API C2 / SC 17
SUBCOMMITTEE ON SUBSEA PRODUCTION SYSTEMS

API 17G4 Riserless Subsea Well Intervention Systems
REVISION TASK GROUP STATUS

8TH JANUARY 2015
1. STATUS

Last meeting held was a telecom meeting September 25th. Changes and additions were made to the document, which was subsequently sent out for comment. Updates and additions were made although very little response was received. The current version of the document is attached below.

2. MEMBERSHIP

17G4 membership has increased with the addition of a couple of new members although most are inactive. We still need some new members or contribution from existing members. The following table identifies current task group members.

**TABLE 1-1: API RP17W TASK GROUP MEMBERS**

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3. **UPDATED TARGET DATES FOR DELIVERABLES**

   A first draft is attached. Plan to have a more complete second draft ready by end of March 2015.

4. **MAJOR ISSUES**

   No major issues but challenge is to get input from more companies to ensure

5. **ANTICIPATED NEW WORK ITEMS**

   Nothing specific but need to add more substance to existing sections and add some new.

6. **PLANS FOR FUTURE MEETINGS**

   Plan to have another telecom meeting in February 2015.

7. **RESOURCE NEEDS**

   None at this time.

8. **ADDITIONAL INFORMATION**

   We are working closely with the 17G2 group to ensure there is no overlap and also the main 17G document to avoid duplication.
Recommended Practice for Riserless Subsea Well Intervention Systems

ANSI/API RECOMMENDED PRACTICE 17G4
FIRST EDITION, December 2014 Draft

(Note .... All Clauses have been updated based on previous topic discussions with highlighted comments in yellow)
1 SCOPE

1.1 Introduction

API 17G4 is a supplementary document to API Spec 17G. 17G4 will describe equipment, practices, and systems used for open water riserless well interventions on subsea wells. It is not intended to replace sound engineering judgment. It is necessary that users of API 17G4 be aware that additional or different requirements can better suit the demands of a particular service environment, the regulations of a jurisdictional authority or other scenarios not specifically addressed.

1.2 Purpose

API 17G4 is intended to supplement API Spec 17G as a Recommended Practice, but with regard to open water riserless subsea well interventions. If not specifically referenced in this supplement, then the expectation would be that the main API 17G document would prevail.

1.3 Specific Equipment Covered in the Document

Specific equipment covered by API 17G4 for Open Water Riserless well intervention operations is listed as follows:
   a) Pressure Control Head and Dynamic Seal
   b) Lubricator and Lubricator Connectors
   c) Lubricator / Re-entry Connector
   d) Tool Storage
   e) Emergency disconnect package (EDP);
   f) Well control package (WCP).

1.4 Specific Equipment Not Covered in the Document

Specific Equipment not covered by API 17G4 for Open Water Riserless well intervention operations is listed as follows:
   a) Internal and external tree caps;
   b) Tree Running Tool
   c) Cross-Overs and/or Adapters from the Subsea Tree to the Well Control Package
   d) Surface wireline units, wireline, and wireline tools;
e) Surface coiled tubing units, coiled tubing, and coiled tubing tools;
f) The vessel and all navigational equipment
g) All equipment above the water line unless specifically mentioned

How manage operational scope in Chapter 1

2 NORMATIVE REFERENCES

The following referenced documents are supplemental to the documents sited in API 17G. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

3 KEY TERMS AND DEFINITIONS

It is recommended that the user refer to API Spec 17G for subsea well intervention terms and definitions not referenced here.

3.1 Terms and Definitions

3.1.1 Open-Water Riserless:
No conduit is used to convey well intervention tools/equipment from the surface to the subsea well intervention package (Lubricator/EDP/WCP).

3.1.2 Well Intervention:
Entry of tools from the well intervention package into the wellbore, typically thru-tubing operations.

3.1.3 Riserless Well Containment Package (RWCP):
Subsea equipment package that connects to the top of the SSXT and contains at least two independent and testable barriers which typically consists of a shear/seal device and one other independent isolation device.

3.1.4 Riserless Emergency Disconnect System (REDS):
Subsea equipment that connects to the WCP and provides a disconnection point and typically isolation device(s) in production bore and annulus to prevent lubricator contents from being released to the sea in the case of disconnect.

