



AMERICAN PETROLEUM INSTITUTE
Spec Q1



Subsea Performance Bolt Workshop

API Spec Q1, Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry, 9th Edition

API Spec 20E, Specification for Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries, 2nd Edition

David Miller, PE, F. ASCE
Director, Standards

Topics

- What is API Spec Q1
- History & Development
- Requirements
- Application for API Specification 20E
- Program Updates

API Background

- API formed in 1919 as national trade association
 - API's mission: support a strong U.S. oil and natural gas industry
 - API develops statistical reports, standards and certification programs
 - API engages in legislative and regulatory advocacy
 - API currently represents ~600 companies

Standards Background

- Standards Department formed in 1923 as one of three foundational programs
- First standards published in 1924 on pipe sizes, threads and couplings
- All industry segments now active in standardization

What is API Spec Q1?

API Spec Q1... "Specification for Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry" ...is

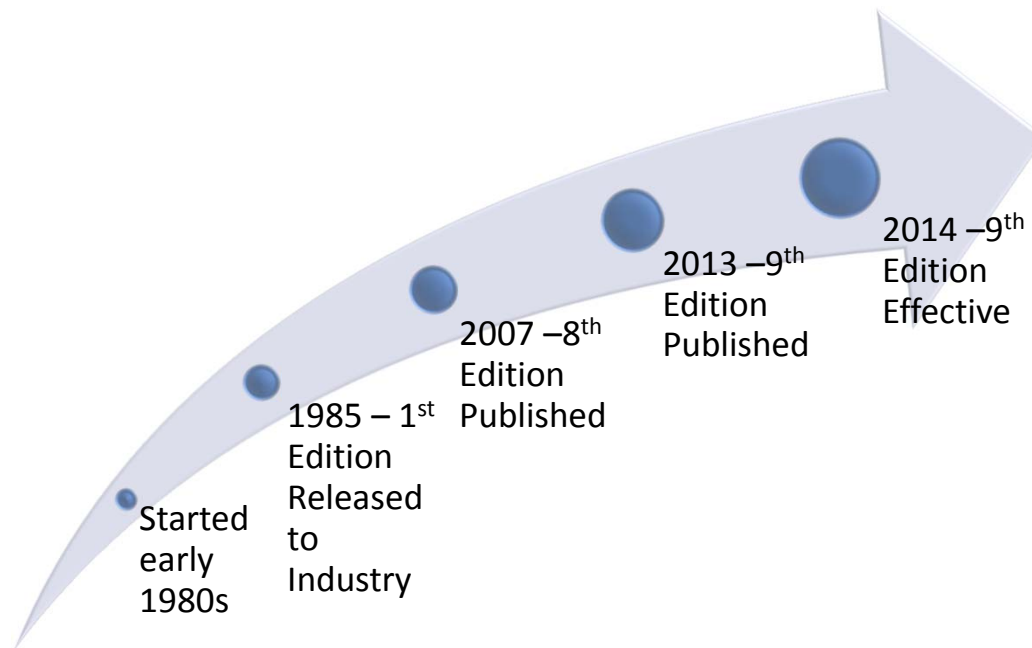
- The "primary" Quality Management System (QMS) Specification / Standard for the Oil and Gas Industry that is more stringent than ISO 9001 and is widely used by the Oil and Gas Industry,
- The QMS that API Licensees must meet and are audited to in addition to an API Product Spec to obtain an API Monogram License, and
- The only QMS listed in CFR 30, Part 250 and recognized by BSEE for equipment manufactured for use in the outer continental shelf.

What is API Spec Q1?

API Spec Q1 contains ...

- Quality management system requirements for manufacturers of oil and natural gas industry equipment
- Process requirements to consistently manufacture conforming products that meet customer, product specification and industry requirements
- Control requirements for design, purchasing and supply chain, contract review, manufacturing/production, inspection and testing, and other QMS controls (e.g., calibration, records, etc.)

History of API Spec Q1



- API Spec Q1 has evolved to meet Industry needs
- 32 years as the international oil and natural gas industry QMS standard for manufacturing equipment
- Basis for the API Monogram Program
- Applies to over 4500 current Licensees and Q1 Certified Companies in 79 different countries

Who Develops API Spec Q1?

