API RP 5C5: Procedures for Testing Casing and Tubing Connections

David Coe
May 8, 2015
1. Technical Objectives of Connection Test Protocols
2. Historical Context of API RP 5C5 Development
3. API RP 5C5 3rd Ed. - Current 2003 Connection Test Protocol
4. API RP 5C5 - Revised 2015 Connection Test Protocol
5. API RP 5C5: Addressing HPHT Well Engineering
6. Conclusion and Path Forward for API RP 5C5
7. Acknowledgements
• API RP 5C5 : Recommended Practice for Testing Casing and Tubing Connections, 3rd Ed.

- Recommends testing procedures and test acceptance criteria
- Addresses fluid pressure, axial force, bending and make-up torsion
- Recommends tests to determine the galling tendency, sealing performance and structural integrity
API Casing and Tubing Connection Test Protocols
1958-2015

- 1958 - API RP 37 1st Ed.
- 1980 - API RP 37 2nd Ed.
- 1990 - API RP 5C5 1st Ed.
- 1996 - API RP 5C5 2nd Ed.
Revising API RP 5C5 2003-2015

- API RP 5C5 3rd Ed.
  - Revisions of the connection test protocol began in 2004
  - Initial revisions failed the ISO country vote in 2011
  - Working on current “API only” document since 2012

Recommended Practice on Procedures for Testing Casing and Tubing Connections

ANSI/API RECOMMENDED PRACTICE 5C5
THIRD EDITION, JULY 2003
REAFFIRMED, AUGUST 2010

ISO 13679:2002 (Identical), Petroleum and natural gas industries—Procedures for testing casing and tubing connections
• Current API RP 5C5 2003

- API RP 5C5 3rd Ed.; ISO 13679

- Eight test specimens

- Varying geometries and make-up conditions

- Series B & C or Series A & C testing

- Elevated temperature

- Four CAL levels
Provides guidance for interpolation and extrapolation of connection tests.

Full-scale testing is neither necessary nor practical.

Physical testing is complemented by FEA analysis.

**Key**
- no test, no analysis
- analysis only
- test and analysis
Revising API RP 5C5 2003-2015

- API RP 5C5, 2015 revision
  - Four sealability test specimens
  - Varying extreme geometries
  - Series A, B & C testing on all four specimens (CAL IV)
  - Elevated temperature, series A & B testing for all four specimens
  - Six to nine months to execute test program for one size/weight/grade
Revising API RP 5C5 2003-2015

• Technical Challenges of API RP 5C5: 2015 revision

  ◦ Elevated temperature performance properties not defined in API 5C3

  • 1\textsuperscript{st} and 2\textsuperscript{nd} quadrants are straightforward

  • 3\textsuperscript{rd} and 4\textsuperscript{th} quadrants are more difficult

  • Standard, high collapse performance properties not currently defined in the standards although a number of candidate rating approaches such as Klever-Tamano are presented in API TR 5C3.
Revising API RP 5C5 2003-2015

- HPHT Well Engineering in the API RP 5C5: 2015 revision
  - The minimum elevated temperature for CAL IV testing is 356 °F
  - Test protocol
  - Revised connection test protocol
Revising API RP 5C5 2003-2015

- HPHT Well Engineering and Connection Test Protocols
  - Current and previous protocols
  - API 5C5: 2015, CAL I – III
  - Other protocols can be suitable for validation
Revising API RP 5C5 2003-2015

• API RP 5C5 - Standards in Action!

  ◦ Provides testing procedures and test acceptance criteria
  ◦ Provides objective physical test evidence
  ◦ Addresses fluid pressure, axial force and bending
  ◦ Specifies tests to determine:
    • Galling tendency
    • Sealing performance
    • Structural integrity
Revising API RP 5C5 2003-2015

- API RP 5C5: RP on Procedures for Testing Casing and Tubing Connections, 2015 revision
  - API staff are formatting the final draft
  - Anticipate a recommendation for ballot vote at the API 2015 E&P Standards meeting
  - The target publication timeframe is by December 2015
• All my industry colleagues who have been working to revise the connection test protocol over the past years
• The operators, manufacturers and test labs providing support for this revision process
• BSEE for the opportunity to present the current work in revising the connection test protocol