

Implementing ISO 9001 and API Q1 for Design Package in Petroleum and Natural Gas Industry

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Abstract - A company that produced a product must be refer to Quality Management Systems and Product Specification for use in the Petroleum and Natural Gas Industry. It defines the fundamental quality management systems requirement for those claiming conformity to the requirement of this specification. It means to provide minimum requirement for the development quality management system that provides for continual improvement, emphasizes defect prevention, and strives to minimize variation and waste for a company.

(keywords : Quality Management System, Product Specification, Petroleum and Natural Gas Industry)

1. INTRODUCTION

ISO 9001 and API Q1 are the Quality Management System, that both of them overall the same, only in API Q1 emphasizing in Petroleum and Natural Gas Industry. A company shall established, documented, implemented, and maintained at the times a Quality Management System for all products and servicing provided to use in Petroleum and Natural Gas Industry. A company shall measure the effectiveness and improve upon the Quality Management System in accordance with the requirements. Top Management in a company shall ensure availability of resources essential to managed the Quality Management System.

Potential benefit to a company which implementing a Quality Management System based on International Standard are :

- The ability to consistently provide products and services that meet customer and applicable statutory and regulatory requirements.
- Facilitating opportunities to enhance customer satisfactions.
- Addressing risks and opportunities associated with its context and objectives.
- The ability to demonstrate conformity to specified quality management system requirements.

The International Standard employs the process approach which incorporates the Plan-Do-Check-Act (PDCA) cycle and risk based thinking.

2. LITERATURE REVIEW

For Design and Development Planning, a company shall maintain a documented procedure to plan and control the design and development of the product.

The procedure shall identify :

- a. The plan(s), including plan updates, used for design and development;
- b. The design and development stages;
- c. The resources responsibility, authorities, and their interfaces to ensure effectiveness communication;
- d. The review, verification, and validation activities necessary to complete each design and development stages, and
- e. The requirement for a final review of the design.

A. Design and Development Input

Input shall be identified and reviewed for adequacy, completeness, and lack of conflict.

Input shall include functional and technical requirements, and the following as applicable

- a. customer-specified requirements;
- b. requirements provided from external sources, included API (American Petroleum Institute) Product Specifications;
- c. environmental and operational conditions;
- d. methodology, assumptions, and formula documentations;
- e. historical performance and their information derived from previous similar design;
- f. legal requirements, and;
- g. results from risk assessments.

B. Design and Development Output

Output shall be documented to allow verification against the design and development input requirements.

Output shall :

- a. meet the input requirements for design and developments;
- b. provide appropriate information for purchasing, production, and servicing;
- c. identify or reference Design Acceptance Criteria (DAC);
- d. include identification of, or reference to, product and/or components deemed critical to the design;
- e. include results of applicable calculations; and
- f. specify the characteristic of the product that are essential for its safe and proper use.

C. Design and Development Review

A suitable stages, review(s) shall be performed:

- a. to evaluate the suitability, adequacy, and effectiveness of the result of design and development stages to meet specified requirements; and
- b. to identify any problems and propose necessary actions.

D. Design and Development Verification and Final Review

To ensure that the design and development outputs have met the design and development input requirements, design and development verification and final review shall be conducted and documented in accordance with planned arrangements.

E. Design and Development Validation and Approval

Design and development validation shall be performed in accordance with planned arrangements to ensure that resulting product is capable of meeting the specified requirements. Validation shall be completed prior to the delivery of the product, when possible.

The completed design shall be approved after validation. Competent individual(s) other than the person or persons who developed the design shall be approve the final design.

F. Design and Development Changes

Design and development changes shall be identified. The changes shall be reviewed, verified, and validated, as appropriate, and approved before implementation.

The review of design and development changes shall include evaluation of the effect of the changes on product and/or their constituent parts already delivered.

Design and development changes, including changes to design documents, shall require the same controls as the original design and development.

3. RESEARCH METHOD

A company received an order from a customer to fabricate Cross Block 2^{1/16}-5M (R-24) 4 ways. A company shall compile a design package of this cross block.

Engineer propose a design plan as follows:

Description: Cross Block 2^{1/16}"-5M 4 Ways.

Applicable design code / Standard	: API 6A, 20th Edition.
Design Method	: ASME Method (API 6 Clause 4.3.3.2)
Service Condition	: Sour Service
Material	: AISI 4130 (75K)
Temperature Class	: U (-18°C to +121°C)
Delivery	: 4 to 5 weeks
Validation Test	: NDE, Hardness Test, Hydro-test

Design and Development Stages consist of: Design Input, First Intermediate Design Review, Second Intermediate Design Review, Design Output, Verification and Final Review, Design Validation, and Final Approval.

