

**RECORD OF MEETING ATTENDANCE**

GROUP: SC6 Valves & Wellheads  
CHAIRMAN: Huntcon  
MEETING: 2007 Summer  
TIME: 8:00  
DATE: Jul 28

COMMITTEE MEMBERS SHOULD MAKE CHANGES TO THEIR PERSONAL RECORD ON THE ATTACHED ROSTER. VISITORS ADDING NAMES TO ROSTER WILL NOT AUTOMATICALLY BECOME MEMBERS OF THE COMMITTEE.

Indicate BEFORE YOUR NAME if you are:  
(M) Member of the Committee in session  
(R) Representing a Committee Member (if so, state member’s name)  
(V) Visitor – ONLY voting members or their Representatives may vote  
(S) Staff

<table>
<thead>
<tr>
<th>NAME (Please Print)</th>
<th>COMPANY/PHONE or email</th>
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<tbody>
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**THIS FORM MUST BE RETURNED TO THE API STAFF**

API standards meetings are open to all interested parties. By participating in the standardization process, you agree: (1) to fully comply with API’s policies and procedures governing standards, (2) that once balloted and approved by API, API shall have the sole and exclusive right to use any materials that are submitted by the participant for use in the standard, (3) you will not provide any material that will violate the rights of any third parties including, but not limited to, patents, copyrights, trade secrets, and trademarks, and (4) to disclose the existence of any patented technologies in the material that you provide.
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<tr>
<th>Name (Please Print)</th>
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An Overview of the New ASME Section VIII, Division 2 Pressure Vessel Code

API Exploration & Production Standards Conference on Oilfield Equipment and Materials
Technical Session 1: Applications of Standards Research
San Francisco, CA, June 26, 2007

David A. Osage
The Equity Engineering Group, Inc.
Shaker Heights, Ohio USA
Presentation Outline

• Introduction
• Development Objectives
• Organization
• Overview – Parts 1 through 9
• Comparison – ASME Section VIII, Div 2: 2006 vs. 2007
• Summary
Introduction

- To remain technically competitive, and to facilitate incorporation of new technology and future updates, ASME is developing a new pressure vessel code.
- This code will replace the existing Section VIII, Division 2 Code, the first release will be July, 2007.
- The new code is being developed primarily to address design and fabrication of *engineered* pressure vessels and will result in significant cost savings for many vessels.
Development Objectives

• Structure/Organize Section VIII considering the following:
  – Division 1 – \textit{Basic} Pressure Vessels (Maintenance/Enhancements)
  – Division 2 – \textit{Engineered} Pressure Vessels (New Code)
  – Division 3 – High Pressure Vessels (Maintenance/Enhancements)

• Optimize code rules to balance technology, user-friendliness, and jurisdictional acceptance

• Develop a new organization and introduce a clear and consistent writing style to facilitate use

• Separate administrative and technical requirements

• Develop rules to facilitate computer implementation

• Incorporate PED and other international requirements

• Incorporate US Customary and Metric units
Organization

- The table of contents for the new code incorporates a modular flat structure to facilitate modifications and enhancements
  - Part 1 – General Requirements
  - Part 2 – Responsibilities and Duties
  - Part 3 – Materials Requirements
  - Part 4 – Design By Rule Requirements
  - Part 5 – Design By Analysis Requirements
  - Part 6 – Fabrication Requirements
  - Part 7 – Examination and Inspection Requirements
  - Part 8 – Pressure Testing Requirements
  - Part 9 – Pressure Vessel Overpressure Protection

- Technical information traditionally placed in Mandatory and Non-Mandatory Appendices at the back of the existing Code will be re-deployed as Annex’s to Parts in the new Code with a similar topic
Overview
Part 1 – General Requirements

- Introduction, Organization and Definitions
- Scope and Jurisdiction
- Pressure Vessels with High Design Pressures
- Unfired Steam Boilers
- Field Assembly
- Referenced Standards
- Units of Measure, Metric and US Customary
Overview
Part 2 – Duties and Responsibilities

- User responsibilities
- Manufacturers responsibilities
- Inspectors duties
- Annexes on User Design Specification (UDS) and the Manufacturers Design Report (MDR)
- Separation of administrative and technical requirements, administrative requirements placed in Informative Annexes
Overview
Part 2 – Duties and Responsibilities

- UDS and MDR – Registered Professional Engineer (RPE) requirement
  - RPE certification has been in the Code since the first issuance; however, codes and standards covering similar equipment do not require RPE certification (e.g. ASME Div. 1, ASME B31.3, API, European, etc.)
  - RPE certification is unique to USA and Canada
  - Industry questionnaire confirmed that RPE certification of UDS and MDR is a barrier to the use of the existing Div 2

- Alternative to the RPE certification developed - Certification of Compliance approach, certification of the UDS and MDR by the individuals in responsible charge of the design and manufacture of the vessel
Overview
Part 3 – Material Requirements

• New allowable stress basis will typically result in higher allowable stresses and lower wall thickness, extent of wall thickness reduction is a function of the YS/TS ratio at the design temperature

• Justification for higher allowable stresses and reduced wall thickness
  – Experience obtained from other PV construction codes
  – More stringent material requirements
  – Higher material toughness requirement
  – Better design rules
  – Increased NDE

• New material models for strength parameters (i.e. stress-strain curves) and physical properties provided to facilitate design and numerical analysis requirements
Overview

Part 3 – Material Requirements

- Modernization of toughness rules - new rules will require higher toughness, CVN=20 ft-lbs minimum
- New toughness rules based on a rigorous fracture mechanics approach
  - Required material toughness developed in terms of a crack driving force based on API 579-1/ASME FFS-1, Part 9 - FAD approach, considers:
    - Reference flaw
    - Primary stress
    - Residual stress
  - Required material resistance developed in terms of a required CVN, CVN will be a function of:
    - Material (generic type, heat treatment, yield strength)
    - Temperature
    - Thickness
Overview
Part 4 – Design By Rule Requirements

• Consolidation of design requirements for welds
• New design methods
  – Cylindrical and spherical shell thickness equations
  – Elliptical and torispherical heads (ASME Code Case 2260)
  – Combined loadings (pressure and net-section axial forces, shear forces, bending moments, and torsion)
  – Junctions at conical transitions including junctions with a stiffening ring and/or knuckle
  – Shells subject to external pressure (ASME Code Case 2286)
  – Evaluation of compressive stresses from combined loadings (ASME Code Case 2286)
  – New nozzle reinforcement design rules for internal/external pressure
Overview
Part 4 – Design By Rule Requirements

• Inclusion of existing design methods:
  – Layered construction
  – Non-circular vessels (ASME Section VIII, Div 1)
  – Lug-type, saddle, and skirt supports (industry accepted procedures, e.g. Zick’s analysis for saddle supports)
  – Rules to evaluate vessels that are outside of tolerances based on API 579-1/ASME FFS-1 2007, Fitness-For-Service
  – Expansion joints (ASME Div 1 rules)
  – Tubesheets (ASME Div 1 rules)

• Part 4 may be used for design of components in the creep range

• Many vessels may be designed using Part 4 without the need for design-by-analysis (Part 5)
Overview
Part 4 – Design By Rule Requirements

- Weld joint efficiency option introduced; the weld joint efficiency will appear explicitly in the design equations as SE, similar to Div 1
- Weld joint efficiencies – significant differences exist between the new Div 2 Code and existing ASME Codes
  - Div 2, 2007 Edition – weld joint efficiencies are a function of material testing group, NDE method and extent of examination, wall thickness, welding process, and service temperature
  - Div 2, 2006 Edition – 100% examination
  - Div 1, 2006 Edition – weld joint efficiencies are a function of extent of examination and weld type; mixed extent of examination is permitted (RT1, RT2, RT3, and RT4)
Overview

Part 5 – Design By Analysis Requirements

- Complete re-organization of Design-By-Analysis (DBA) methods based on prevention of failure modes
  - Plastic Collapse
  - Local Failure (strain limit)
  - Collapse From Buckling
  - Fatigue
- Modernization of DBA methods to accommodate advances in numerical analysis (i.e. FEA)
- Continued use of Hopper Diagram with elastic stress analysis
- Design procedures to prevent plastic collapse using limit load or elastic-plastic stress analysis based on Load Resistance Factor Design (LRFD) concepts
Overview

Part 5 – Design By Analysis Requirements

- Fatigue Analysis
  - Screening criteria for fatigue analysis requirement provided
  - Continued use of fatigue analysis based on smooth bar data
  - New design rules for fatigue based on elastic-plastic analysis
  - Inclusion of new welded joint fatigue method using the Equivalent Structural Stress and Master Fatigue Curve approach developed by Battelle (WRC 474)
  - New cycle counting procedures

- Part 5 analysis methods can be used for design of all components that are not operating in the creep range

- Basic wall thickness equations in Part 4 need not be satisfied if a thinner thickness can be determined using DBA methods in Part 5
Overview
Part 6 – Fabrication Requirements

- Similar fabrication requirements to the existing Div 2
- New fabrication tolerances; if tolerances are exceeded an evaluation may be performed using API 579-1/ASME FFS-1 *Fitness-For-Service*
- Similar PWHT requirements are planned for the initial release; however, development of new time-temperature-thickness criterion for PWHT is under development by PVRC
Overview
Part 7 – Examination Requirements

- Introduction of Testing Group concept to define NDE requirements and weld joint efficiency
- Inclusion and new definition of partial radiography
  - Div 1: approximately 1% coverage
  - Div 2, 2007: 10% coverage
- Ultrasonic NDE may be substituted for radiographic NDE for weld examination
Overview
Part 8 – Pressure Testing Requirements

• New hydrostatic test pressure

\[ P_T = \max \left[ 1.43 \cdot MAWP, \ 1.25 \cdot MAWP \cdot \left( \frac{S_T}{S} \right) \right] \]

• New pneumatic test pressure

\[ P_T = 1.15 \cdot MAWP \cdot \left( \frac{S_T}{S} \right) \]

• Other requirements similar to 2006 edition of Div 2
Overview
Part 9 – Overpressure Protection

- Complete reorganization, utilizes the requirements of Section VIII, Div 1 by reference
- Inclusion of Code Case 2211 philosophy (system design in lieu of pressure relief)
- Update to isolation valve strategy to match what is currently in Appendix M of Section VIII, Div 1
Comparison
ASME Section VIII, Div 2: 2006 vs. 2007

- New allowable stress basis will typically result in higher allowable stresses and lower wall thickness, extent of wall thickness reduction is a function of the YS/TS ratio at the design temperature
- Increase in allowable stress and resulting Wall Thickness Reduction (WTR) may be significant for many materials, indicator is the MYS/MTS ratio
- Consider the following comparison:
  - Design pressure: 1000 psig
  - Inside diameter: 60 inches
  - Weld joint efficiency: 1.0
## Comparison
### ASME Section VIII, Div 2: 2006 vs. 2007

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<td>850</td>
<td>24.5</td>
<td>1.250</td>
<td>28.9</td>
<td>1.056</td>
<td>16</td>
</tr>
</tbody>
</table>
Summary

- ASME Section VIII, Division 2, 2007 has been rewritten to incorporate the latest technology for pressure vessel design
- Alternative to RPE certification of UDS and MDR is provided
- A new allowable stress basis and toughness requirements has been incorporated
- Design-by-rule methods significantly updated to handle most of the common design requirements
- Design-by-analysis procedures have been rewritten and modernized to take advantage of the latest technologies in numerical analysis
- Examination requirements have been updated to support the new allowable stress basis
- New test pressures have been adopted
- Requirements for pressure relief design have been updated
- The new code will result in a significant wall thickness reduction when compared to earlier editions of Section VIII, Division 2
The Materials Task Group of the API RP 6HP Steering Committee shall deliver design data requirements, materials of construction, service environments, and materials performance and testing protocols necessary to enable application of the API RP 6HP design methodology.
ECS January Guidance to API RP 6HP
TG 1 & Materials Work Group

Direction

• The work of the Materials Work Group should continue in order to develop the testing protocols needed for the materials pilot testing.

