Does API 19G1 and 19G2 sufficiently cover surface-controlled gas lift systems?

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Surface-Controlled Gas Lift Systems

- Does API 19G1 and 19G2 sufficiently cover surface-controlled gas lift systems?

- Is there a need to develop an API standard that covers surface-controlled gas lift?

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Surface-Controlled Gas Lift Systems

- What is surface-controlled gas lift?
  - Not the opening and closing the gas lift surface choke
  - Defined as a gas lift system that allows <u>selective</u> control (opening, closing, adjusting) of a <u>downhole</u> gas lift valve(s) via <u>surface input</u>. (abstract)
  - *"Surface-controlled gas lift can be defined as an artificial lift system that is able to adjust the downhole gas injection <u>without any intervention into the wellbore</u> when measured bottom-hole conditions change, continuously lowering the produced fluids density and allowing their flow to the surface. In order to achieve that goal, the Surface-controlled gas lift system is able to emit a surface signal, by various means, to a downhole injection valve assembly <u>while gathering well information</u> concurrently from said assembly."*

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API 19G Response

- Question proposed to the API 19G task group El Jefe
  - "*Does API 19G1 , G2 and G3 cover surface controlled gas lift equipment? There are some components of surface controlled gas lift that are like in nature however we (Jason Bigelow, Michael Romer, and me) do not believe the intent of 19G 1, G2 & G3 is to cover surface controlled gas lift. Since you are Gas Lift El Jefe what is API's response?*"

- Answer given by API 19G Chair
  - "*Surface-controlled gas lift equipment is not covered by any other API standard. This includes 19G1, 19G2 and (obviously) 19G3. It also includes 19ICV (interval control valves). I thought that there might be a chance with the last one. But, that particular Task Group had no interest in including surface-controlled gas lift in their standard. I suspect that there are aspects of several SC19 documents that could serve as source material for a surface-controlled gas lift document. But, that will depend on how the Work Group crafts their document scope once they have approval to move forward.*"

API 19ICV Response "Does SCGL fall within API 19ICV?"

- Answer from API 19ICV task group

"*This was not my decision but agreed by all the participating companies in full consensus not to include eGas Lift in API 19ICV.*

This was brought up to API 19ICV committee in two occasions.

1. *See item 11: Initially the decision was taken to exclude it from scope when we set up the 19ICV WG (this was before I took over chairmanship).*
2. *See item 224: This was brought up again by Greg Stephenson in API summer conf in 2019. Following that we again discussed this in API 19ICV committee meeting in August and agreed to exclude again (this was a consensus decision by all participating companies).*

Main reason is that even though physical architecture of the eGasLift may be similar to an electrical ICV, <u>functionality is different.</u> The V&V program is mostly driven thru functionality needs and eGas lift does not fit well.

It is too late to include it in 19ICV. It is already in its final draft and too late to change."

API 19E Specification for Electric Components for use in Downhole Completions Equipment (Draft)

- Scope
  - *"This Specification provides the requirements for electric components / subassemblies utilized in downhole completion equipment as they are defined herein for use in the petroleum and natural gas industries. Electric components related to equipment covered under API specifications such as API 11D1, 14A, 19AC, 19CI, 19ICV, 19G1, 19G2 and 19V are included. This specification is intended to be complimentary to other API specifications."*
  - *"This Specification cover electric downhole completions components / subassemblies such as:*
    - *Actuation devices intended for use in applications such as safety valves, interval control valves, chemical injection valves, gas lift valves, built-in setting devices.*
  - Validation of different test criteria (Functionality, thermal cycling, mechanical shock, reliability, etc) for different functions of the tool (General electronics, Telemetry, Sensing, Actuation, Energy Generation and Storage)

API 19G1 Side Pocket Mandrels

- For retrievable systems follow this standard
  - If SPM already been validated, then just valve interface required if this is different product (open/close system vs WINS)
- For permanent systems follow API 19G15(draft) or would this exclude portions of this standard?