3.1.5 Contingent Safe State:
RWCP has two barriers to the sea activated and holding such that with all other equipment disconnected, the remaining RWCP components and barrier devices can secure the well and allow for future well recovery.
3.2 Abbreviated Terms
Likely a few RLWI specific terms to add here.

3.3 Symbols
Likely nothing in here

3.4 Nomenclature
We do need to generate similar “block diagrams” as is in the main 17G to show the major components of a RLWI system. Similar to Figure 3-2 in 17G, as we want to be consistent.

4 SYSTEM REQUIREMENTS

4.1 Purpose

Section 4 recommends system requirements for riserless open-water riserless subsea well intervention systems.

4.2 Responsibilities

As per 17G

4.3 Description

The system and contingency states must maintain containment at all times. A subsea riserless open-water well intervention system comprises the following:

- Subsea Lubricator & Pressure Control Head
- Riserless subsea Well Containment Package (RWCP)
- Riserless Emergency Disconnect System (REDS)
- Tool Package
- Vessel Support Equipment for intervention operations

4.4 System General Arrangement

A typical arrangement of a subsea riserless well interventions system is illustrated in Figure 1.
4.5 System Engineering, Definition and Design

The subsea riserless well intervention control systems, equipment, valves and connections shall be designed and qualified for the intended subsea application, and in accordance with applicable standards. The system must be designed to handle contingencies and maintain containment at all times.

4.5.1 General Requirements

- System integrity design, pressure and temperature ratings, and other applicable general system design and performance shall be in accordance with API 17G.
- All RLWI control systems including emergency disconnect, hydraulic controls, BOP & connector controls, jumpers and Injection/circulation lines shall all be in accordance with API 16D.
- For a riser contingency based system, all flanged connections in the vertical part of the WCP shall be in accordance with API 17D (ISO 13628-6)/ API6AF and where applicable, have a capacity of a 13 5/8” API 10m flange.
- In order to minimize bending moment in the lubricator stack in a drift off situation, the guide wires, injection/circulation lines and umbilical disconnects shall be designed and operated in a way to prevent snag loads to the lubricator if the vessel is drifting off position.

Figure 1: General Layout for RLWI system (needed?)
• If vessel position is lost, where applicable, the wireline, guide wires, deployment wires, umbilicals and injection/circulation lines shall be released in a controlled manner before unacceptable loads occur in the subsea system, XT or any well barrier elements below.
• The control system shall be designed such that whenever an emergency quick disconnect (EQD) is initiated, an automatic release/cutting/pull-off of wireline, guide wires, deployment wires, umbilicals, and injection/circulation lines will take place.
• The RLWI system shall contain a hydraulic interface to control the subsea tree and down hole safety valve where applicable. For horizontal X-mas tree systems with a ball valve in the tree cap, features for operating this ball valve should be included.

4.6 General
(As per 17G)

4.7 Modes of Operation

Wireline (Electric Line, Braided Wire and Slick Line)
Coiled Tubing (tbd)

4.8 System Functional Requirements

An open-water riserless subsea well intervention system shall fulfill the following requirements, as appropriate:
   a) Allow wellbore servicing with wireline and coiled tubing (tbd);
   b) Provide a means of subsea access for tools to the individual bores of a subsea tree or tubing head;
   c) Provide a means to circulate or displace fluids
   d) Provide the means for connecting riserless equipment together in a safe and efficient manner;
   e) Allow for running conveyance and intervention tooling through open sea;
   f) Provide a means for connecting control lines to the riserless equipment.

4.9 Design Principles (as per 17G)

4.10 Operational Principles (as per 17G)

4.11 Safety Principles (as per 17G)
4.12 Safety Strategy (as per 17G)

4.13 Barrier Requirements

The primary barrier envelope extends from the existing subsea tree to the lubricator and dynamic seals. The secondary barrier envelope terminates at the subsea riserless well control package.
At least two independent and tested barriers between the reservoir and the environment should be available in order to prevent unintentional flow from the well. The purpose of the secondary barrier is to maintain containment until the primary can be reinstated.

4.14 Regulations, Codes, and Standards

Need a table similar to 17G Table 4-2.