• The work on revision 5 of RP 6HP should continue in addressing the comments received to date, but revision 6 should not be circulated for comments in order to reduce the resource burden on reviewers, with work continuing only after the pilot materials testing has been successfully completed.

Action

• Demonstration project – advise API RP 6HP TG 01
• Advice to SES MMS F22 characterization
• Post demonstration project address equipment and service environments of interest per API RP 6HP Materials Work Group (~after demonstration project 2008+)
• Low Alloy Steel F22 (2 ¼ Cr 1 Mo) 85 ksi  Hot Work Ratio > much greater than 4

• Testing Program
  – Tensile Testing E8 & E21 (Recommend adding high temperature 450 F, true stress strain curves and shake down behavior cyclic stress strain curve ASTM E1823)
  – CVN testing E23 (Establish upper shelf CVN energy tests at -20 F)
  – Fracture Toughness Testing E1290/E1820
    • Air
    • Slow strain rate 10^-6 per second (API 579 RP Fitness-for-Service)
    • Mildly Sour pH 4.0-4.5 10 kPa (1.4 psi) H2S
  – Fatigue Crack Growth Rate E647
    • Air(20 Hz)
    • Environments
      – Seawater (1/3 Hz) CP (-1100 mv Ag/AgCl)
      – Mildly Sour pH 4.0-4.5 10 kPa (1.4 psi) H2S

• Follow-up Meetings for 6HP RP Materials Work Group to provide testing advice to SES for MMS funded test program (next meeting late July/August)
Back-Up Slides
Scope of Test Program

• Procurement of 2-1/4 Cr – 1 Mo forged material
  – 85 ksi SMYS material
  – Material meets NACE MR0175 / ISO 15156-2
  – Material meets API Spec 6A (PSL 3)
  – Multiple heats of material

• Yield strength
  – Strength vs. Temperature up to 350°F

• Material Toughness
  – Charpy V-Notch
  – Plane strain fracture toughness, $K_{IC}$

• Fatigue Crack Growth Rate
Schedule

- Complete all testing and report by December 2007
- Procurement of materials samples – complete
- Tensile testing – complete
- Charpy V-Notch testing – complete
- Plane strain fracture toughness – Sept 2007
- Fatigue crack growth rate – Nov 2007
Material Samples

- 2-1/4 Cr – 1 Mo forged material typically used for drill through equipment
- Material meets NACE MR0175 / ISO 15156-2
- Material meets API Spec 6A (PSL 3)
- Forgings from 3 different heats of material
  - 8 x 8 x 9 inch forged blocks
- 85 ksi SMYS Q&T
- Test samples taken within 1/4T of forged blocks
- Test samples taken in the transverse direction (S-T)

(a) Rectangular Sections—Specimens Aligned with Reference Directions
Strength vs. Temperature

- Yield strength vs. temperature
- Room temp to 350°F
  - Test at 75°F, 200°F, 350°F
- Test per ASTM E 8 and E 21
  - 3 heats of material
  - 2 specimens per heat per temperature
  - 18 specimens
Charpy V-Notch Toughness

- Charpy V-Notch Impacts
  - 10 mm x 10 mm
  - 3 heats of material
  - 12 specimens
- Test per ASTM E 23
  - Test at -20°F
  - Air
Plane Strain Fracture Toughness

• Compact tension specimens
  – 1-inch thick
  – 3 heats of material
  – 18 specimens
• Test per ASTM E 1820
  – Resistance curve procedure
  – $K_{IC}$, $J_{IC}$, and CTOD
  – Test at 75°F
• Test environment
  – Air
  – Seawater
  – Mild $H_2S$
    • 5.0 – 5.5 pH
    • 3 – 4 psi partial pressure
Fatigue Crack Growth Rate

- Compact tension specimens
  - 0.25-inch thick
  - 3 heats of material
  - 12 specimens
- Test per ASTM E 647
  - 75°F test temperature
  - Environment
    - Air at 20 Hz cycle rate
    - Seawater at 1 Hz cycle rate
    - Mild H₂S at 1/3 Hz cycle rate
  - Decreasing $\Delta K$ procedure
  - Constant stress ratio, R
    - 0.1 and 0.5
ECS Action Summary Items for RP 6HP

- Example Application For Process Clarity
- Finish 5th Revision Comments
- Hold Until Example Complete & Action Taken
Example Application for Clarity-ECS

- Identify Example Component for Analysis
- Perform Div 3 & 6A Analysis Comparison
- Specify to Materials Group Data Required
- Materials Group to Specify Material Test Protocols
- Perform Material Testing Using Protocols
- Adjust Analysis Assumptions
- Write Technical Report
- Build & Test?
DESIGN VERIFICATION ANALYSIS

Design Verification Analysis

Limit Load Analysis
- Design meets strength requirements
  - Redesign: No

Fatigue Analysis
- Design meets Fatigue life requirements
  - Redesign: No

Design meets Mfg functional requirements
- Redesign: No

Design Validation Testing
Materials Property Data via SES-MMS

- Basic Mechanical Design Properties
- Fracture Toughness Testing
- Fatigue Testing
Modify 6HP Approach

- Maintain Full Life Cycle Analysis - Div 3
  - Static Load Analysis
  - Cyclic Fatigue Analysis
  - All Loads Considered (Thermal, Pressure, & Applied)
  - Environmental Exposure Included
- Flow Chart to Determine Fatigue Analysis
  - Two Possible Paths Exist
    - Leak Before Burst Allows S-N Fatigue Analysis
    - Fast Fracture Requires Fracture Mechanics Analysis
- Convene Design Work Group to Review All Details of the Analysis and Agree to Existing Methods or Recommend Alternative Approach
**LIMIT LOAD AND SHAKEDOWN ANALYSIS**

1. **Limit Load and Shakedown Analysis**
   - Incrementally increase loads to verify dimensional stability
   - Run FEA at 1.732 x rated working loads
   - Run FEA at rated working loads
   - Run FEA shakedown analysis

2. **Collapse load > 1.732 x rated working load**
   - Plastic strain < 5%
   - Through section yielding does not occur

3. **Plastic strain < 5%**
   - Yes
   - Σ principal stresses < 2.5 Sy
   - Yes
   - Shakedown occurs within 2 cycles after hydro
   - Yes

4. **Design meets functional sealing & operational requirements**
   - Yes
   - Proceed with Fatigue Analysis

5. **Through section yielding does not occur**
   - Yes

6. **Collapse load > 1.732 x rated working load**
   - Yes
   - Run FEA at 1.732 x rated working loads
   - Run FEA at rated working loads
   - Run FEA shakedown analysis

7. **Yes**
   - Yes
   - Yes
   - Yes
   - Yes

8. **Proceed with Fatigue Analysis**
   - Yes
FATIGUE ANALYSIS

Fatigue Analysis

Leak Before Burst

Failure Mode

Fast Fracture

Fatigue Analysis Based on S-N

Design Meets Specification Requirements

Fatigue Analysis Based On Fracture mechanics

Design Meets Specification Requirements

Re-Design Options:
1) NDE - Improve inspection technology, or
2) Material - Increase fracture toughness, or
3) Design - Redesign to reduce stresses
Material Design Properties

- Fatigue Crack Growth Rate
  - Value needed vs environment
    - Air
    - Mild sour
    - Aggressive sour
  - Value needed vs stress ratio
    - Stress ratio values to be determined
      - \( R = 0 \)
      - \( R = 0.25 \)
      - \( R = 0.50 \)
      - \( R = 0.75 \)
  - Values at 73°F
Overview of 6HP Approach

Assumptions

• Design Life Cycle Analysis
  – Insitu Temp, Press, Loads, & Environments

• Static Stress Analysis
  – FEA to Find Plastic Zones & Peak Stress

• Cyclic Fatigue Analysis
  – Using Environment and Life Cycle Loads

• Since Div 3 Requires the Above, It was Referenced as the Basic Code
Lifecycle analysis requires the user and designer to understand and determine the failure mode of the equipment under review. Knowing the failure mode(s), analysis can be performed to determine the number of load cycles (pressure, temperature, and external/internal loads) to failure. This requires an understanding of the loads by the user and designer. Knowing the load cycles and number of cycles to failure, a determination of the application of the particular piece of equipment can be made.
Design Lifecycle Analysis
Results

- The number of load cycles exceeds the design life requirements of the service of the equipment and it is satisfactory for use.
- The number of load cycles does not meet the expected service load cycles and the equipment will need to be inspected at certain intervals.
- The number of load cycles does not meet the expected service load cycles and the equipment cannot be inspected or it is decided there are design changes required.
Sour Service Considerations

• The User and Designer agree on the BOD and Design Parameters for the Component

• Typically the Pressure Containment Component will be Used for:
  – Drilling
  – Production

• The Wellbore Fluids Exposed to Surfaces:
  – Drilling/Completion Fluids
  – Produced Fluids
Sour Service Considerations

1. Drill Through

- For drill through equipment (6A, 16A, 17D), the user can specify the wetted wellbore surfaces of the equipment will have a drilling water base fluid of pH about 10, or, a synthetic oil base mud. Both of these fluids will mitigate the effects of a mild to moderate aggressive sour environment.

- Existing Materials are Used for this Application
2. Production Equipment

• For production equipment, the user and designer can agree that the pressure containment material will be a Corrosion Resistant Alloy (CRA) or if low alloy steel is used, the wetted surfaces will be protected from sour service environments by some form of CRA overlay or cladding.

• Existing Materials are Used for this Application
3. Qualification of Materials for Sour Service

- Materials may be selected for use in drilling or production where the exposure to sour environments is not known.
  - This will require extensive material testing in a sour environment
  - Obtaining the material properties for a fatigue analysis using S-N curves or Fracture Mechanics Analysis (depending on the failure mode) is not well known.
Sour Service Considerations

• While all three options above are valid for possible application, historically only 1 and 2 have been widely used.

• These methods are valid for use in a RP 6HP (Div 3) verification.

• Option 3 above is more applicable to casing or tubing where higher strength and sour properties are desirable from cost effective materials.
Example of Plane Strain Fracture
Fast Fracture
Objectives (Implementation)

- Establish sub-committees to carry out necessary tasks in support of RP requirements
- Publish
  - material design requirements (data tables of properties)
  - materials of construction
  - service environments
  - testing protocols to provide required material properties
    o Performance
    o QC requirements (?)
- Integration of above into final recommendations/report for Steering Committee
Timeline

- Start middle of 2006
- Monthly meetings (2nd Thursday of each month)
- Draft document-June 2007 API Summer Meetings
- Target First Version Completion-December 2007

Key Dates
- MMS Work Starts 1 Quarter 2007 ($280 M)
- REPSA funding opportunity
- API January Meeting-Sour Service Committee
- NACE – March 11 to 16 Nashville
1-DESIGN DATA REQUIREMENTS

Properties of metals required for application of API RP 6HP design methodology

- Tensile Properties
- Fracture Toughness
- Fatigue Crack Growth Rate
- Initial flaw size/Probability of Detection
- H2S Resistance

2-MATERIALS OF CONSTRUCTION

Candidate Materials of Construction

3-ENVIRONMENTS

Basis of Design (BOD) Environments for various components

- Classes of DOB Environments
- Representative environments for identified DOB environment class

4-MATERIAL CHARACTERIZATION

Protocols for characterization of candidate materials to provide appropriate design data and design tables

- Tensile Properties
- Physical Properties
- Fracture Toughness
- Fatigue Crack Growth Rates
- H2S Resistance
- Other Environmental Resistance
Scope – Design Task Group

- Identify material properties necessary for doing a design verification analysis of HPHT equipment in accordance with API RP 6HP.
  - Limit Load Analysis
  - Shakedown Analysis
  - Linear Elastic Fracture Mechanics Analysis
  - Corrosion
  - Environmentally assisted cracking

- Material QA/QC data requirements are not included
- Should weldment of HPHT pressure containing be permissible?
Material Design Properties

- Plane strain fracture toughness, $K_{1C}$
  - Value needed vs environment
    - Air
    - Mild sour
    - Aggressive sour
  - Test temperatures
    - -20°F
    - 39°F (4°C)
Material Design Properties

- Fatigue Crack Growth Threshold
  - Value needed vs environment
    - Air
    - Mild sour
    - Aggressive sour
  - Values at 73°F
Issues Relating to 6HP Effort

• Subsea Equipment Needs to Be Rated for Differential Pressure Rather Than Absolute
  – Surface vs. Subsea Rating
    • Subsea Needs Tension and Bending Moments Incl.
  – Water Depth Rating
    • Deepwater vs. Shallow Water Depths

• 18 ¾” – 20 ksi Flange Development
  – One WG Kick-Off Meeting
    • Significant Industry Interest
June 27, 2007

Attention:  API T/G Members

Subject:  Minutes of meeting on 6D/6DSS Revisions and Corrections

Date:  June 27th, 2007

Location:  84th Exploration & Production Standards Conference on Oilfield Equipment and Materials held at the Hyatt Regency Hotel San Francisco, California USA.