API 19G1 Annex B Validation Testing

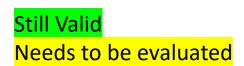| Criterion	V3	V2	V1	V1H
Documentation	B.1.2.2	B.1.3.2	B.1.4.2	B.1.5.2
Design review (burst, collapse, tolerance)	B.1.2.3	B.1.3.3	B.1.4.3	B.1.5.3
Burst and collapse validation pressure test to destruction at ambient temperature	NR	B.1.3.4 B.1.4.6	NR	NR
Pressure testing at rated temperature	B.1.2.4	B.1.3.5	B.1.4.4	B.1.5.4
Internal pressure cycles	NR	B.1.3.6	B.1.4.5	B.1.5.5
Finite element analysis/strain gauge	NR	NR	B.1.4.6	B.1.5.6
Failure mode and effect analysis	NR	NR	NR	B.1.5.7
Flow control—install/pull with KOT	B.1.2.5	B.1.3.7	B.1.4.7	B.1.5.8
Slick line operational test with KOT	NR	NR	B.1.4.8	B.1.5.9
Product validation internal drift test	C.1.3.3	C.1.3.3	C.1.3.3	C.1.3.3
Product validation external drift test	C.1.3.4	C.1.3.4	C.1.3.4	C.1.3.4

Still Valid
Needs to be evaluated

API 19G1 Annex C Function Testing

Criterion	F3	F2	F1	F1H
Internal pressure test	C.1.3.2	C.1.4.2	C.1.5.2	C.1.6.2
External pressure test	NR	C.1.4.3	C.1.5.3	C.1.6.3
ID drift test	C.1.3.3	C.1.4.4	C.1.5.4	C.1.6.4
OD drift test	C.1.3.4	C.1.4.5	C.1.5.5	C.1.6.5
Installation/removal method—KOT	NR	C.1.4.6	C.1.5.6	C.1.6.6

Still Valid
Needs to be evaluated

API 19G2 Flow Control Devices - Scope

- Scope – Provides requirements for subsurface flow-control devices used in side-pocket mandrels. The specification addresses IPO, PPO, pilot, orifice and dummy flow-control devices. This includes requirements for specifying, selecting, designing, manufacturing, quality control, testing and preparation for the shipping of the flow-control devices
- Outside of scope
  - Installation and retrieval (API 19G3)
  - Flow-control devices used in center-set mandrels or tubing retrievable applications
  - Side-pocket mandrels (API 19G1)
  - Running, pulling, kickover tools (API 19G3)
  - Latches (API 19G3)

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API 19G2 Flow Control Devices – Functional Specification

- Functions define
  - Device type
  - IPO, PPO, seat material, elastomers, packing type, Ptro and Pvc ranges, and special coating(s)
  - Device size
  - Port size and type (square-edged, beveled, tapered, venturi, cross-over)
  - Maximum bellows pressure and bellows protection
  - Maximum spring load rate
  - Stem travel
  - Min/max flow rate when fully open
  - Back-check flow control devices
  - Choke size and type if applicable
  - Latch (size and type)
  - Seal bore
  - Communications ports
  - Conduit ports

API 19G2 Flow-Control Types

- IPO
- Balanced IPO
- IPO with choke

- PPO
- Pilot
- Orifice

- Venturi
- Nozzle
- Shear orifice

- Dump/kill
- Dummy

- Surface controlled could be one of these or have several attributes at the same time.

API 19G2 Design Verification

- Requires more then one flow-control device for evaluation

- Meets supplier/manufacturer's technical specification

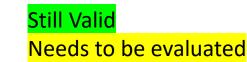- Validation testing shall be performed in fixtures/apparatus