4.15 Operational Requirements

Riserless subsea well intervention systems are classified as a temporary system and normally have a limited operating envelope. In situations where operating conditions are expected to exceed the allowable values, barriers shall be set and the riserless subsea well intervention system shall either be disconnected from surface lines or retrieved. Refer to 17G Table 4-3 for lowering probability of drive/off drift/off occurrence. Table 4-4 for managing consequences.

5 FUNCTIONAL REQUIREMENTS

5.1 Purpose

Section 5 specifies the functional requirements for the individual types of equipment included in a subsea riserless well intervention system (SRWIS). Each equipment type is defined in terms of its function and system interfaces.

5.2 Common Requirements

Requirements that are common to all equipment in the subsea riserless well intervention system are as follows:

a) The SRWIS shall be maintainable. All parts of the system intended for maintenance shall be capable of being safely dismantled. Trapped volumes with potential pressure shall be safely evacuated;
b) The SRWIS must be compatible with all chemicals and hydrocarbons that may be encountered;

c) The SRWIS shall conform to a dual barrier philosophy;

d) All equipment that can be subject to net differential pressure (i.e., from hydrostatic head or internal pressure greater than ambient) shall be designed to withstand these pressures;

e) No portion of the SRWIS shall transmit undue forces to the subsea architecture / well control package;

f) The system must allow for safe release of pressure and flushing of complete system;

g) The design of guidance systems shall address seal makeup tolerance, angle of re-entry and release, damage to control interfaces and seal surfaces, ability to access existing guidelines, and posts or re-entry funnels, wherever appropriate;

h) Consideration shall be given to safe operation and lifting / handling of the equipment;

i) The SRWIS is to be designed to maximize health and safety of the operator, maintenance, crew and environment;

5.2 Riserless Well Containment Package (RWCP)

A RWCP may typically include the following components:
   a) Subsea control system;
   b) Upper barrier valve/ram;
   c) Lower barrier valve/ram;
   d) Lubricator/re-entry hub connector;
   e) Wireline/Coiled tubing pressure control equipment & shear seal rams/valves;
   f) Injection/circulation system;
   g) Emergency disconnect system (EDS)
   h) Tree running tool (TRT);
   i) Connector adapter;
   j) ROV/Diver interfaces;

The RWCP may be configured as a single unit or as a sectioned unit and may be equipped with an upper re-entry spool interface with the EDS or other connector.

The RWCP shall provide all mechanical support and be able to withstand the combined effects of down lines, tensioning, and bending, as well as internal and external pressure.
All valves in the flow path shall have position indicators observable by ROV/diver.

5.3.1 Subsea Control System

The subsea control system should perform in a manner, which is efficient, safe and protects the environment. Performance requirements for the control system as a whole should;

a) Shall adequately control the RWCP;
b) Must be able to initiate the EDS;
c) Should allow for redundancy as required;

5.3.2 Upper Barrier Valve/Ram

The upper test valve serves as a barrier element, and is also used for lubricator pressure testing every time the lubricator is run. The valve shall be “fail in position” and control logic of the valve shall be designed to ensure the valve will remain in position in case of loss of hydraulic supply. The valve shall have bi-directional sealing capabilities.

5.3.3 Lower Barrier Valve/Ram

The lower test valve shall serve as a barrier element during the operations to ensure a double block against well pressure when lubricating tool strings in and out of the well. The valve shall be “fail in position” and control logic of the valve shall be designed to ensure the valve will remain in position in case of loss of hydraulic supply. The valve shall have bi-directional sealing capabilities. It shall be possible to close the valve after a disconnection by use of an ROV hot stab and a mechanical locking device shall prevent the valve from accidentally opening after closure.

5.3.4 Lubricator/Re-entry Hub Connector

A disconnect point with a re-entry hub shall be located above the test valve to allow for retrieval/repair of the Lubricator and/or pressure control head. The re-entry connector shall be designed to take all expected loads from the lubricator and/or pressure control head and allow for separate retrieval of that section.