- API Spec Q1 is developed and maintained by petroleum industry professionals for petroleum industry professionals
- API Spec Q1 is maintained by the API Subcommittee on Quality (SC18) which consists of international oil company professionals, equipment manufacturers, service and supply companies, regulators, quality system auditors/consultants, and other quality professionals

API Standards Program Accreditation

- API is an American National Standards Institute (ANSI) accredited standards developing organization
- ANSI accreditation requires:
 - Openness, Balance, Consensus and Due Process
 - Approved and Published Procedures
 - Requirement for standards updates
 - Regular Program Audits

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Section 1 - Scope

- Application
- Exclusions

Section 2 – Normative References

Section 3 – Terms & Definitions

Section 4 – Quality Management System Requirements

- Quality Management System
- Management Responsibility
- Organizational Capability – Resources
- Documentation Requirements & Records Control

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Section 5 – Product Realization

- Contract Review
- Planning
- Risk Assessment & Management
- Design & Development
- Contingency Planning
- Purchasing
- Production & Servicing Provision
- Control of Testing, Measuring and Monitoring Equipment for Product Conformity
- Product Release
- Control of Nonconforming Product
- Management of Change

Section 6 – General Management System Measurement, Analysis, and Improvement

- Monitoring, Measuring & Improving
- Analysis of Data
- Improvement – Corrective Action & Preventative Action
- Management Review

Annexes

- A – API Monogram Program
- B – Cross Reference – API Spec Q1, 9th-API Spec Q2-API Spec Q1, 8th
- C – Cross Reference – API Spec Q1, 8th-API Spec Q1, 9th-API Spec Q2

API Spec Q1, 9th Edition Requirements

**Specification for Quality Management
System Requirements for
Manufacturing Organizations for the
Petroleum and Natural Gas Industry**

API SPECIFICATION Q1
NINTH EDITION, JUNE 2013
EFFECTIVE DATE: JUNE 1, 2014

- **Contract Review** – determining & defining requirements
- **Design Controls** – designing conforming product
- **Purchasing Controls** – suppliers & purchased product meet requirements
- **Production Controls** – planning & execution of production
- **Inspection & Test** – ensuring product conforming throughout process (QA & QC)
- **Supporting Controls** – documents, records, equipment
- **Personnel Competence** – defining competence, establishing training, ensuring people are competent
- **Management System** – risk assessments, contingency planning, MOC, internal audits, management review, continual improvement, data analysis, nonconforming products, corrective & preventive actions

Why API Spec Q1?

Q1 provides:

- Procedures, process controls, competent personnel, equipment and facilities to manufacture consistent, conforming products for the oil and natural gas industry.

API Spec Q1 is especially designed to stand alone as the leading global standard specifically designed for the Petroleum, Petrochemical and Natural Gas Industries

API Spec Q1 promotes a common approach to a QMS for the Petroleum, Petrochemical and Natural Gas Industries

API Spec Q1 goes above and beyond other QMS standards by including industry-specific requirements

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Annex A – Use of Monogram by Licensees

- Control of the application and removal of the Monogram
- Monogram program requirements
 - QMS in place and conforming to API Spec Q1
 - Design package / documentation requirements
 - Manufacturing capability
 - Nonconformance reporting
 - Regular audits by independent auditors to both the requirements of API Q1 and the product specification

Background Information

API Spec 20E: Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries

- First Edition published in August 2012, Second Edition published in February 2017
- First API Spec 20E Licensing audit in October 2013
- First License Issued in November 2013
- 31 API Spec 20E Licensees and Applicants

Background Information

API Spec 20E: Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries

1.1 Purpose - This standard specifies requirements for the qualification, production, and documentation of alloy and carbon steel bolting used in the petroleum and natural gas industries.