Minutes

- Meeting was opened at 8:30am and welcome was given by Rick Faircloth Chairman of API 6D/6DSS Task Group. All in attendance we asked to give there name and company affiliation.

- A final report was issued by the API 6DSS Sub-Task Group on the Ballot for API Regional Annex G and presented the publication of the new API Spec 6DSS / ISO 14723, Subsea Pipeline Valves including API Regional Annex G.

- A status report was given on the progress of ISO TC67 SC2 WG2 and EDC to move ISO- DIS 14313 Pipeline valves. Also it was advise that SC6 has been requested to parallel vote to adopt back this document as the 23rd Edition of API Spec 6D.

- The TG members reviewed the purposed FDIS-14313 text that is currently being edited by ISO in Geneva. Most members agreed with text as presented, however there is an issue with mandatory chemistry and carbon equivalent for all carbon steel pressure containing and pressure controlling parts subject to welding, weld repair or weld overlay. This may not be acceptable to SC6 membership and a future API Regional Annex may be needed to resolve this issue.

The TG chairman agreed to contact the ISO WG2 technical committee to Determine if a compromise can be found prior to publication to avoid an API Regional annex on the 23rd Edition of API spec 6D.
• Discussion on process to provide audit check list questions for new API Spec 6DSS and recommend that API quality programs to add this standard to the API Quality monogram program. It was agreed by the TG that API Quality programs provide a draft list of check list questions and the TG to review for comment and ranking of the specific audit questions.

• Report on use of API RP 6DR Repair and Remanufacture of Pipeline Valves was given and that API Standards associate to forward copy to MMS/DOT for review and possible use in CFR’s.

• TG discussed the need to provide a specific section in API spec 6D to address validation of processes. It was agreed by the TG that the current 6D product standard has sufficient text in the material section, control of welding, heat treatment and non-destructive testing that no further reference is needed. This agreement will be forwarded to SC18 as requested.

• Meeting was concluded at 11:30 am.

Regards,

Rick Faircloth

Chairman- 6D/6DSS TG on Revisions and Corrections
API SC6 Task group Report

Work Item 6A-2002-06-3: Verification/Validation in API Spec 6A

Task group Members:

Austin Freeman, chairman
Sterling Lewis
Eric Wehner
John Yonker

Prepared June 18, 2007
Background

At the API SC6 meeting in June, 2006, a task group was commissioned to study API Spec 6A for the use of the word “verification” in instances where the intended meaning might more correctly be met with the term “validation”. This was investigation was to bring the document into alignment with the requirements of API Spec Q1. See the Appendix of this report for the additional Q1 requirements related to design verification [7.3.5] and design validation [7.3.6]. For reference, the definitions of the two terms are given below:

3.1.6 design validation
process of proving a design by testing to demonstrate conformity of the product to design requirements

3.1.7 design verification
process of examining the result of a given design or development activity to determine conformity with specified requirements

Progress & Methodology

Following pre-work by the chair to gather the instances of the usage of the terms, the members of the workgroup met on March 12 and May 8, 2007 to review the document and agree on the necessary changes. An initial report was drafted and sent to the workgroup and chairman of SC6 for review. Additionally, the report was reviewed by an AWHEM taskgroup who suggested that the term “performance verification” in the original 6A document should be replaced entirely by “design validation” instead of creating a new term “performance validation”. These changes were reviewed by the members of the NWI workgroup on June 18 and this final version of the report developed. The methodology chosen for the review was to copy the selected text into a Word document, make changes in the document using strikeout font for words removed and red font for words added.

Results

The 6A document was reviewed for the use of the words “verification” and “validation”. There were 218 instances found of the use of verification. Of these, there were many references to “dimensional verification” and many others refer to “performance verification”, or “verification procedures” or “verification tests”. The word “validation” is not in the current version of API Spec 6A.

Performance verification

Following are the instances where the words “performance verification” should be replaced by “design validation” and the words “verify” or “verified” replaced by “validate” or “validated.” The word “verification” alone was also inconsistently used in the original document when it was meant to say “performance verification”. The changes suggested below correct that inconsistency by replacing “verification” with “design validation” where appropriate.

4.7 Design verification validation
Manufacturers shall document their design verification validation procedures and the results of performance verification design validation. The performance verification design validation procedures including acceptance criteria for SSVs and USVs are given in Annex I. Additional verification validation procedures, including acceptance criteria, are given in Annex F to be used if specified by the manufacturer or purchaser.
10.20.2.2 SSV valve design
A multiple or block-type valve qualifies as a wellhead SSV for performance requirement PR2 standard service and Annex I class I or II service, without verification validation testing, if it is of the same internal design as an SSV valve within the manufacturer’s product line which has passed the verification validation test in Annex I. Such valves shall be manufactured and supplied in accordance with all other applicable requirements of this International Standard.

10.20.4.3 Verification Design validation testing
a) PR2 class I and II service
To verify validate a specific PR2 standard service valve for a SSV/USV design, the manufacturer shall satisfy the class I or class II test in accordance with Annex I.
b) Test requirements
Any significant change in the design or materials of construction which would affect the SSV/USV valve bore sealing mechanism shall require re-qualification by verification validation testing. Qualification of an SSV qualifies a USV with the same SSV valve-bore sealing mechanism and vice versa. The valve may be tested with or without the actuator.

10.20.4.4 Verification Validation testing of heat-sensitive lock-open devices
Tests to confirm the design requirements of 10.20.2.5 shall be done in an air environment with air velocity past the SSV actuator due to natural air convection only. The manufacturer shall have data available to show that the device has been sufficiently tested to ensure that it is capable of satisfying the design requirements.

A.2 Data sheets
The following pages contain questions and information that can be used to select wellhead equipment, including chokes and actuators. Table A.2 contains general information which pertains to the entire well. Tables A.3 to A.12 are designed to be used for each type of equipment.
The effects of external loads (i.e. bending moments, tensions, etc.) on the assembly of components are not explicitly addressed by this International Standard (see 4.2.1.3). The purchaser should specify any exceptional loading configuration.
The purchaser should specify whether the performance verification design validation procedures in Annex F are applicable.

Annex F (informative)
Performance verification Design validation procedures

F.1 Performance verification Design validation - General requirements
F.1.1 Application
F.1.1.1 General
This annex provides performance verification design validation procedures for qualification of equipment specified by this International Standard, which shall be applied if specified by the manufacturer or purchaser.
The performance requirements apply to all products being manufactured and delivered for service (see 4.1). The performance verification design validation procedures in this annex are to be applied to designs of products, including design changes. Verification Validation testing specified in this annex is intended to be performed on prototypes or production models (see also 4.7).

F.1.1.3 Other verification validation tests
Verification Validation tests that have been completed in accordance with verification validation testing requirements of API Spec 6A, during its validity, will satisfy the requirements of this annex.
The task group noted that the phrase "during its validity" was incorporated by the ISO workgroup with thoughts that API Spec 6A would be going away. We recommend changing this language to reflect the current situation. If a specific version of 6A needs to be referenced it should be done here.

F.1.2 Effect of changes in product
a) Design changes
A design that undergoes a substantive change becomes a new design requiring performance verification design validation. A substantive change is a change identified by the manufacturer which affects the performance of the product in the intended service condition. This may include changes in fit, form, function or material.

b) Metallic materials
A change in metallic materials may not require new performance verification design validation if the suitability of the new material can be substantiated by other means.

c) Non-metallic seals
A change in non-metallic materials may not require new performance verification design validation if the suitability of the new material can be substantiated by other means. Substantive changes in the original documented design configuration of non-metallic seals resulting in a new design shall require performance verification design validation in accordance with F.1.13.

F.1.3 Compliance
All products evaluated in performance verification design validation tests shall comply with the applicable design requirements of this International Standard. Test articles shall be hydrostatically tested to PSL1 prior to verification validation testing.

F.1.4 Products for verification design validation testing
F.1.4.1 General
Performance verification Design validation testing, if applicable, shall be performed on prototypes or production models of equipment made in accordance with this International Standard to verify that the performance requirements specified for pressure, temperature, load, mechanical cycles and standard test fluids are met in the design of the product.

F.1.4.2 Testing product
Performance verification Design validation testing shall be conducted on full-size products or fixtures that represent the specified dimensions for the relevant components of the end product being verified, unless otherwise specified in this Annex.

F.1.4.3 Product dimensions
The actual dimensions of equipment subjected to verification validation testing shall be within the allowable tolerance range for dimensions specified for normal production equipment. Worst-case conditions for dimensional tolerances should be addressed by the manufacturer, giving consideration to concerns such as sealing and mechanical functioning.

F.1.6 Acceptance criteria
F.1.6.1 General
Verification Design validation testing of the product shall include all of the testing requirements of the applicable PR level in this annex.

F.1.13 Testing of non-metallic seals
F.1.13.1 Non-metallic seals
Non-metallic seals which are exposed to fluids, either produced from or injected into a well, shall undergo the performance verification design validation procedure described in this subclause.

F.1.13.2 Intent of procedure
The intent of this procedure is to verify validate the performance of the seal for the standard test fluid rating as specified in F.1.3.4, not the performance of products containing the seal. The full-size seals shall be tested as specified in F.1 or F.2 to determine temperature and pressure performances.

F.1.14.3 Limitations of scaling
F.1.14.3.1 Verification Design validation by pressure rating
The test product may be used to qualify validate products of the same family having equal or lower pressure ratings.

F.1.14.3.2 Verification Design validation by size
Testing of one size of a product family shall verify validate products one nominal size larger and one nominal size smaller than the tested size. Testing of two sizes also verifies validates all nominal sizes between the two sizes tested.

F.1.14.3.3 Verification Design validation by temperature rating
The temperature range verified validated by the test product shall verify all temperature classifications that fall entirely within that range.

F.1.14.3.4 Verification Design validation by standard test fluid rating for non-metallic seals
The standard test fluid rating verified validated by the test product shall verify validate all products of the same product family and material properties as the test product. See Table F.3.

F.1.14.3.5 Verification Design validation by PSL
Verification Validation of equipment is independent of the PSL of the production equipment.

F.1.15 Documentation

F.1.15.1 Verification Design validation files
The manufacturer shall maintain a file on each verification design validation test.

F.1.15.2 Contents of verification validation files
Verification Validation files shall contain or reference the following information, if applicable:

F.1.16.1 General
This subclause describes the calibration requirements for equipment which is necessary to conduct the verification design validation tests described in this annex. Test equipment which requires calibration includes: pressure-measuring equipment, load-measuring equipment, temperature-measuring equipment, torque-measuring equipment, elastomer physical and mechanical property-measurement equipment, and any other equipment used to measure or record test conditions and results.

Except for specific requirements in the following subclause, the manufacturer’s instructions shall provide all the requirements for the identification, control, calibration, adjustment, intervals between calibrations, and accuracy of all the testing equipment to which this International Standard is applicable.

F.1.16.3 Status
When used for verification design validation testing, equipment shall be calibrated in accordance with the requirements of the manufacturer and this International Standard.

F.2 Product-specific verification design validation testing
F.2.1 General
F.2.1.1 Verification Design validation testing
This subclause contains procedures which are specific and unique to the product being tested. The procedures shall be in addition to the procedures of F.1 unless otherwise specified in this annex. There are two performance verification levels design validation procedures, corresponding to performance requirement levels PR1 and PR2.