5.3.5 Wireline/Coiled Tubing Pressure Control Equipment & Shearing Rams/Valves

The wireline shear seal ram shall be able to cut all relevant wire and or coiled tubing sizes, if required, and seal in the closed position. This valve shall be able to hold pressure from below up to the system rated pressure. A shear seal ram not meeting the requirements for coiled tubing operations will limit the possibility to perform remedial operations utilizing a high pressure riser system. A shear seal ram for coiled tubing operations is therefore the recommended option if the ability to connect a riser is required. Design and performance shall be in accordance with API 16A (ISO 13533).

5.3.6 Injection/Circulation System

There shall be an injection/circulation system with the function to inject fluid mixtures into the wellbore. The system shall have a pressure rating equal to the subsea well intervention system. It shall be possible to displace seawater with hydrate inhibiting fluid prior to allowing well pressure to enter the lubricator and to circulate out, or bleed off hydrocarbons from the RLWI system prior to disconnect. This shall be obtained by flushing lines located at the
upper- and lower end of the lubricator tube and WCP. It shall be possible to bleed pressure from the lubricator through all circulation ports in case of hydrates blocking an outlet from the lubricator.
The Injection/Circulation system lines shall have two isolation valves in series between the WCP main bore and the Injection/Circulation line connection point. The isolation valves shall be hydraulic operated, “fail safe close” and have a bidirectional sealing design. The isolation valves nearest to the WCP production bore or XT annulus bore shall be integrated or bolted directly to the WCP block. It shall be possible to connect and disconnect the Injection/Circulation line by use of an ROV. In addition, an emergency disconnect device that is independent of the ROV shall be included.

5.3.7 Emergency Disconnect System (EDS)
The intent of the EDS is to prevent unacceptable release to the environment and/or transmission of unacceptable loads to the subsea safety module. The emergency disconnect package (EDS) shall provide a disconnect of subsea fluid conduits, or umbilicals attached to a surface vessel in the event of a loss of vessel station-keeping or unexpected environmental conditions.

The EDP shall be configured such that the initiation of an emergency disconnect will result in the WCP having the required number of barriers sealing the well bore. If accumulators are used, there shall be a method to monitor and charge the system. The EDP shall be remotely operated at surface and have a mechanical override. Following an emergency release of lines, with vessel back on location, it shall be possible to rerun and connect guide wires, deployment wires, umbilicals, jumpers and injection/circulation lines subsea by use of an ROV. 

5.4 Lubricator Assembly
The lubricator is situated above the WCP. The primary function of the lubricator is to allow entry of the tool string into the well and its return while under well pressure. The lubricator may consist of stress joint and lubricator pipe sections. The lubricator sections shall be designed to take operational loads without lateral support. The design shall ensure failure above the well containment barriers in the case of excessive bending moments. The upper lubricator section consists of the following:

• Pressure control head
• Tool catcher (or tool trap in lower section)
• Upper lubricator section connector (optional)

The lower lubricator section consists of the following:

• Lubricator tube
• Injection circulation system
• Tool trap (or tool catcher in upper section)
• Lower lubricator section connector
The design of the lubricator shall allow for disconnection of the lubricator and or pressure control head for retrieval to surface for maintenance with required well barrier elements in place and controlling the well.

5.4.1 Pressure Control Head
The primary function of the pressure control head is to allow the wireline/coiled tubing to enter the well under pressure with minimum friction and no well fluid escape. The pressure control head provides for a primary well barrier while allowing the wireline/coiled tubing to move into or out of the well. This will require a “dynamic seal” common in wireline and coiled tubing operations. Dynamic seals isolate the wellbore from the environment whilst allowing a means of conveyance such as wireline or coiled tubing to pass between the environment and the wellbore either statically or in motion.
A grease injection system shall have a working pressure that provides adequate seal, and shall be capable of retaining pressure greater than the wellhead shut-in pressure. A backup system shall be incorporated to seal around the wireline in case of loss of the grease-seal. Release of grease to the environment shall be kept to a minimum. The grease shall be environmentally friendly. *(Mention the need to seal from the sea to the wellbore in deep water?)*

5.4.2 Grease Pack Off Assembly
The grease pack off assembly shall have the same functionality as a wireline PCE. The pack off assembly shall act as a back up to the primary barriers in the stuffing box/grease head. There shall be a minimum of two elements sealing around the applicable wire with the provisions for grease injection between the elements.