- Ten sections covering Scope, Normative References, Terms, Qualification Bolting, Production of Qualified Bolting, Calibration Systems, Test Report, Marking, Record Retention and Storage & Shipping

20E Review Project Description

Project Manager	<i>Monogram/APIQR Program Manager</i>	Project Sponsor	<i>Director, API Standards</i>
Project Description	<ul style="list-style-type: none"> • Review Monogram/APIQR program audit reports related to API Spec 20E (<i>Alloy and Carbon Steel Bolting for Use in the Petroleum and Natural Gas Industries</i>) licensees to: <ul style="list-style-type: none"> • Identify possible trends in non-conformities related to raw materials provided to API Spec 20E licensees by their suppliers • Where possible, differentiate between technical (API Spec 20E) and quality management process (API Spec Q1) issues • Data as basis for API subcommittee considerations for possible improvements in API Spec 20E, API Spec Q1, and other API standards to address concerns with standard requirements or industry performance. • Identify ways to improve auditing of licensees and their suppliers 		

Analysis of QMS Audits of Manufacturers

- Considers only QMS non-conformities documented during audits of manufacturing facilities
- Excludes non-conformities against ISO 14001, OHSAS 18001 and API Spec Q2
- Based on QMS audits of manufacturers conducted between October 15, 2013 and March 31, 2016
- Small sample size of 20E audits may have had an impact on the data and analysis

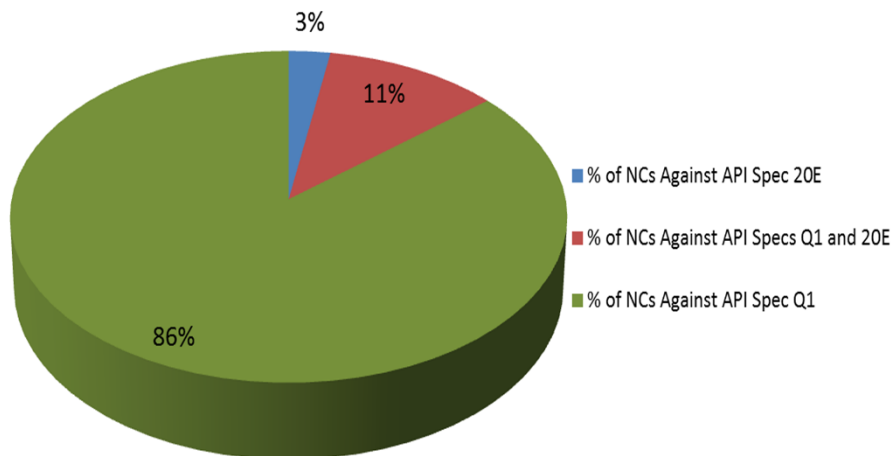
**API Spec 20E Audits and Audits of Other Manufacturers
October 15, 2013 to March 31, 2016**

Year	API Spec 20E Audits (% of Total)	Audits of Other Manufacturers (% of Total)
October 15, 2013 to year end	0.55 %	99.45 %
2014	0.29 %	99.71 %
2015	0.36 %	99.64 %
Up to March 31, 2016	0.12 %	99.88 %
TOTALS	0.33 %	99.67 %

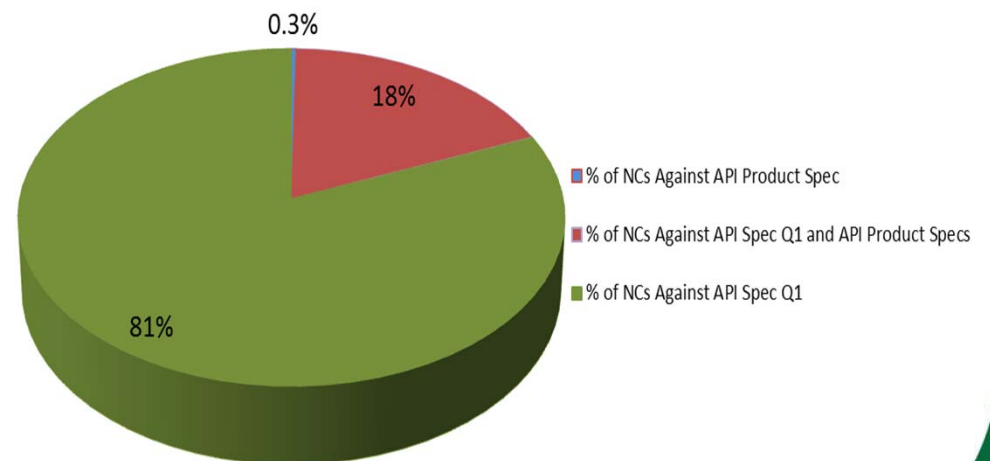
Analysis – Distribution of Non-Conformities