Design and Development Input:

- A. Customer specified requirement :
 - a. Email Inquiry from customer
 - b. Work order

- B. Requirement from external sources :
 - a. API 6A 20th edition Table B.53, B54 and B.65 (Flange Dimensional Data).
 - b. API 6A 20th edition Table B.53, B.54 and Annex C (Bolt Dimensional Data).
 - c. NACE MR0175, 2nd edition.

- C. Environmental and operation condition:
 - a. Material Class : DD-NL / Sour Service
 - b. Temperature Class : U (-18°C to +121°C).
 - c. PSL level : PSL 2

- D. Methodology, assumption, and formula documentation
 - a. ASME method, as per API 6A 20th edition, clause 4.3.3.2
 - b. ASME Boiler and Pressure Vessel Code, Section VIII, Division 2, Appendix 4
 - c. ASME Section VIII Division 2, Table 4.16.1 (Gasket Factor for Determining The Bolt Loads)
 - d. ASME Section VIII Division 2, Table 4.16.4 (Flange Stress Factor Equations involving Diameter)
 - e. ASME Section VIII Division 2, Table 4.16.5 (Flange Stress Factor Equations)

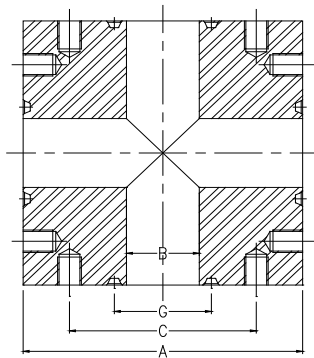
- f. ASME Section VIII Division 2, Table 4.16.6 (Moment Arms For Flange Loads For The operating Condition)
- g. ASME Section VIII Division 2, Table 4.16.7 (Flange Moment Of Inertia)
- h. ASME Section VIII Division 2, Table 4.16.8 (Flange Stress Equations)
- i. ASME Section VIII Division 2, Table 4.16.9 (Flange Stress Acceptance Criteria)
- j. ASME Section VIII Division 2, Table 4.16.10 (Flange Rigidity Criteria)

Design and Development Output:

Design and Development Outputs are provided with the following characteristics:

- A. Meet the input requirement for design and development;
 - Engineering drawing has followed the API 6A 20th edition and specified requirement;
 - Material AISI 4130 (HN #432232), Ring Gasket (HN #16789), Stud bolt (HN #47235), Nut (HN #1103132) comply with the input service condition requirement. (suitable for sour service, T= -18°C to +121°C and 5000 PSI Working Pressure).
- B. Provide appropriate information for purchasing, production, and servicing.
 - Material size, service conditions, machining details is included in the design.
- C. Identify or reference design acceptance criteria.
 - Dimensional tolerances are provided in the design.
- D. Include identification of products and/ or components deemed critical to the design.
 - Stud bolt & nut size, length, & grade details are provided.
 - Ring gasket size, type, and grade details are provided.
- E. Include results of applicable calculations.
 - Design calculation is provided.
- F. Specify the characteristics of the product that are essential for its safe and proper use.
 - Working pressure for specific model or type designation is provided.

4. RESULT AND DISCUSSION



Quick rundown on events:

A final validation will be conducted to the Design by Quality Department, to ensure that the design have met the requirement of API Spec 6A 20th edition.

To ensure that the design and development outputs have met the design and development input requirements, design verification and final review meeting has been conducted by the person who has experiences in design and development.

Material mill certificate, in-process and dimensional inspection reports, completed Travelling Work Order (TWO) and other relevant documents were submitted to the person for Final Verification.

After reviewing, the output design is satisfactory and found to be in compliance with API 6A 20th edition, T= -18°C to +121°C and sour service requirement.

Document	Standard / Reference	Remark
Design Acceptance Criteria	API 6A 20th Edition	Verified and Satisfactory
Material Mill Certificate	Work Instruction	Verified and Satisfactory
Calculation	<ul style="list-style-type: none"> • API 6A 20th Edition clause 4.3.3.2 • ASME Sec. VIII, Division 2, Appendix 4 • ASME Sec. VIII, Division 2, Table 4.16.1-10 	Verified and Satisfactory

To ensure the final product is capable of meeting the specified requirement, NDE test, hydrostatic test and hardness test were performed by Quality Department.

Description	Reference	Remark
Design Validation Test	Hydro test	Verified and Satisfactory
	Hardness Test	Verified and Satisfactory
	NDE (Wet Fluourescent Method)	Verified and Satisfactory

5. CONCLUSION

This paper aims to state the importance of ISO 9001 and API Q1 especially in design and development in The Petroleum and Natural Gas Industry, where the goods produced are goods that must be designed in accordance with the conditions needed, and must be given the necessary restrictions accordingly with the condition of the item being used.

Each department / division or part of a company has its own responsibilities and must carry out these responsibilities in accordance with existing procedures and follow the specified international standards.

When referring to ISO 9001 and API Q1, any nonconformities can be minimized by following all stages of design and development process.

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