API 19G2 Annex B Design Validation Testing Requirements

A	API Monogram	Provide guidance to API Licensee on the application of the API Monogram.
B	Design validation and device functional testing requirements	List purpose of each annex List all required design validation and device functional test requirements
C	Validation and device functional testing overview	Table summarizing the design validation and device functional testing requirements
D	Interface testing requirements	Design validation testing of all interfaces between flow-control devices and other related devices such as SPMs
E	Insertion testing requirements	Design validation testing of insertion and retrieval of flow-control devices into and from SPMs
F	Probe and travel testing and load rate determination	Design validation testing of maximum travel and load rate Device functional testing of maximum travel and load rate
G	Dynamic flow testing and flow coefficient, , calculation	Design validation testing of flow and flow coefficient, Device functional testing of flow and flow coefficient,
H	Back-check testing	Design validation testing of back-check devices Device functional testing of back-check devices
I	Opening and closing pressure testing	Design validation testing of opening and closing Device functional testing of opening and closing
J	Bellows actuation life cycle testing	Design validation testing of bellows life cycles
K	Erosion testing requirements	Design validation testing of effects of erosion
L	Shelf (bellows integrity) testing requirements for nitrogen-pressure charged flow-control devices	Design validation shelf (bellows integrity) testing Device functional shelf (bellows integrity) testing
M	Conducting port/seat leakage rate testing	Design validation testing of port/seat leakage rates Device functional testing of port/seat leakage rates

Still Valid

Needs to be evaluated

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API 19G2 Annex D Interface

- SPM, KOT, Latch, Running/Pulling tool
- For retrievable systems yes this should still be valid
- For non-retrievable not required (assumption) but reference to API 19G15 (permanent)
- Interface to surface acquisition and control API 19E?

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API 19G2 Annex E Insertion

- Insertion into the SPM shall not change "set pressure or operating characteristics"
- Permanent systems not required
- Retrievable same follow the standard but testing the open/close feature or bellows if applicable

API 19G2 Annex F Probe and Travel Testing and Load Rate Determination

- For bellows system no change

- For open/close system - evaluate

- Are 7 devices needed?

- Measure device open/close movement and does it fall withing manufacturer's specification.

- Record Load rate or other measurement (load force?)

- Probe test – signal vs movement (variable)

- Lots of graphs/plots/equations for bellows system – equivalent?

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API 19G2 Annex G Dynamic Flow Testing and Flow Coefficient Calculation

- Evaluate the flow coefficient of various port sizes
- Minimum and maximum port sizes will be tested
  - Variable choke manufacture recommends the minimum port size and maximum would be fully open
  - Need to determine the equivalent number of port sizes in a variable choke size to properly characterize the valve
  - For open/close system or the FCD would be evaluated as per standard
  - Crack pressure vs open?

API 19G2 Annex H Back-check testing

- No change for systems that have back checks
- If open/close system can act as a programmed back check or barrier then must comply with the testing in this section

API 19G2 Annex I – Opening and Closing Pressure Testing

- For bellows systems no change
- For surfaced controlled systems need number of cycles to open and close before failure
- 3500 cycles is the minimum, maximum to failure
- Temperature vs electronics
- API 19E

API 19GX

- For a surface controlled gas lift system, need to validate and function test the surface controller as per manufacturer specification which is not covered in API 19G1, 19G2 or 19G3.
- Identify what can be used from API 19G1, 19G2, 19G3, API 19E and bring this together into a standard for surface controlled GL.
- Would operators want API monogram on such a system?

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Surface-Controlled Gas Lift Systems

- Does API 19G1 and 19G2 sufficiently cover surface-controlled gas lift systems?
  - NO

- Is there a need to develop an API standard that covers surface-controlled gas lift and would you participate?
  - YES (Industry Survey)
    - 17 out of 20 supporters and willing participants
    - 5 operators "Yes" out of 8 with one maybe
    - 8 suppliers "Yes" and 4 consultants "Yes"
    - SRRR submitted

Acknowledgements/Thanks & Questions

- Simon Suarez (Silverwell Energy) - for definition of surfaced controlled gas lift system.
- Greg Stephenson (Gas Lift API 19G task group El Jefe, Oxy)– Answering the question if API19G standards covers surfaced controlled gas lift.
- Oguzhan Guven (API 19ICV Chair, Schlumberger) – Answering the question if API 19ICV covers surfaced controlled gas lift.

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