- Distribution of non-conformities cited during QMS audits of other manufacturers follows a similar pattern to API Spec 20E audits
- Higher percent of non-conformities cited against requirements of API Spec Q1

API Spec 20E QMS Audits
% of NCs Documented Against Requirements

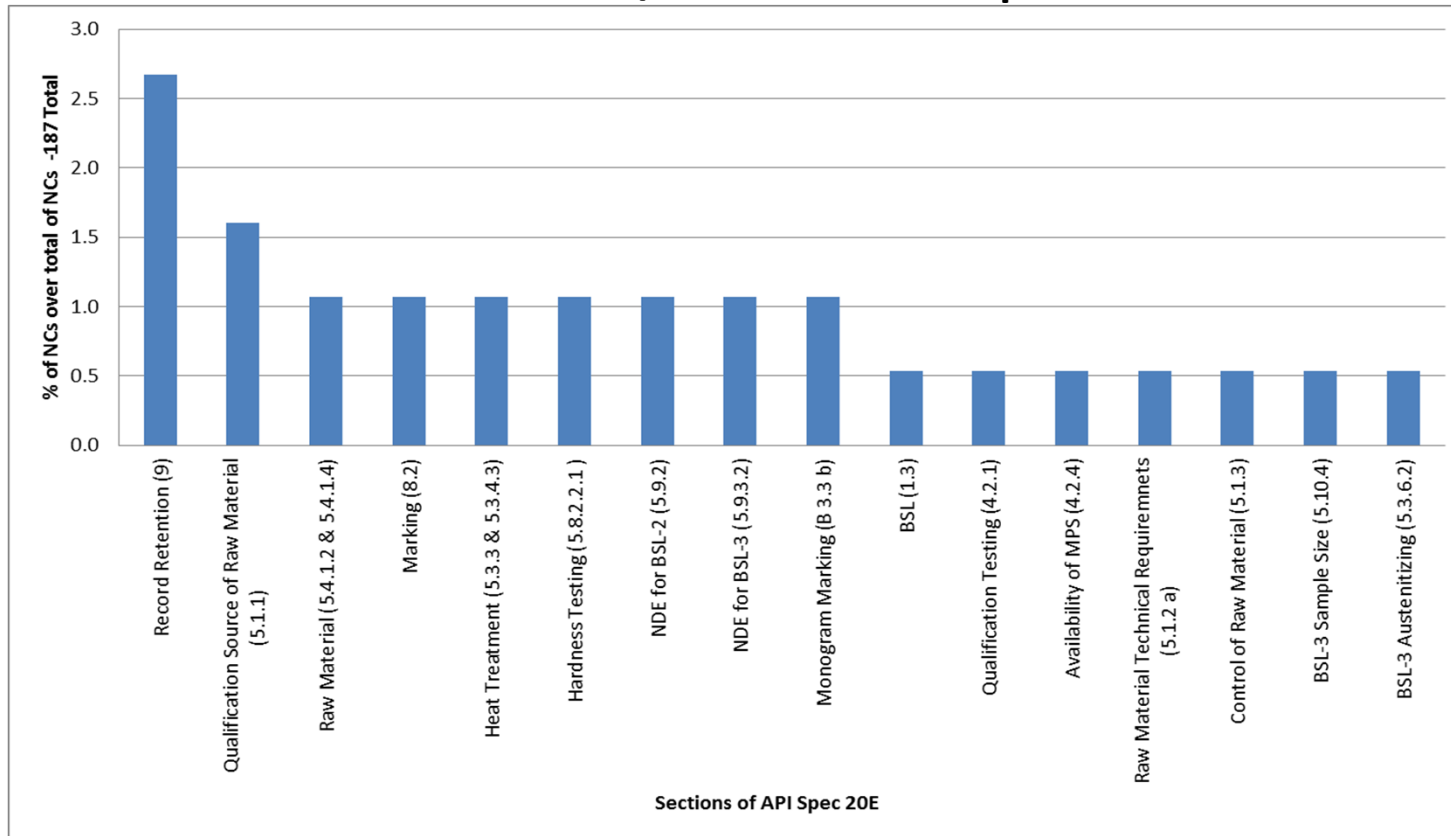


API QMS Audits of Other Manufacturers
% of NCs Documented Against Requirements



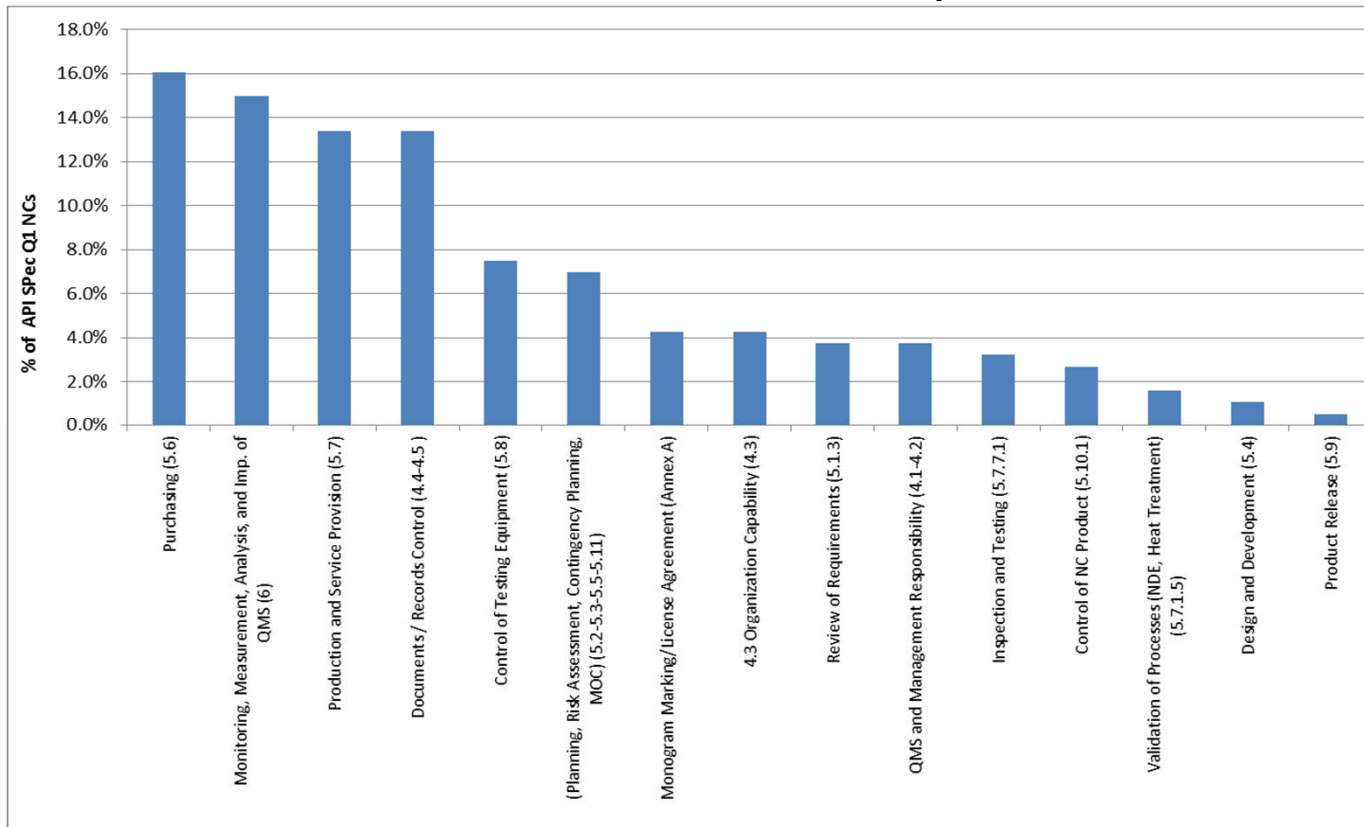
Analysis – Percentage of 20E NCs by Sections