F.2.1.5 Actuated valves, chokes or other actuated products
Valves, chokes or other products designed for actuators shall have the same performance verification design validation as the manually actuated products. Verification Design validation of a
manual valve or choke shall verify validate an actuated valve or choke if the basic design is the same, provided that functional differences between manual and actuated designs are subjected to appropriate verification validation through fixture testing or product testing. These functional differences to be considered shall include, but may not be limited to,
- stem seal design;
- stem size;
- stem movement (linear vs. rotary);
- bonnet design;
- relative speed of operation (hydraulic vs. pneumatic).
The manufacturer shall have documentation and/or verification to support the application of the actuated valve, choke or other product to the type of actuator, hydraulic or pneumatic.

F.2.2 Performance verification Design validation testing for PR1 valves (see Table F.4)
F.2.2.1 General
Acceptance criteria, unless noted otherwise for specific steps in this subclause, shall be in accordance with F.1.

F.2.2.2 Verification Design validation test procedure
Table F.4 - Performance verification Design validation tests for valves

F.2.3 Performance verification Design validation testing for PR2 valves (see Table F.4)

F.2.3.3 Verification Design validation test procedure

F.2.4 Performance verification Design validation for PR1 actuators (see Table F.5)
Table F.5 - Performance verification Design validation tests for actuators

F.2.5 Performance verification Design validation for PR2 actuators (see Table F.5)
Actuators including electric actuators shall be subjected to a functional test to demonstrate proper assembly and operation. Testing medium for pneumatic actuators shall be a gas. Testing medium for hydraulic actuators shall be a suitable hydraulic fluid. The actuator shall be tested either on a valve/choke or on a fixture which simulates the opening/closing dynamic force profile of a valve/choke. A fixture test of a valve operator shall include the reduction in resisting force and resulting motion of the stem which occur when the valve is opened against differential pressure. If the bonnet assembly is part of the actuator, verification validation of stem seal and bonnet design shall be performed to verify validate the design to the requirements for valves.

F.2.6 Performance verification Design validation for PR1 chokes (see Table F.6)
F.2.6.1 General
Verification Design validation of an adjustable choke also verifies validates a positive choke that has the same body design and seat seal design.

F.2.7 Performance verification Design validation for PR2 chokes (see Table F.6)
F.2.7.1 General
Verification Design validation of an adjustable choke also verifies validates a positive choke which has the same body design and seat seal design. For testing of a positive choke, the dynamic test cycles (F.2.7.4, F.2.7.5 and F.2.7.7) are not required.
Table F.6 - Performance verification Design validation tests for chokes

F.2.8 Performance verification Design validation testing for PR1 casing-head housings, casing-head spools, tubing-head spools, cross-over connectors, and adapter and spacer spools (see Table F.7)
Table F.7 - Performance verification Design validation for casing-head housings, casing-head spools, tubing-head spools, cross-over connectors and adapter and spacer spools

F.2.9 Performance verification Design validation testing for PR2 casing-head housings, casing-head spools, tubing-head spools, cross-over connectors and adapter and spacer spools (see Table F.7)

F.2.10 Performance verification Design validation testing for PR1 Group 1 slip hangers (see Table F.8) Load cycling capacity shall be verified validated by objective evidence. The performance design validation test of PR1 Group 1 slip hangers shall be satisfied by objective evidence.

F.2.11 Performance verification Design validation testing for PR2 Group 1 slip hangers (see Table F.8)

Table F.8 - Performance verification Design validation for Group 1 slip hangers

F.2.12 Performance verification Design validation testing for PR1 Group 2 slip hangers (see Table F.9)

Table F.9 - Performance verification Design validation for Group 2 slip hangers

F.2.13 Performance verification Design validation testing for PR2 Group 2 slip hangers (see Table F.9)

F.2.14 Performance verification Design validation testing for PR1 Group 3 slip hangers (see Table F.10)

F.2.15 Performance verification Design validation testing for PR2 Group 3 slip hangers (see Table F.10)

Table F.10 - Performance verification Design validation for Group 3 slip hangers

F.2.16 Performance verification Design validation testing for PR1 Group 4 slip hangers (see Table F.11) Same as PR1 Group 3 hangers. Retention of the hanger shall be verified by objective evidence. The design validation testing of PR1 Group 4 slip hangers with respect to retention characteristics shall be satisfied by objective evidence.

F.2.17 Performance verification Design validation testing for PR2 Group 4 slip hangers (see Table F.11)

Table F.11 - Performance verification Design validation for Group 4 slip hangers

F.2.18 Performance verification Design validation testing for PR1 Group 1 mandrel hangers (see Table F.12)

F.2.19 Performance verification Design validation testing for PR2 Group 1 mandrel hangers (see Table F.12)

Table F.12 - Performance verification Design validation for Group 1 mandrel hangers
F.2.20 Performance verification Design validation testing for PR1 Group 2 mandrel hangers (see Table F.13)

Table F.13 - Performance verification Design validation for Group 2 mandrel hangers

F.2.21 Performance verification Design validation testing for PR2 Group 2 mandrel hangers (see Table F.13)

F.2.22 Performance verification Design validation testing for PR1 Group 3 mandrel hangers (see Table F.14)

Table F.14 - Performance verification Design validation for Group 3 mandrel hangers

F.2.23 Performance verification Design validation testing for PR2 Group 3 mandrel hangers (see Table F.14)

F.2.24 Performance verification Design validation testing for PR1 Group 4 mandrel hangers (see Table F.15)

F.2.25 Performance verification Design validation testing for PR2 Group 4 mandrel hangers (see Table F.15)

Table F.15 - Performance verifications Design validations for Group 4 mandrel hangers

F.2.26 Performance verification Design validation testing for PR1 Group 5 mandrel hangers (see Table F.16) Same as PR1 Group 4 hangers except test hanger retention feature with full blind annular pack-off load at room temperature with pressure from below. The preparations for back-pressure valves preparation shall be verified satisfied by objective evidence.

F.2.27 Performance verification Design validation testing for PR2 Group 5 mandrel hangers (see Table F.16)

Table F.16 - Performance verification Design validation for Group 5 mandrel hangers

F.2.28 Performance verification Design validation testing for packing mechanisms for PR1 lock screws, alignment pins and retainer screws (see Table F.17) The performance design validation of PR1 products shall be verified satisfied by objective evidence.

F.2.29 Performance verification Design validation testing for packing mechanisms for PR2 lock screws, alignment pins and retainer screws (see Table F.17)

Table F.17 - Performance verification Design validation for packing mechanisms for lock screws, alignment pins and retainer screws

F.2.30 Performance verification Design validation testing for PR1 Group 1 tubing head adapters (see Table F.18)

Table F.18 - Performance verification Design validation for Group 1 tubing head adapters

F.2.31 Performance verification Design validation testing for PR2 Group 1 tubing head adapters (see Table F.18) Performance Design validation testing is achieved through production hydrostatic pressure testing as required for the PSL to which the equipment is manufactured, in lieu of the procedure of F.1.11 (see 10.8.5).
F.2.32 Performance verification Design validation testing for PR1 Group 2 tubing head adapters (see Table F.19)

Table F.19 - Performance verification Design validation for Group 2 tubing head adapters

F.2.33 Performance verification Design validation testing for PR2 Group 2 tubing head adapters (see Table F.19)

F.2.34 Performance verification Design validation testing for PR1 other end connectors (see Table F.20)

Table F.20 - Performance verification Design validation for other end connectors

F.2.35 Performance verification Design validation testing for PR2 other end connectors (see Table F.20)

F.2.35.1 PR2 verification validation test

F.2.36 Performance verification Design validation testing for PR1 fluid sampling devices (see Table F.21)

The performance design validation of PR1 fluid sampling devices shall be verified satisfied by objective evidence.

Table F.21 - Performance verification Design validation for fluid sampling devices

F.2.37 Performance verification Design validation testing for PR2 fluid sampling devices (see Table F.21)

F.2.38 Performance verification Design validation testing for ring gaskets, bolting and other specified products

Verification Validation testing is not required for specified flanged or studded end and outlet connections, threaded end and outlet connections, studs and nuts, ring joint gaskets, bullplugs, tees and crosses, test and gauge connections, and other specified products that are completely specified (dimensions and materials) by this International Standard.

F.2.39 Summary of product-specific verification design validation

Table F.22 provides a summary of the product-specific cycle requirements.

Table F.22 - Summary of product-specific verification design validation

NOTE 1 Performance verification Design validation testing is not required for specified designs or features that are completely specified (dimensions and material strength) in this International Standard.

Annex I (normative)

Performance verification Design validation procedures for surface safety valves and underwater safety valves

I.1.1 Purpose

This annex provides requirements to

a) verify validate that a valve designed and manufactured to satisfy the PR2 requirements of 10.5 can may be used as a surface safety/underwater safety (SSV/USV) valve according to one or both of the following classes:
1) Class I: This performance requirement level is intended for use on wells that do not exhibit the
detrimental effects of sand erosion.
2) Class II: This performance requirement level is intended for use if a substance such as sand could
be expected to cause an SSV/USV valve failure.
b) demonstrate that the verification design validation testing covered by this annex qualifies specific
valve-bore sealing mechanisms which are manufactured in accordance with this International
Standard for PR2 class II valves.

I.1.2 Performance requirements
To qualify a SSV/USV for class I service, the valve shall pass the verification design validation test
specified in I.3.
To qualify a SSV/USV for class II service, the valve shall pass the verification design validation test
specified in I.4.
A valve qualified for class II also satisfies the requirements of class I.

I.1.3 Verification Design validation testing
The verification design validation testing requirements in this annex are not represented as
duplicating actual well conditions. Verification Validation tests that have been completed in
accordance with verification validation testing requirements of API Spec 14D or API Spec 6AV1,
during their validity, will satisfy the requirements of this annex.

See earlier note about validity of 6A. Since 14D is no longer valid, we should probably include
reference to a specific edition.

I.2.1 General
The typical piping arrangement and test section detail of a test facility for PR2 class II SSV/USV
verification design validation testing are shown in Figures I.1 and I.2.

I.2.2 Design considerations
a) The test facility shall be designed to permit the verification design validation tests to be made as
detailed in I.3 and I.4.

I.3 PR2 class I SSV/USV valve verification design validation testing

I.3.2 Verification Design validation test requirements
A flanged nominal 2 1/16, 52 mm 34.5 MPa (5 000 psi) rated working pressure SSV/USV valve shall
be used for the qualifying test. The valve to be tested shall be hydrostatically and functionally tested
in accordance with 7.4.9 and be PR2-verified. The successful completion of the test shall qualify all
sizes and all pressure ratings of that manufacturer’s SSV/USV of the same basic design and
materials of construction for class I service. Any significant change in the design or materials of
construction which would affect the SSV/USV valve-bore sealing mechanism shall require
requalification by verification validation testing.

I.3.3 Documentation (verification files)
The manufacturer is required to maintain a file on each test, including any retest that may have been
required to qualify a particular SSV/USV design and materials of construction. As a minimum this file
shall contain sufficient documentation to satisfy F.1.15 of Annex F and shall be retained for 10 years
after a design has been discontinued.

I.3.4 Verification Design validation test procedure
The following procedures are general and are intended to show the limits and extent of the class I
service SSV/USV verification design validation test.
I.4 PR2 class II SSV/USV verification design validation testing

Table I.1 - Example of a PR2 class II SSV/USV valve test form
I. Tested SSV/USV valve and SSV/USV actuator verification design validation

Figure I.1 - Example of piping arrangement test facility for PR2 class II sandy service SSV/USV verification validation testing

Figure I.2 - Example of SSV/USV verification validation test section detail

The List of Figures, List of Tables, and Table of Contents will all be updated automatically by the document administrators when the above changes are implemented. Additionally, the regional Annex will need the following changes:

3.1 Test Agency
any independent third party which provides a test facility and administers a testing program which meet the Class II SSV/USV valve verification design validation testing requirements of Annex I of this specification and API Specification 6AV1.

Should API Spec 6AV1 be removed?