5.4.3 Tool Trap/Tool Catcher
The lubricator stack shall include an arrangement to prevent the tool from accidentally being dropped into the well or onto the top of a well barrier, in case the wire parts or is pulled out of the rope-socket.
The tool-catcher shall be located directly below the pressure control head. Alternatively a tool-trap can substitute for a tool-catcher. The tool-trap shall be situated just below the lubricator.

5.4.4 Upper Lubricator Section Connector
The upper lubricator section connector shall ensure efficient subsea mating of the two lubricator sections and shall have the same functional requirements as per API 17D. The connector shall be designed for multiple make/break instances without the need to change the seal. Guide wire guide arms may be used for lateral control of the connector during running/mating.

5.4.5 Lubricator Tube
The lubricator may be divided into sections of suitable lengths with connections that are gas tight and have seals as per API 17D (ISO 13628-7).
Depending on the design of the wellhead, XT and WCP, it may be necessary to design the lubricator tube to be a safety joint/weak link, to ensure acceptable consequences of accidental events, e.g. loss of position. For accidental load conditions, controlled yielding/bending of the lubricator tube is acceptable, as long as well control is maintained.
5.4.6 Lower Lubricator Section Connector
The lower lubricator section connector shall ensure efficient subsea mating of the Lower lubricator section and the Well control package. It shall be possible to disconnect the lower lubricator section connector without any umbilical connected to the RLWI system. Guide wire guide arms may be installed for lateral support.

5.5 Connectors
Connectors shall be in accordance with API 17G 5.21.1, 5.21.2 and 6.6 connector design requirements.

5.6 Pumping Equipment

5.6.1 Surface Pumping Equipment
Surface pumping equipment is covered by other specifications and requirements;

5.6.2 Subsea Pumping Equipment
Subsea pumping equipment shall conform to the common requirements of API 17G4 sect. 5.2.

Subsea pumping control systems should be incorporated in to the EDS philosophy to prevent continued pumping after an EDS event.

5.7 Intervention Fluid Storage

5.7.1 Surface Fluid Storage
Functional requirements for surface fluid storage are covered under other applicable API and ASME specifications and guidelines.

5.7.2 Subsea Fluid Storage
Subsea fluid storage equipment should be designed with an appropriate foundation that can adequately support the combined weight of the package and intended contents at full capacity. Subsea fluid storage equipment shall be pressure balanced with ambient pressure during deployment and recovery. It is not intended for subsea fluid storage equipment referred to in this section to accept returns from the well bore.

5.8 Subsea Fluid Conduits
This section refers to fluid conduit connecting a surface vessel to the RWCP. Subsea fluid conduits allow fluids to be safely pumped from the surface equipment the SBP. They are exposed to both internal pressure and external pressure. Internal pressure can be as high as the equipment maximum allowable test pressure, while external pressure can approach the ambient seawater pressure at the maximum reach of the conduit.
Subsea fluid conduits may be comprised of jointed pipe; semi-ridged products such as carbon steel coil tubing, composite coiled tubing; bonded products, or various hoses. Subsea fluid conduits may be made up of different types of materials to fit environmental factors such as vessel movement or depth, and other job requirements. Typically subsea conduits incorporate a flexible flying lead to aid in ease of handling subsea or to absorb vessel movement. Subsea fluid conduits must be compatible with any fluid or chemical that it may contain.

5.9 Down line/Conduit Deployment and Recovery System

  g)  Must be able to recover with conduit filled with heaviest fluid used.
  h)  Must contain the conduit at all times in the event of loss of tension control.
  i)  Must maintain the conduit within the allowable minimum bend radius.
  j)  Reel process piping and components, which include swivels, valves, instrumentation must meet or exceed the MAOP of the conduit.
  k)  System shall be designed to withstand the dynamic forces induced by vessel motion. Particular consideration should be given to the point of over boarding of the conduit.
  l)  Consideration should be given to an isolation philosophy that will allow repair of sealing components that could fail during operations, i.e. fluid swivels, seals, etc.
  m)  Operator controls shall be in a safe location that is removed from potential hazards such as; high-pressure leaks and parting of the conduit.
  n)  Deployment and recovery system should have appropriate equipment or device(s) to allow proper management of conduit fatigue and deployment length.