API Spec 20E Audits
% of Total NCs v/s Section of API Spec 20E



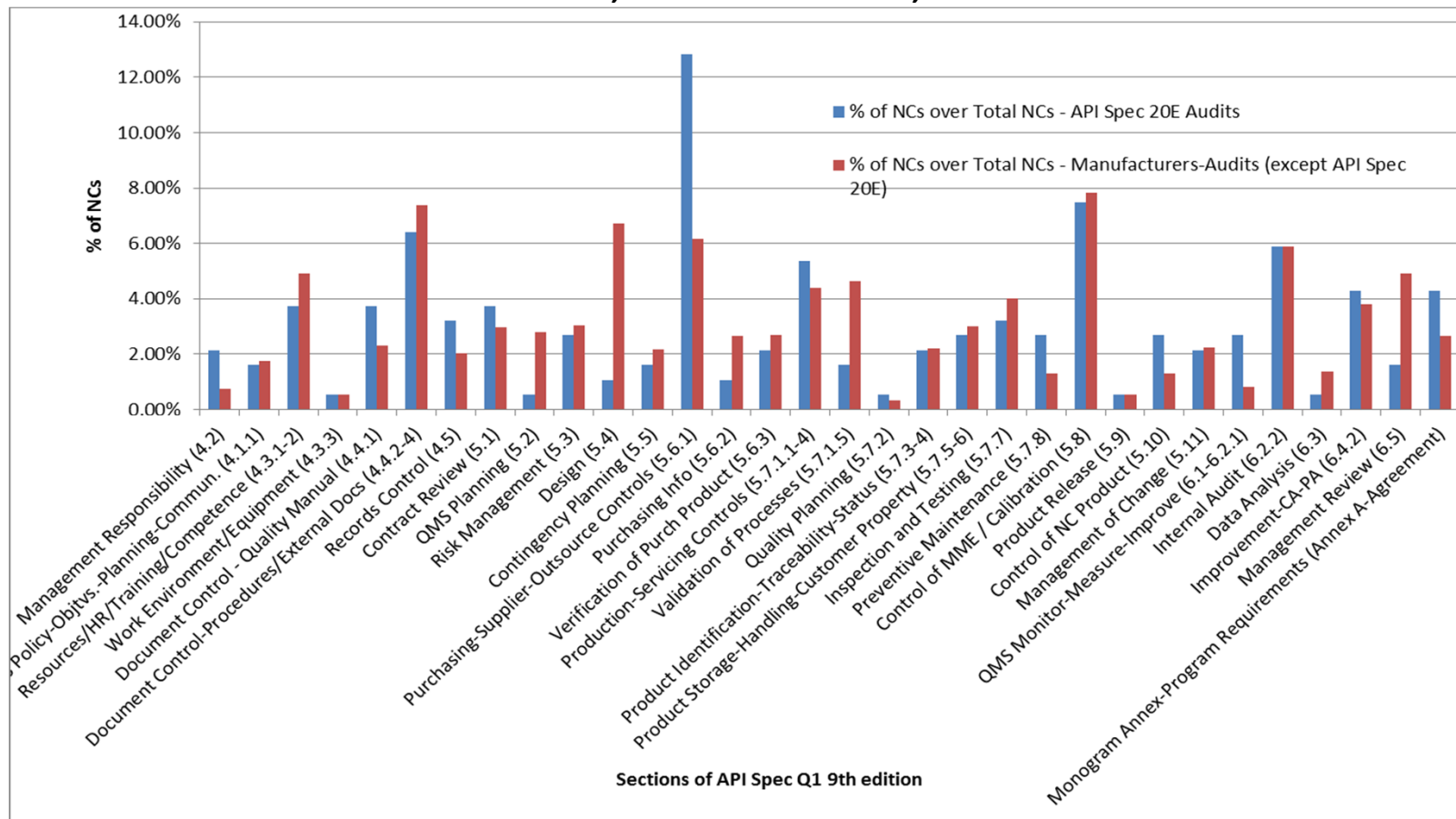
Analysis – Percentage of API Q1 NCs by Section