10.20.4.3 Add the following requirements at the end of the subclause:
"c) Test Agency
To verify validate a specific Class II SSV/USV design, the manufacturer must submit an SSV/USV of the same basic design and materials of construction to a Test Agency as defined below. Verification Design validation testing at a Test Agency is not required for SSV/USV equipment other than valve bore sealing mechanisms, PR2 Class II, Sandy Service.

Dimensional verification

In this case, the word "verification" was considered to be un-related to "design verification" as mentioned earlier. Therefore, the definition for verification from ISO 9000:2005 was used for reference since it is not in 6A. It follows below.

verification: confirmation, through the provision of objective evidence (3.8.1), that specified requirements (3.1.2) have been fulfilled

This was compared to the definition for inspection as given below.

inspection: conformity evaluation by observation and judgment accompanied as appropriate by measurement, testing or gauging

It was the conclusion of the task group that the correct words to describe the intended activities in 6A was really "dimensional inspection" instead of "dimensional verification". These suggested changes are shown below.

7.4.2.1.4 Dimensional verification inspection
Dimensional inspection shall be performed on components manufactured to this PSL. The manufacturer shall specify and verify critical dimensions.

a) Sampling
Sampling shall be in accordance with ISO 2859-1, Level II, 1.5 AQL. End and outlet connection threads on all components shall all be gauged. Critical dimensions on all components shall be verified.

b) Test method
Threaded end and outlet connections shall be gauged for stand-off at hand-tight assembly by use of the gauges and gauging practices illustrated in Figures 10, 11 and 12.

c) Acceptance criteria
These shall be in accordance with ISO 10422 API Spec 5B or ASME B1.1 and ASME B1.2 and ASME B1.3 as applicable. Acceptance criteria for critical dimensions shall be as required by the manufacturer’s written specification.

Table 11 - Quality control requirements for bodies, bonnets, end and outlet connections and hub end connectors - Subclause reference
Change "Dimensional verification" to "Dimensional inspection" The sub-clause numbers remain the same.

7.4.2.2.4 Dimensional verification inspection
Dimensional verification inspection requirements for PSL 2 shall be identical to the requirements for PSL 1.

7.4.2.3.4 Dimensional verification inspection
Dimensional verification inspection requirements for PSL 3 shall be identical to the requirements for PSL 1. Additionally, verification inspection shall be performed on all parts.

7.4.2.4.4 Dimensional verification inspection
Dimensional verification inspection requirements for PSL 4 shall be identical to the requirements for PSL 3.

Table 13 - Quality control requirements for stems
Change "Dimensional verification" to "Dimensional inspection" The sub-clause numbers remain the same.

7.4.6 Ring gaskets (PSL 1 to PSL 4) (see Table 15)
7.4.6.1 Dimensional verification inspection
Dimensional inspection shall be performed on ring gaskets manufactured to this International Standard.

a) Sampling
Sampling shall be in accordance with the manufacturer’s documented requirements.
b) Test method
The manufacturer’s documented procedures shall be followed.
c) Acceptance criteria
Acceptance criteria shall be in accordance with 10.4.2.1

Table 15 - Quality control requirements for ring joint gaskets
Delete entire table. The requirements are the same for all PSLs.

7.4.7 Studs and nuts (PSL 1 to PSL 4) (see Table 16)

Table 16 - Quality control requirements for studs and nuts
Delete entire table. The requirements are the same for all PSLs.

7.4.7.4 Dimensional verification inspection
Dimensional inspection shall be performed on studs and nuts manufactured to this International Standard.

a) Sampling
Sampling shall be in accordance with the applicable ASTM specification, or the manufacturer’s written specification for CRAs not covered by ASTM.

b) Test method
The method shall be in accordance with the applicable ASTM specification, or the manufacturer’s written specification for CRAs not covered by ASTM.

c) Acceptance criteria
The acceptance criteria shall be in accordance with the applicable ASTM specification, or the manufacturer’s written specification for CRAs not covered by ASTM.

7.4.8 Non-metallic seals-sealing material (PSL 1 to PSL 4) (see Table 17)

7.4.8.1 PSL 1

7.4.8.1.1 Dimensional verification inspection
Dimensional inspection shall be performed on non-metallic seals manufactured to this International Standard.

a) Sampling
Sampling shall be performed on non-metallic seals in accordance with ISO 2859-1, Level II, 2.5 AQL for O-rings and 1.5 AQL for other seals.

b) Test method
Each piece of the sample shall be dimensionally inspected for compliance to specific tolerances.

c) Acceptance criteria
If inspection methods produce fewer rejections than allowed in sampling, the batch shall be accepted.

Table 17 - Quality control requirements for non-metallic seals sealing material
Change row heading from Dimensional verification to Dimensional inspection.

7.4.8.2 PSL 2

7.4.8.2.1 Dimensional verification inspection
Dimensional verification inspection requirements for PSL 2 shall be identical to the requirements for PSL 1.

7.4.8.3 PSL 3

7.4.8.3.1 Dimensional verification inspection
Dimensional verification inspection requirements for PSL 3 shall be identical to the requirements for PSL 1.

7.4.8.4 PSL 4

7.4.8.4.1 Dimensional verification inspection
Dimensional verification inspection requirements for PSL 4 shall be identical to the requirements for PSL 1.

7.4.10.1.2 Dimensional verification inspection
Dimensional inspection shall be performed on casing and tubing hanger mandrels manufactured to this International Standard. The manufacturer shall specify critical dimensions.

a) Sampling
All suspension, lift and back-pressure valve threads or retention profiles shall be gauged. Critical dimensions on all components shall be verified.

b) Test method
Gauge the connections for stand-off at hand-tight assembly by use of the gauges and gauging practices illustrated in Figures 10, 11 and 12. Dimensionally verify inspect ACME and other parallel thread profiles, in accordance with the manufacturer’s specifications.

c) Acceptance criteria
Acceptance criteria for critical dimensions shall be in accordance with the manufacturer's applicable specification.
Threads shall be in accordance with API Spec 5B or ASME B1.1 and ASME B1.2 and ASME B1.3 as applicable.

7.4.10.2.3 Dimensional verification inspection
Dimensional verification inspection requirements for PSL 2 shall be identical to the requirements for PSL 1.

7.4.10.3.3 Dimensional verification inspection
Dimensional verification inspection requirements for PSL 3 shall be identical to the requirements for PSL 1. Additionally, verification inspection shall be performed on all parts.

7.4.10.4.3 Dimensional verification inspection
Dimensional verification inspection requirements for PSL 4 shall be identical to the requirements for PSL 3.

Table 25 - Quality control requirements for casing and tubing hanger mandrels
Change "Dimensional verification" to "Dimensional inspection" The sub-clause numbers remain the same.

7.4.11 Bullplugs, valve-removal plugs and back-pressure valves (see Table 26)

7.4.11.5 Dimensional verification inspection
Dimensional verification inspection shall be in accordance with 7.4.2.1.4. In addition, all threads shall be gauged.

Table 26 - Quality control requirements for bullplugs, valve-removal plugs, and back-pressure valves
Change "Dimensional verification" to "Dimensional inspection" The sub-clause numbers remain the same.

7.5.2 Records to be maintained by manufacturer
7.5.2.1 Body, bonnet, end and outlet connections, stem, valve-bore sealing mechanism, mandrel tubing and casing hanger records
c) PSL 3

7) Dimensional verification inspection records (those activities required by 7.4.2.3.4).
Appendix - Reference Information

1. Requirements from API Spec Q1

   7.3.5 Design and development verification

   ISO 9001:2000, Quality management systems—Requirements
   7.3.5 Design and development verification

   Verification shall be performed in accordance with planned arrangements (see 7.3.1) to ensure that the design and development outputs have met the design and development input requirements. Records of the results of the verification and any necessary actions shall be maintained (see 4.2.4).

   Note: Design verification activities can include one or more of the following:
   a. Confirming the accuracy of design results through the performance of alternative calculations.
   b. Review of design output documents independent of activities of 7.3.4.
   c. Comparing new designs to similar proven designs.

   7.3.6 Design and development validation

   ISO 9001:2000, Quality management systems — Requirements
   7.3.6 Design and development validation

   Design and development validation shall be performed in accordance with planned arrangements (see 7.3.1) to ensure that the resulting product is capable of meeting the requirements for the specified application or intended use, where known. Wherever practicable, validation shall be completed prior to the delivery or implementation of the product. Records of the results of validation and any necessary actions shall be maintained (see 4.2.4).

   Note: Design validation can include one or more of the following:
   a. Prototype tests.
   b. Functional and/or operational tests of production products.
   c. Tests specified by industry standards and/or regulatory requirements.
   d. Field performance tests and reviews.

2. Language from other API Specifications under the purview of SC6 and pertinent to the use of verification and validation were reviewed.

   a. API Spec 14A

      6.4 Design verification

      Design verification shall be performed to ensure that each SSSV design meets the supplier's/manufacturer's technical specifications. Design verification includes activities such as design reviews, design calculations, physical tests, comparison with similar designs and historical records of defined operating conditions.

   6.5 Design validation

   6.5.1 General

   The SSSVs produced in accordance with this International Standard shall pass the validation test required by this subclause.

   a) SSSVs shall pass the applicable validation test specified in Annex B and shall be performed by a test agency.

   b) Seals shall meet the requirements of 6.3.4.3.

   The validation testing requirements in this International Standard are not represented as well conditions.

   b. Language from API Spec 14L
6.4 Design verification

Design verification shall be performed to ensure that each lock mancrel and landing nipple design meets the supplier's/manufacturer's technical specifications. Design verification includes activities such as design reviews, design calculations, physical tests, comparison with similar designs and historical records of defined operating conditions.

6.5 Design validation

6.5.1 General

This International Standard specifies three grades of design validation for which the product shall be supplied. The user/purchaser shall specify the grade of design validation required. Products shall be supplied to at least the design validation grade specified. Landing nipples are provided in grades V2 or V3 only.

Products previously qualified in accordance with ISO 10432 or API Spec 14A, prior to the publication of this International Standard, shall be considered as meeting the design validation requirements at their relevant grade of this International Standard.
ERRATA 4

Changes are shown in bold text.

*Page 66, change the reference as follows:
In clause 7.4.2.2.14 d) change ASME Section V, Article 5 to Article 4.

*Page 76, Table 17 change the last line to the following:

| Storage and age control | 9.6 a) | 9.6 a) | 9.6 b) | 9.6 b) |

* Page 72, change the heading as follows:
7.4.5 Valve-bore sealing mechanisms and choke trim (PSL 1 to PSL 4)

* Page 97, change the text as follows:
7.5.2.1 d)
3) Actual heat-treatment temperature charts showing times and temperatures are required for bodies, bonnets, end and outlet connections, stems, mandrel tubing and casing hangers.

* Page 100, change the marking for Extreme Line threads from XL to XC.

* Page 101, Table 27, remove OD of connector from marking requirements for Product Specification Level (4.1).

* Page 210, Clause 10.21.3, change the text as follows:
Bullplug material shall meet the requirements of 5.2 and 5.10. This International Standard is not applicable to bullplugs and threaded connections with components of less than material designation 60K.

* Page 392, Clause L.4, change the text as follows:
Valve-removal plug body material shall meet the requirements of 5.2 and 5.10 except no impact testing is required. Material shall be to material designation 60K for 13,8 MPa (2 000 psi) to 69,0 MPa (10 000 psi) working pressure and 75K for 103,5 MPa (15 000 psi) to 138,0 MPa (20 000 psi) working pressure. Valve removal plugs shall be material class DD, FF or HH.

* Page 148, Clause 10.4.1, change the text as follows:
Types R or RX gaskets shall be used on 6B flanges. Only BX gaskets shall be used with 6BX flanges.

NOTE: RX and BX gaskets provide a pressure-energized seal but are not interchangeable. The RX gasket provides additional clearance between the flanges.
* page 137, Clause 10.1, Table 46 and page 265, Table B.46

Replace the figure at the top of the table with the new figure below to correct the T dimension extension lines.

* Page 365, Figure K.1 b)
The dimension L corrected to show proper depth. Replace the figure with the new figure below.
* Page 369, Figure K.2 a)
The chamfer callout was incorrectly changed to 1 decimal place. Replace the figure with the new figure below.

