lower Box	1.4704-14	1.4704-14	1.4704-14	1.8024-14
Ball & Seat Number		12H		12H	12M
Cage Part Number		(U)37HD-IG-1PC	(U)37H-IG-1PC	(U)37H-HD-IG-1PC	(U)37M-IG-1PC

Oversized Cage, Closed, RW/RX Barrel

Tubing Size		2-3/8"			2-7/8"		
Pump Bore		1-1/16"	1-1/4"	1-1/2"	1-1/16"	1-1/4"	1-1/2"
Cage OD (in.)		1.875"	1.875"	1.875"	2.312"		
Thread Size	Upper Pin	1.125-16	1.3330-16	1.5730-16	1.125-16	1.3330-16	1.5730-16
	Lower Box	1.5604-14	1.5604-14	1.5604-14	1.8024-14		
Ball & Seat Number		12K2/12K	12K2/12K	12K2/12K	12M2/12M		
Cage Part Number		(U)37KB-HD-IG-1PC	(U)37KD-HD-IG-1PC	(U)37KF-HD-IG-1PC	(U)37MB-HD-IG-1PC	(U)37MD-HD-IG-1PC	(U)37MF-HD-IG-1PC

Cage, Closed, Double Valve, Insert Guided, 1-Piece

Pump Bore		1-1/4"	1-1/2"	1-3/4"	2"	2-1/4"
Cage OD (in.)		1.224"	1.474"	1.724"	1.974"	2.224"
Thread Size	Upper Pin	1.000-14	1.2500-14	1.4704-14	1.5604-14	1.8024-14
	Lower Box	1.000-14	1.2500-14	1.4704-14	1.5604-14	1.8024-14
Ball & Seat Number		12D	12F	12H	12K	12M
Cage Part Number		(U)38D-IG-1PC	(U)38F-IG-1PC	(U)38H-IG-1PC	(U)38K-IG-1PC	(U)38M-IG-1PC

(INSERT GUIDED CAGE)

Cage, Closed, Pin End Plunger, Insert Guided, 1-Piece

Pump Bore		1-1/4"	1-1/2"	1-3/4"	2"	2-1/4"
Cage OD (in.)		1.224"	1.474"	1.724"	1.974"	2.224"
Thread Size	Upper Box	1.0000-14	1.2500-14	1.4704-14	1.5604-14	1.8024-14
	Lower Box	1.0000-14	1.2500-14	1.4704-14	1.5604-14	1.8024-14
Ball & Seat Number		12D	12F	12H	12K	12M
Cage Part Number		(U)39D-IG-1PC	(U)39F-IG-1PC	(U)39H-IG-1PC	(U)39K-IG-1PC	(U)39M-IG-1PC

Oversized Cage, Closed, RH Barrel, Insert Guided, 1-Piece

Tubing Size		2-3/8"			2-7/8"		
Pump Bore		1-1/16", 1-1/4"		1-1/16", 1-1/4"	1-1/4"	1-1/2"	1-3/4"
Cage OD (in.)		1.750"	1.875"	1.875"	2.312"		
Thread Size	Upper Box	1.5730-16	1.5730-16	1.5730-16	1.5730-16	1.8750-16	2.0870-16
	Lower Box	1.4704-14	1.4704-14	1.5604-14	1.8024-14		
Ball & Seat Number		12H2/12H	12H2/12H	12K2/12K	12M2/12M		
Cage Part Number		(U)39H1 -IG-1PC	(U)39H1-HD -IG-1PC	(U)39K1-HD-IG-1PC	(U)39M3-HD-IG-1PC	(U)39M1-HD-IG-1PC	(U)39M2-HD-IG-1PC

Cage, Closed, Box End Plunger Insert Guided, 1-Piece

Pump Bore		2-1/4"
Cage OD (in.)		2.224"
Thread Size	Upper Pin	1.9864-14
	Lower Box	1.8024-14
Ball & Seat Number		12M
Cage Part Number		(U)40M-IG-1PC

NOTES:
1. "U" in part number represents material:
   A—Alloy
   M – Monel
   S – Stainless Steel
2. Insert material is Cobalt Alloy.

CANADA
6798 - 52 Avenue, Red Deer, AB T4N 4K9
P: 403.343.8802

USA
TGAAR Tower, 24 Smith Road, Suite 100
Midland, TX 79705 P: 432.685.2600

Artificial Lift Services

Q2 ARTIFICIAL LIFT SERVICES CORPORATE OFFICES

CANADA
7883 Edgar Industrial Way Red Deer, AB

P: 403.343.8802

USA
3427 E. Hwy 158 Midland, TX 79706

P: 432.685.2600

sales@Q2als.com www.Q2als.com