API Spec 20E Audits
% of Total NCs v/s Section of API Spec Q1



Analysis – Variations in NCs Cited During API Spec 20E and Other Manufacturer Audits

**% of API Spec Q1 NCs for API Spec 20E and Other Manufacturer Audits
October 15, 2013 to March 31, 2016**



Summary

- Data is being used to facilitate informed changes and improvements to API Spec Q1 and API Spec 20E
- Summarizes information that can be used to assess industry performance and trends in QMS and technical areas

Program Updates

- API Multi Segment Task Group made recommendations to Spec Q1
 - TGR-19: SC18 to form a TG to review the BSEE FIT-QC Report on connector bolt failures to determine if the current requirements of API Spec Q1 has the provisions needed to ensure that system control features are in place, and clearly stated, to eliminate these type of failures in the future
- The proposed changes to Spec Q1 have been balloted and are in comment resolution

Program Updates

- API Multi Segment Task Group made recommendations to API Spec 20E
 - TGR-2: TG recommends that API expand 20E to more adequately cover the requirements of plating and coating as well as move the supplemental requirements for plating and coating into the body of the document.
 - TGR-3: TG recommends to prohibit Zinc Plating (>95% Zn) for Subsea/ Marine application. TG further recommends that an investigation be conducted under the direction of SC21 to determine a better short term (storage) corrosion protection system that would not create hydrogen in service. The results of this would then need to be adopted into product standards.
 - TGR-9: TG recommends that volumetric examination where bolt diameter exceeds 2.5" should be added as a requirement to 20E, 20F, BSL-2, as well as BSL-3.
 - TGR-21: Strengthen heat treating and furnace loading requirements (more prescriptive requirements related to spacing, QTC location, thermocouple placement). Include requirements for oven calibration for Pre and post bake operations.
- The changes to Spec 20E are reflected in the 2nd edition published in February 2017

Conclusion

- API Spec Q1 is the industry quality management system standard
- API Spec 20E is the industry bolting standard
 - Both are developed under an ANSI accredited process and are regularly reviewed and updated
- Under the API Monogram Program Spec Q1 and Spec 20E work together to produce quality and conforming products for industry use



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Thank You for your attention!

- For more information:
 - API's website: www.api.org
 - <http://www.api.org/products-and-services/standards>
 - API's main phone number: +1-202-682-8000
 - David Miller, PE, F.ASCE, miller@api.org



Subsea Bolt Performance Workshop - Annex

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Section 4 – QMS Requirements

- Quality Policy, Objectives and Communications
- Resources
 - Human Resources – Competence and Training
 - Work Environment – Equipment, Buildings, Supporting Services
- Control of Documents and Records
 - Procedures required
 - Use of external documents (the API product specifications – Spec 20E)

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Section 5 – Product Realization

- 5.1 Contract Review – Determining and Reviewing Requirements
- 5.2 Planning
- 5.3 Risk Assessment and Management
 - Impacts on product quality and delivery
 - Procedures define methods, tools and requirements
- 5.4 Design and Development
- 5.5 Contingency Planning
 - Controls to mitigate product quality and delivery impacts of disruptive incidents
- 5.6 Purchasing
 - Process for identifying critical and non-critical purchases
 - Supplier and outsourcing controls

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Section 5 – Product Realization

- 5.7 Production and Servicing Provision
 - Control of production processes
 - Servicing controls – Product maintenance, adjustment, repair and/or on-site installation when installation is required by applicable product specification
 - Process control documents
 - Product realization capability documents
 - Validation of processes – Welding, NDE and heat treatment
 - Product quality plans – If required by customer
 - Identification and traceability requirements
 - Preservation of product
 - Inspection and testing – In-process and final inspections
 - Preventive maintenance

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Section 5 – Product Realization

- 5.8 Control of Testing, Measuring and Monitoring Equipment
- 5.9 Product Release
- 5.10 Control of Nonconforming Product
- 5.11 Management of Change
 - Changes in organizational structure, changes in key or essential personnel, changes in critical suppliers, changes to management system procedures
 - Identify and control potential risks related to impacts on product quality