* Page 369, Figure K.2b)
The dimension L corrected to show proper depth. Replace the figure with the new figure below.

* Page 404, API Regional Annex O,
Correct the callout for ASTM reference. Change the text to read as follows:
ASTM E280, Standard Reference Radiographs for Heavy-Walled (4% to 12 in.) Steel Castings
Page 258, Table B.42 (continued)
Correct the callout for the first flange size. Change first line of table to the following:

| 1 1/16  | 5.75  | 8   | %   | 0.88 | +0.06 | 5.00 | 151 |

* Indicates a new errata item since the publishing of Errata 3, June, 2006
<table>
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<th>Number</th>
<th>Clause</th>
<th>Issue Requiring Attention</th>
<th>Suggested Changes &amp; Comments</th>
<th>Rationale</th>
<th>Specific document changes to be done</th>
<th>Persons Responsible</th>
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| #1     | Throughout Document | Elimination of PSL-4 - this option is no longer included as part of the recommendations in Annex A. Due to the complexity of this level of requirements and individuals customers needs, it is usually associated with additional specs and is not supplied as standard PSL-4. | Remove the PSL-4 requirements form the document. Could be separated out as a recommended practice if the users feel it is needed. | PSL-4 is no longer a recommended practice in Annex A and is usually modified by the user selecting. Almost never used as a standard requirement without modification, thereby defeating the purpose of this option in a standard type document. | Edit MS Word copy of ISO 10423 to remove all references to PSL 4. | Austin Freeman  
Straw vote was 27 for, 3 more detail, 2 against. |
| #2     | 4.2.2.3 and other places | Temperature Classes – The list of temperature has been expanded to a point where certain of the options are seldom used to meet the demands of the market. | Re-evaluate the temperature classes based on the typical demands of the market. | Re-alignment of the temperature classes with the needs of the market will eliminate confusion and promote standardization. For example, consider the elimination of Temperature Classes R, S, T, V & Y as there does not appear to be much demand if any for these categories. | Table 2 changes along with Table 6. Get latest Table 2 from Annex O and work from that. Delete temperature service classifications N, and R. Add the option for manufacturer defined temperature range and mark with the actual numbers of service instead of the temperature class. | Austin Freeman  
Straw vote was 16 for, 19 more detail, 0 against. |
| #3     | 10.5.7 wafer 10.5, 10.6, 10.20, 10.12 | Wafer Check Valves, Reduced Opening Plug Valves and Fluid Sampling Devices – Remove the products from the standard as they no longer fit with market demand for wellhead products and are seldom produced with the API Monogram. | Recommend removal from the standard. We might consider spinning these off into a separate standard if they are truly needed in the market. | These categories do not appear to fit in the scheme of the document for the product offerings. | Copy over change as written in final version of ISO 10423 document. | Austin Freeman  
Straw vote was 25 for, 6 more detail, 0 against. |
| #3     | Throughout Document | 15 KSI Long Pattern Valves – Delete this option as it does not appear to be needed in the market. | Recommend deletion of this option. | This option does not appear to be needed to support the current market demands. | Copy over change as written in final version of ISO 10423 document. | Austin Freeman  
Straw vote was 25 for, 6 more detail, 0 against. |
| #4     | Throughout Document | PR Language – The language in the body of the document describes the standard PR requirements as design requirements. Although most manufacturers understand that it is necessary to test to validate the design requirements, we feel this is another loophole that needs to be closed. | Define the PR for each product. Eliminate the need for PR-1 and PR-2. | None recommended. Leave the document as is. | None recommended. Leave the document as is. |  
Straw vote was 10 for, 24 more detail, 1 against. |
| #5     | Throughout Document | PSL Limitations – Re-evaluate the using of the various PSL and develop realistic options for use to ensure requirements are aligned with the application. | Consider limiting PSL-1 to 5K applications, PSL-2 for 10K & up to PSL-3G. Reduces the various options at the pressure and temperature requirements get more severe. | This type of approach would eliminate confusion, promote standardization, but would also re-evaluate the guidelines in Annex A regarding “Primary Equipment”. | Consider making the YES/NO chart in Annex A a normative reference. Consider creating matrix for minimum PSL for each product type. | No change to document due to time constraints.  
Straw vote was 20 for, 18 more detail, 0 against. |
Allow use of PT as an alternative to MT for ferromagnetic materials. Needs to address sensitivity level issue and the process qualification.

If PT is a viable option for validating an indication detected by MT examination, in a ferromagnetic component, then it should be considered a viable option for surface NDT of ferromagnetic components provided the proper sensitivity level is used.

The document needs to require a level of sensitivity for using PT for ferromagnetic and non-ferromagnetic materials equivalent to the sensitivity requirements for MT as currently specified in the document. This closes a loop hole in the document.

By adding this definition of the sensitivity level to the document, we feel this would significantly reduce confusion on this issue.

Recommend relaxing the tolerance to +/- 2% to allow use of standard pressure gauges per ASME B40.1. At the present time, there are only a few gauge manufacturers in the world who make high pressure dial type gauges to meet the +/- 0.5% full scale range requirement of API Spec 6A.

1. The accuracy of monitoring and measuring equipment (MME) is usually determined by the specified tolerance for which the MME is to be used for verification. In the absence of a defined tolerance, equipment is usually selected based on availability per a commercial standard. Most test pressures in 6A have no tolerance, and the smallest tolerance is in 7.4.9.5.8 (a): +/- 10%.

2. API Spec 6D requires a calibration standard of +/- 2%, the same as is proposed for 6A.

None recommended. Leave the document as is. Delete. Not an issue per Jerry Longmire.

Straw vote was 28 for, 1 more detail, 0 against.

None recommended. Leave the document as is.
**API Ballot Comments and Resolution**

**Ballot:** Spec 6A PSL 3G Revisions  
**Proposal:**  
**Ballot ID:** 1023  
**Date:** October 10, 2007

<table>
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<th>Type of Comment</th>
<th>Comment (justification for change) by the Voting Member</th>
<th>Proposed change by the Voting Member</th>
<th>Comment Resolution</th>
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| Item 1  
Eric Wehner Cameron (Affirmative) | 7.4.9 | Technical | (1) The change proposed for 7.4.9.1 would delete the last sentence: "The sequence of other tests shall be at the option of the manufacturer." This sentence was added to 6A to allow variation in the sequence of gas testing. Primarily, it was desired that a manufacturer be able to perform the gas back-seat test of PSL 3G or 4 before other gas testing. In many cases, the back-seat test is the most difficult to pass, so it may save time to do it first. Also, if a valve has to be disassembled to take remedial action in order to pass the back-seat test, the manufacturer would typically want to perform that gas test first before proceeding to the body and seat gas tests. This could avoid repeating testing unnecessarily.  
(2) The proposed wording: "...a hydrostatic body test and a hydrostatic valve seat test..." could be taken to imply that only one seat test need be performed prior to gas testing, due to the use of "a." The intention was that all hydrostatic testing be performed prior to any gas testing, so this sentence should use "all hydrostatic...testing" instead of "a hydrostatic...test." | Replace the last sentence of 7.4.9.1 with:  
"All hydrostatic body testing and all hydrostatic valve seat testing shall be performed prior to any gas testing. The sequence of gas tests may be varied at the option of the manufacturer." | Replace the last sentence of 7.4.9.1 with:  
"All hydrostatic body testing and all hydrostatic valve seat testing shall be performed prior to any gas testing. The sequence of gas tests may be varied at the option of the manufacturer." |
| Item 2  
Roy Benefield FMC Technologies (Negative) | 7.4.9 | Technical | Discussion / Argument:  
1- The wording changes below will bring ISO_DIS_13628-4_E and ISO 10423 in alignment. This promotes standardization.  
2- When gas testing is to be conducted the true purpose of the hydrostatic testing is to stress the valve components while opening the valve against full differential. Hydrostatic tests with extended hold times, leakage monitoring or chart recording add no value when the gas testing is much more accurate to ensure that the acceptance criteria is met. |  
1- AS BALLOTED: 7.4.9.1 General Replace the last sentence with: "A hydrostatic body test and a hydrostatic valve seat test shall be performed prior to any gas testing."  
1- FMC PROPOSAL: Replace the last paragraph with: "A hydrostatic body test and hydrostatic valve seat test shall be performed prior to any gas testing. The hydrostatic seat test may be conducted as described in subclause 7.4.9.4.5.a by opening the valve against full differential pressure to stress the " | See Item 1 |
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<th>Type of Comment</th>
<th>Comment (justification for change) by the Voting Member</th>
<th>Proposed change by the Voting Member</th>
<th>Comment Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Item 2</td>
<td></td>
<td></td>
<td>3- Removal of “in place of” wording and defining an exact requirement is acceptable but should not be done with the motive of changing the writer’s original intentions.</td>
<td>sealing surfaces and drive train, in which case the requirements for hold times, monitoring of leakage, hydrostatic pressure test records, and use of a chart recorder are not applicable.</td>
<td>2- AS BALLOTED: 7.4.9.5.8 PSL3G gas seat test - Valves Delete the words “or in place of” 2- FMC PROPOSAL: Delete the words “or in place of”; delete the word (extended); change the wording “(in accordance with 7.4.9.5.6)” to “(in accordance with 7.4.9.4.5.a)” Change Table 20 as follows: Column PSL 36, Row Hydrostatic Test Seat, add ”7.4.9.4.5. Same column, Row Extended Seat Test, Remove 7.9.9.5.6. 3- AS BALLOTED: 7.4.9.5.8 b) and 7.4.9.6.7 b) Revise the subclauses as follows: “A maximum reduction of the gas test pressure of 2,0 MPa (300 psi) for high pressure tests and 0,2 MPa (30 psi) for low pressure tests is acceptable as long as there are no visible bubbles in the water bath during the holding period.” 3- FMC PROPOSAL: 7.4.9.5.8 b), 7.4.9.5.9 b and 7.4.9.6.7 b)</td>
</tr>
<tr>
<td>Voter Name (Vote)</td>
<td>Clause No./ Subclause No./Annex (e.g. 3.1)</td>
<td>Type of Comment</td>
<td>Comment (justification for change) by the Voting Member</td>
<td>Proposed change by the Voting Member</td>
<td>Comment Resolution</td>
</tr>
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</tr>
<tr>
<td>Item 3</td>
<td>Austin Freeman</td>
<td>7.4.9.5.8 b)</td>
<td>Editorial</td>
<td>The proposed text references a &quot;high pressure test&quot; and a &quot;low pressure test&quot; while the original text in the document calls the tests a &quot;primary test&quot; and a &quot;secondary test&quot;.</td>
<td>Revise the subclause as follows: A maximum reduction of the gas test pressure of 2,0 MPa (300 psi) for high pressure tests and 0,2 MPa (30 psi) for low pressure tests is acceptable as long as there are no visible bubbles in the water bath during the holding period. Use wording &quot;primary and secondary&quot;</td>
</tr>
<tr>
<td>Item 4</td>
<td>Austin Freeman</td>
<td>7.4.9.6.7 b)</td>
<td>Editorial</td>
<td>The proposed text references a &quot;high pressure test&quot; and a &quot;low pressure test&quot; while the original text in the document calls the tests a &quot;first pressure holding period&quot; and a &quot;second pressure holding period&quot;.</td>
<td>Change the subclause to read as follows: A maximum reduction of the gas test pressure of 2,0 MPa (300 psi) for the first pressure holding period and 0,2 MPa (30 psi) for the second pressure holding</td>
</tr>
<tr>
<td>Voter Name (Vote)</td>
<td>Clause No./ Subclause No./Annex (e.g. 3.1)</td>
<td>Type of Comment</td>
<td>Comment (justification for change) by the Voting Member</td>
<td>Proposed change by the Voting Member</td>
<td>Comment Resolution</td>
</tr>
<tr>
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</tr>
<tr>
<td>Item 5</td>
<td>John Fowler On-line Resources (Affirmative)</td>
<td>Editorial</td>
<td>It looks to me like the new sentence should be inserted between the first and second sentences of the last paragraph of 7.4.9.1. The last sentence is, &quot;The sequence of other tests shall be at the option of the manufacturer.&quot; I don't see why that sentence should be removed. Alternatively, the new sentence could replace the first sentence of the paragraph. Also the word &quot;valve&quot; should be replaced in the current second sentence, with &quot;equipment&quot;. Insert the new sentence after (or instead of) the first sentence which states that the body hydrostatic test is to be the first test. Thus the entire paragraph would read: &quot;The hydrostatic body test shall be performed first. The hydrostatic body test and the hydrostatic valve seat test shall be performed before any gas testing. The drift test shall be performed after the equipment has been assembled, operated and tested. The sequence of other tests shall be at the option of the manufacturer.&quot;</td>
<td>Wording incorporated in Item 1.</td>
<td></td>
</tr>
</tbody>
</table>

The period is acceptable as long as there are no visible bubbles in the water bath during the holding period.
Work item 6A-2007-02-1: **Heat Treat Furnace Calibration Annex.**

Two changes are required:

1. **Add new second sentence to subclause 5.3.3.1 as follows (new text underlined):**

   **5.3.3.1 Equipment qualification**

   All heat-treatment operations shall be performed utilizing equipment qualified in accordance with the requirements specified by the manufacturer. A recommended practice for heat-treating furnace calibration can be found in Annex N of this International Standard.

2. **Add Annex N, identical to API Spec 16A Annex A. (See following pages) Renumber existing Annexes N and O.**

Eric Wehner
19 June 2007
Annex A
(normative) (informative)

Qualification of heat-treating equipment

A.1 General

All heat treatment of parts and QTCs shall be performed with equipment meeting the requirements of this annex.

A.2 Temperature tolerance

The temperature at any point in the working zone shall not vary by more than ± 13 °C (± 25 °F) from the furnace set-point temperature after the furnace working zone has been brought up to temperature. Furnaces which are used for tempering, ageing and/or stress-relieving shall not vary by more than ± 8 °C (± 15 °F) from the furnace set-point temperature after the furnace working zone has been brought up to temperature.

A.3 Furnace calibration

A.3.1 General

Heat treatment of production parts shall be performed with heat-treating equipment that has been calibrated and surveyed.

A.3.2 Records

Records of furnace calibration and surveys shall be maintained for a period not less than two years.

A.3.3 Temperature survey method for calibration of batch-type furnaces

A temperature survey within the furnace working zone(s) shall be performed on each furnace at the maximum and minimum temperatures for which each furnace is to be used.

A minimum of nine thermocouple test locations shall be used for all furnaces having a working zone greater than 0.3 m³ (10 ft³).

For each 3.5 m³ (125 ft³) of furnace working zone surveyed, at least one thermocouple test location shall be used, up to a maximum of 40 thermocouples. See Figures A.1 and A.2 for examples of thermocouple locations.

For furnaces having a working zone less than 0.3 m³ (10 ft³), the temperature survey may be made with a minimum of three thermocouples located either at the front, centre and rear, or at the top, centre and bottom of the furnace working zone.

After insertion of the temperature-sensing devices, readings shall be taken at least once every 3 min to determine when the temperature of the furnace working zone approaches the bottom of the temperature range being surveyed.

Once the furnace temperature has reached the set-point temperature, the temperature of all test locations shall be recorded at 2-min intervals, maximum, for at least 10 min. Then readings shall be taken at 5-min intervals, maximum, for sufficient time (at least 30 min) to determine the recurrent temperature pattern of the furnace working zone.
Before the furnace set-point temperature is reached, none of the temperature readings shall exceed the set-point temperature by more than 13 °C (25 °F).

After the furnace control set-point temperature is reached, no temperature reading shall vary beyond the limits specified. The temperatures within each furnace shall be surveyed within one year prior to use of the furnace for heat treatment.

When a furnace is repaired or rebuilt, a new temperature survey shall be carried out before the furnace is used for heat treatment.

![Diagram of furnace views](image-url)
\textbf{A.3.4 Continuous-type furnaces method}

Furnaces used for continuous heat treatment shall be calibrated in accordance with procedures specified in SAE AMS-H-6875F.

\textbf{A.4 Instruments}

\textbf{A.4.1 General}

Automatic controlling and recording instruments shall be used.

Thermocouples shall be located in the furnace working zone(s) and protected from furnace atmospheres by means of suitable protective devices.

\textbf{A.4.2 Accuracy}

The controlling and recording instruments used for the heat-treatment processes shall be accurate to $\pm 1\%$ of their full-scale range.

\textbf{A.4.3 Calibration}

Temperature-controlling and -recording instruments shall be calibrated at least once every three months.

Equipment used to calibrate the production equipment shall be accurate to $\pm 0.25\%$ of full-scale range.
Organizational Meeting January 24, 2007

Summary:

- Two Priorities were Identified
- 18 3/4” - 20 ksi Flange is Presently not included in existing API Specifications
- 13 5/8” - 20 ksi Flanges are in Specs, but, Need Review for Subsea Applications for Tension and Bending
- It was agreed that other sizes and types of flanges may need review

Task Group Members:
Paul Bunch (Cameron)
Shafiq Khandoker (Hydril)
Mike Miller (DrillQuip)
David O’Donnell (NOV)
David Pang (Bureau Veritas)
Xichang Zhang (Vetco)
John Fowler (Online Resources)
Reference:


API 15K Gate Valve, Table B.58 has Nominal Size up to 5-1/8”

API 20K Gate Valve, Table B.59 has Nominal Size up to 3-1/16”

Need for further standardization - Face to-Face dimension

1. 7-1/16, 15K
2. 4-1/16, 20K
3. 7-1/16, 20K
1. Make provision for non-standard materials having yield strength less than 75,000 psi
2. Make provisions for designing high temperature equipment using non-standard materials.
3. Correct the metric conversion rounding rules to the rules used for the 19th Edition.
4. Eliminate the nickel limit on alloys for sweet service.
Topic 1

- Make provision for non-standard materials having yield strength less than 75,000 psi
- Examples:
  » Austenitic Stainless Steels
  » API 5L Grade A, B, X42 and X46 Pipe
Permitting non-standard materials < 75 K

- 4.3.3.1 Now: Non-standard materials are materials with specified minimum yield strength in excess of 517 MPa (75 000 psi) that do not meet the ductility requirements of Table 5 for standard 75K materials.

- Proposed: Non-standard materials are materials with properties that do not meet all requirements of Table 5 for a standard material.

- Reason: Permit the use of austenitic stainless steels and other materials having properties that do not all meet Table 5.
5.4.1 a) (last sentence) Now: All non-standard materials shall exceed a 75K minimum yield strength and meet a minimum of 15% elongation and 20% reduction of area.

Proposed: All non-standard materials shall meet a minimum of 15% elongation and 20% reduction of area. Non-standard materials for applications shown in Table 4 shall have a design stress intensity $S_m$ per 4.3.3.6 at least equal to that of the lowest-strength standard material permitted for that application.

Reason: Provide rules for non-standard material applications with $S_y < 75K$ and eliminate “cheating” on $S_m$ values, i.e. $S_y=75$ ksi and $S_u = 90$ ksi would give a 45 ksi $S_m$ vs. 50 ksi based on yield only.
Broadening non-standard materials definition, cont.

- Table 4 Remove all “NS” from the table.
- Reason: The above revision spells out the rules for non-standard materials in all applications.
- Table 4 Footnote b: Remove and renumber c to b
- Reason: Footnote b is no longer needed.
### Table 4 — Standard material applications for bodies, bonnets and end and outlet connections

<table>
<thead>
<tr>
<th>Part</th>
<th>Pressure ratings MPa (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>13.8 (2 000) 20.7 (3 000) 34.5 (5 000) 69.0 (10 000) 103.5 (15 000) 138.0 (20 000)</td>
</tr>
<tr>
<td><strong>Material designation</strong></td>
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</tr>
<tr>
<td>Body, bonnet</td>
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</tr>
<tr>
<td>36K, 45K</td>
<td></td>
</tr>
<tr>
<td>60K, 75K</td>
<td></td>
</tr>
<tr>
<td>NS b</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Integral end connection</td>
<td></td>
</tr>
<tr>
<td>Flanged</td>
<td></td>
</tr>
<tr>
<td>60K, 75K</td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Threaded</td>
<td></td>
</tr>
<tr>
<td>60K, 75K</td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Other c</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Loose connectors</td>
<td></td>
</tr>
<tr>
<td>Welding neck</td>
<td></td>
</tr>
<tr>
<td>45K</td>
<td></td>
</tr>
<tr>
<td>Blind</td>
<td></td>
</tr>
<tr>
<td>60K, 75K</td>
<td></td>
</tr>
<tr>
<td>NS</td>
<td></td>
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</tr>
<tr>
<td>Other</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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a If end connections are of the material designation indicated, welding is in accordance with clause 6 and design is in accordance with clause 4.

b NS indicates non-standard materials as defined in 4.3.3 and 5.4.1.a.

c As specified by manufacturer.
4.3.3.2 (ASME Method) Now: \( S_T = 0.83 \, S_Y \)

Proposed: \( S_T = \frac{5}{6} \, S_Y \)

Reason: To make this paragraph consistent with 4.3.3.6 and the original intent.

It would also result in more convenient numbers for the allowable stresses, i.e. 50,000 psi for 60K material vs. 49,800 psi.
Topic 2

- Make provisions for designing high temperature equipment using non-standard materials.
High temperature design rules, non-standard materials

- **G.5.2.1 (New Material)** Add to the end of the present G.5.2.1:
  - For non-standard materials, an $S_m$ value may be used that is the lower of $2/3$ of the elevated-temperature yield strength, one-half the minimum specified tensile strength, or $0.55$ times the elevated-temperature tensile strength.
  - Elevated-temperature tensile strength shall be determined in the same manner as the elevated-temperature yield strength.
  - **Reason:** Presently Annex G does not have rules for non-standard materials. This method is consistent with the ASME Code Section II Part D tables 2-100a and b.
Correct the metric conversion rounding rules in Annex B to the rules actually used for the revised dimensions of the 19th Edition.
Proposed Changes to Annex B

- **Paragraph B.1.1 Purpose:** The second paragraph is no longer true. The new dimensions are calculated directly from the decimal inch values.
Paragraph B.1.2 Conversion Rules: These rules are no longer correct. These rules were used to develop the dimensions in the 17th and 18th editions of 6A. The new dimensions have been converted directly from the decimal inch numbers in the 17th Edition without the additional step of converting the dimension to the original fractional value. This can be verified by comparing the numbers in the 14th Edition to the 17th and 18th Edition (they agree except for the 6B flange bolt holes – ref. paragraph B.2.3). They do not agree with the new 19th Edition numbers.
Paragraphs B.2.3 and B.2.4 Bolt holes and fasteners: These paragraphs are no longer correct. The new dimensions no longer agree with ANSI B16.5-1981, and therefore metric fasteners cannot be used on 6B flanges.

Also note: Meanwhile ASME has released a new metric version of ASME B16.5 wherein the bolt holes as well as the bolts are in inch sizes.
Topic 4

- Proposed Change to Materials Requirements
Proposed change: In Table 8, page 38, remove the restrictions on nickel content from the table.

Rationale: These restrictions are appropriate for sour service only, and should not be imposed on all equipment. When equipment is made to NACE, these restrictions will automatically be imposed.

Restricting nickel content in low alloy steels eliminates several important materials from being used as bodies, bonnets, and end connectors, in particular the 43xx deep-hardening low alloy steels, which are commonly used in OECs, and also several low-temperature low alloy materials such as ASTM A350-LF3 and LF9.
Dear George:

**SUBJECT: PROPOSED CHANGES TO API 6A**

As a former design task group chairman, and on behalf of design engineers everywhere, I would like to propose the attached technical revisions to API Spec 6A.

First, I feel it is time to finish the unfinished business of providing rules for high-temperature design of equipment using non-standard materials. At the same time we can broaden the definition of non-standard materials and permit the use of austenitic stainless steels and other materials that have yield strengths of 75,000 psi and less but do not meet all the material property requirements of the standard materials.

Second, there are still several of my earlier “errors and inconsistencies” that have not been resolved.