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Section 6 – Monitoring, Measuring, and Improving

- Customer satisfaction
- Internal audits
- Data analysis
- Corrective and preventive actions
- Management reviews

Program Updates

- **20E Changes:**
- **Requirements for suppliers of subcontracted processes:** Section added to provide for qualification and control of suppliers. (Addresses the concerns expressed in BSEE reports and by API Multi-segment Bolting TG regarding control of subcontracted processes.)
- **Requirements for plating/coating:** Section added to provide for procurement and control of plating and coating. Section has measures for the prevention of hydrogen embrittlement and includes a prohibition on electrodeposited zinc coating. (Addresses BSEE concerns on control of plating and API Multi-segment Bolting Failure TG recommendation to prohibit zinc plating.)
- **Requirements for proprietary bolting material specification:** Clarified use of such specifications. (Change made to align 20E with API 16A and API 16F and potentially other specifications that have provisions for OEM-proprietary, non-ASTM, alloy and carbon steel bolting material grades.)
- **Definition of Bolting Manufacturer:** Added definition. (Change made in order to establish that the entity certifying the bolting as compliant with the requirements of 20E is actually manufacturing the product.)
- **Heat treatment control:** Expanded requirements for control of the heat treat process, particularly at the higher BSLs. (Addresses concerns of BSEE and the Multi-Segment Bolting TG that incorrect heat treatment was the source of some bolting failures.)

Program Updates

- **Heat treatment control:** Expanded requirements for control of the heat treat process, particularly at the higher BSLs. (Addresses concerns of BSEE and the Multi-Segment Bolting TG that incorrect heat treatment was the source of some bolting failures.)
- **Forging/ Hot heading control:** Added specific requirements for these processes including control of heating. (This adds more control to special processes known to be the source of bolting failures.)
- **Quality Management System (QMS) requirements:** Added mandatory compliance to ISO 9001, API Q1 and, ISO 17025 in appropriate sections. (Addresses overall BSEE and API concerns as to bolting quality.)
- **8 Marking**
- **8.1 ASTM Product Marking**
- Product marking shall be in accordance with ASTM A193, ASTM A194, ASTM A320, ASTM A540, ASTM A962 or the equipment manufacturer's proprietary bolting material specification, as applicable.
- NOTE The referenced ASTM specifications require marking of individual parts for headed bolting 1/4 in. nominal diameter and larger, for studs 3/8 in. nominal diameter and larger and for nuts of all sizes.
- **8.2 Marking Required by this Specification**
- Bolting shall be marked with unique heat lot identification and the following:
 - "20E1" for BSL-1;
 - "20E2" for BSL-2;
 - "20E3" for BSL-3.
- Each piece 1 in. nominal diameter and larger shall be marked. For bolting less than 1 in. nominal diameter, the bolting shall be securely containerized to maintain heat lot identification and traceability. Multiple heat lots shall not be mixed in a single container. Containers used in the processing, storing, and shipping of bolting not individually marked shall be clearly labeled with all marking information required by the relevant ASTM or equipment manufacturer's proprietary bolting material specifications and this standard.
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Program Updates

- Additional actions arising from Multi-Segment TG
- 6A, 21st Edition
 - - Will require conformance to API 20E bolts.
- 6DSS 3rd Edition
 - - Will require conformance to API 20E and API 20F for pressure boundary bolts.
- 16A, 4th Edition
 - - In publication
 - - Will require conformance to API 20E and API 20F for pressure controlling bolting, closure bolting and pressure retaining bolting.
- 16AR, 1st Edition
 - In publication
 - Will require conformance to API 20E and API 20F for pressure controlling bolting, closure bolting and pressure retaining bolting.
- 64, 3rd Edition
 - In publication
 - Will require conformance to API 20E and API 20F for primary and closure bolting.
- 16C, 3rd Edition
- Q1, 9th Edition (Addendum 2)
- 16F, 2nd Edition
 - - Will require conformance to API 20E and API 20F.
- Spec 17D, Subsea Production Systems—Subsea Wellhead and Tree Equipment is also reviewing Spec 20E and will likely follow Spec 6A and make a normative reference to this standard