And third, I would like to propose loosening the restrictions on nickel content, which are now imposed on all equipment, and which are only appropriate for sour service.

I will be attending the meeting in Calgary and would be glad to present these items myself. You may want to include them with the meeting agenda.

Best regards,

John H. Fowler, P.E.
cc: Jonathan Jordan, API
<table>
<thead>
<tr>
<th>Subclause</th>
<th>Present</th>
<th>Proposed</th>
<th>Reason</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Non-standard materials are materials with specified minimum yield strength in excess of 517 MPa (75,000 psi) that do not meet the ductility requirements of Table 5 for standard 75K materials.</td>
<td>Non-standard materials are materials with properties that do not meet all requirements of Table 5 for a standard material.</td>
<td>Permit the use of austenitic stainless steels and other materials having properties that do not all meet Table 5.</td>
</tr>
<tr>
<td>4.3.3.2</td>
<td>$S_T = 0.83 , S_Y$</td>
<td>$S_T = 5/6 , S_Y$</td>
<td>To make this paragraph consistent with 4.3.3.6 and the original intent.</td>
</tr>
<tr>
<td>5.4.1 a) (last sentence)</td>
<td>All non-standard materials shall exceed a 75K minimum yield strength and meet a minimum of 15% elongation and 20% reduction of area.</td>
<td>All non-standard materials shall meet a minimum of 15% elongation and 20% reduction of area. Non-standard materials for applications shown in Table 4 shall have a design stress intensity $S_m$ per 4.3.3.6 at least equal to that of the lowest-strength standard material permitted for that application.</td>
<td>Provide rules for non-standard material applications with $S_Y &lt; 75K$ and eliminate &quot;cheating&quot; on $S_m$ values, i.e. $S_Y = 75$ ksi and $S_u = 90$ ksi would give a 45 ksi $S_m$ vs. 50 ksi based on yield only.</td>
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<td>Table 4</td>
<td>&quot;NS&quot;</td>
<td>Remove all &quot;NS&quot; from the table</td>
<td>The above revision spells out the rules for non-standard materials in all applications. No longer needed.</td>
</tr>
<tr>
<td>Table 4</td>
<td>Footnote b (Not Addressed) The proposed material would be added to the end of the present G.5.2.1.</td>
<td>Remove and renumber c to b For non-standard materials, an $S_m$ value may be used that is the lower of 2/3 of the elevated-temperature yield strength, one-half the minimum specified tensile strength, or 0.55 times the elevated-temperature tensile strength. Elevated-temperature tensile strength shall be determined in the same manner as the elevated-temperature yield strength.</td>
<td>Presently Annex G does not have rules for non-standard materials. This method is consistent with the ASME Code Section II Part D tables 2-100a and b.</td>
</tr>
</tbody>
</table>
Table 17, page 76: for Storage and Age Control (last line): The table should refer to 9.6a for PSL 1 and 2 and to 9.6b for PSL 3 and 4. The present table indicates that there is no requirement for PSL 1 and 2. The requirement for the manufacturer to have a documented procedure is a requirement.

Paragraph 8.6, page 104: Marking of loose connectors. This paragraph states that marking of PR levels is not required for loose connectors. However, Table 27 on page 101 shows the PR level as a required marking. Suggested fix: Remove “OD of Connector” from the “loose connectors” column for Performance requirements level in Table 27.

Appendix B

Paragraph B.1.1 Purpose: The second paragraph is no longer true. The new dimensions are calculated directly from the decimal inch values.

Paragraph B.1.2 Conversion Rules: These rules are no longer correct. These rules were used to develop the dimensions in the 17th and 18th editions of 6A. The new dimensions have been converted directly from the decimal inch numbers in the 17th Edition without the additional step of converting the dimension to the original fractional value. This can be verified by comparing the numbers in the 14th Edition to the 17th and 18th Edition (they agree except for the 6B flange bolt holes – ref. paragraph B.2.3). They do not agree with the new 19th Edition numbers.

Paragraphs B.2.3 and B.2.4 Bolt holes and fasteners: These paragraphs are no longer correct. The new dimensions no longer agree with ANSI B16.5-1981, and therefore metric fasteners cannot be used on 6B flanges.

Appendix F

Paragraph F.2.35.3, page 331: Bending Moments: This paragraph is vague. What is the “highest stress case” for a connector? API 6AF shows that there are an infinite number of combinations of tension, pressure, and bending moment that are all equally “highest stress cases.”
Proposed Change to Materials Requirements

Proposed change: In Table 8, page 38, remove the restrictions on nickel content from the table.

Rationale: These restrictions are appropriate for sour service only, and should not be imposed on all equipment. When equipment is made to NACE, these restrictions will automatically be imposed.

Restricting nickel content in low alloy steels eliminates several important materials from being used as bodies, bonnets, and end connectors, in particular the 43xx deep-hardening low alloy steels, which are commonly used in OECs, and also several low-temperature low alloy materials such as ASTM A350-LF3 and LF9.

In addition, NACE lists three martensitic stainless steels with more than 4.5% nickel as being comparable to S41000 stainless. If NACE doesn't care, why should we?

Proposed by John H. Fowler P E, member, SC6


Date: 8th April 2007

on the status of all work items and action to be taken

1. WG title: Wellhead and Christmas tree equipment

2. WG scope: Standardization of Wellhead and Christmas tree equipment used in the petroleum and natural gas industries

3. WG Convenor: Ries Langereis (The Netherlands) was confirmed as convenor at the ISO/TC67/SC4 meeting in 2002 (Resolution 11, 2002).
   
   Tel. +31 06 53493667 Fax: +31 70 3645941
   E-mail: ries.langereis@c-a-m.com

4. WG Secretary: Alfred Kruijer
   Tel nr. 31 70- 3772364
   e-mail alfred.kruijer@shell.com

5. Work programme (may be attached as annex to report):

   1. To follow ISO 10423:2003 Petroleum and natural gas industries –Drilling and production equipment-Wellhead and Christmas tree equipment (Third Edition);

   2. To work on and prepare for the fourth edition of ISO 10423, planned by 2008.

   3. To follow the technical processes around the publication of API 6A 19th edition; this in conjunction with coordination and liaison with API SC 6

   Through 2006 and 2007 various formal meetings were held with various key staff and members of API SC 6, AWHEM and various ISO workgroup members to prepare for the fourth edition of ISO 10423.

   A new work item proposal had been prepared for the preparation of the 4th edition of ISO 10423, this was accepted during September 2005 by all relevant members.

   Since September 2006 an active workgroup has emerged with sufficient participants from major Operators as well as significant representation from the suppliers.

   The latest version of NACE MR 0175/ISO 15156:2004 has resulted in different materials classes at certain places and thus with respect to materials classes we must now consider ISO 10423-version 3 in need of revision. Other areas where now ISO 10423:2003 vs 3 differs from the newly published API Spec-6a 19th edition:

   -Annex N adds API monogram programme. No ISO equivalent.
-API annex O adds “regional “changes”:

-API has deleted all references towards a repair clause of any description. It should be possible to introduce such clause to be valid for at least the highest quality product specification levels say PSL-2 and higher.

-Consequence of latest version of NACE MR 0175/ISO 15156:2004 (see above)

Possible allowance of castings for PSL 3-4 in line with past versions of API Spec 6A

**Proposed plan ahead for ISO 10423**

a) The convenor proposes to keep ISO 10423:2003 (third edition) as the industry standard for the next one to two years.

b) ISO/TC67/SC4/WG3 convenor has now an approved new work item to prepare the 4th version of ISO 10423.
A CD-committee draft is to be ready by Q-1 2008.

c) This new work item proposal has a number of objectives the main ones being:
-technically update ISO 10423:2003 aiming to ensure that it is technically identical to the 19th edition of API Spec 6A.
to ascertain which technical areas of the new version can be brought in line with the latest version of API Spec -6A 19th edition.

-If possible, simplify the standard for the common user
-Any specific MMS requirement (not applicable for international application) should appear in the API Spec 6A regional annex.

d) ISO/TC67/SC4/WG3 will continue to monitor any other changes, from any source, identified as being necessary to improve the standard.

e) To maintain close links with API subcommittee 6, to facilitate alignment of ISO 10423 and API Spec 6A.

f) To keep CEN/TC12 appraised of the situation.(to ensure parallel working in CEN )

6. **Specific areas of concern or progress:**

1) The current industrial situation is extremely tight and as a result companies are restructuring and knowledge workers in need for this WG 3 are in high demand.

2) Nevertheless a work group of sufficient technical ability has been formed and is active with notable participation from the USA.

3) A project group that needs to investigate the castings versus forging issue has been formed and is chaired by Alfred Kruijer Shell with active participation of: Scott Higgins-BP, Hugh Parker of Shell, Maarten Kuipers of Mokveld and Eric Wehner of Cameron.
3) A list of errata and other common changes has been made and coordinated through API and AWHEMS. This list is used to prepare for the first CD and is coordinated through Shell Global Solutions in the Hague, the Netherlands.

4) A project group coordinating the ramifications of new NACE MR0175/ISO 15156:2004 and later versions for the update of ISO 10423 has been formed under the active guidance of Maarten Kuipers.

5) Repair and remanufacture is another major area of difference between ISO and API since API 6A no longer carries this subject in the current standard. A new work item has been initiated within API Sc 6 to take care of this and pending the outcome of this the ISO WG will keep its current repair and remanufacture chapter as is.

7. Specific action items for ISO/TC 67/SC 4:
1) Agree plan forward for ISO 10423

8. Meetings since last report:
Past meetings

<table>
<thead>
<tr>
<th>Date of meeting</th>
<th>Location</th>
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<tbody>
<tr>
<td>6th September 2006</td>
<td>BP Aberdeen Scotland</td>
</tr>
<tr>
<td>6th December 2006</td>
<td>Mokveld Gouda Netherlands</td>
</tr>
<tr>
<td>1st February 2007</td>
<td>API SC 6 A Houston Texas.</td>
</tr>
<tr>
<td>20th March 2007</td>
<td>Norsk Hydro Bergen Norway</td>
</tr>
</tbody>
</table>

Future meetings

<table>
<thead>
<tr>
<th>Date of meeting</th>
<th>Location</th>
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<tbody>
<tr>
<td>26th June 2007</td>
<td>API week, San Francisco USA</td>
</tr>
<tr>
<td>September</td>
<td>Cameron Celle Germany??</td>
</tr>
</tbody>
</table>


10. Summary list of TC67/SC4/WG3 experts (and others).

- Davy Stewart Shell Ryswyk – Manager Wellservices
- Scott Higgins BP Aberdeen - Senior Project Engineer
- Ries Langereis Cameron Celle /The Hague; Industrial Liaison
- Mario Schiatti Breda Milano Vp Technology
- Maarten Kuipers VP QC Mokveld Gouda Holland
- Alfred Kruyer Shell The Hague Global Solutions expert
- Hugh Parker Shell Aberdeen Equipment specialist
- John McAuley Vetco Aberdeen
- Richard Preston FMC Aberdeen
- Thierry Cassagne Total France
- Dag Ketil Fredhem Hydro Norway
PSL 3G Ballot Proposal

Chart Recording/Pressure Monitoring Gauge
7.4.9.5.8 PSL 3G gas seat test - Valves

b) Acceptance criteria

No visible bubbles shall appear in the water bath during the holding period. A maximum reduction of the gas test pressure of 2,0 MPa (300 psi) is acceptable as long as there are no visible bubbles in the water bath during the holding period.
7.4.9.5.8  PSL 3G gas seat test - Valves

b) Acceptance criteria

No visible bubbles shall appear in the water bath during the holding period.

A maximum reduction of the gas test pressure of 2.0 MPa (300 psi) is acceptable as long as there are no visible bubbles in the water bath during the holding period.

If a pressure-monitoring gauge and/or chart recorder is used for documentation purposes, the pressure settling rate shall not exceed 3% of the test pressure per 15 min or 2 MPa (300 psi), whichever is less. The final settling pressure shall not fall below the test pressure before the end of the test period. Initial test pressure shall not be above 5% of the specified test pressure.

For the secondary low pressure test, the test pressure shall be 2 MPa (300 psi) +/- 10% over the hold period.