



BODY OF KNOWLEDGE
API 570 AUTHORIZED PIPING INSPECTOR
CERTIFICATION EXAM

2023 (Replaces 2022)

API Authorized Piping Inspectors must have a broad knowledge base relating to maintenance, inspection, alteration, and repair of in-service metallic piping systems. The API Authorized Piping Inspector Certification Exam is designed to determine if applicants have such knowledge.

Questions may be taken from anywhere within each document in this BOK, unless specifically excluded herein.

If specific sections of a document are listed as excluded— all other sections within that document are included. In some cases, specific paragraphs, or sections, such as the example shown below, are included as an aid to the candidate. This is not intended to exclude other paragraphs.

For example: In the “Corrosion Rate and Inspection Intervals” section of this BOK (Section A, Sub-section 1), it states:

The Inspector must be able to calculate:

- a) Corrosion Rates (API 570, 7.1.2).

This means that the corrosion rate calculation will be found in 7.1.2 It does not mean that other paragraphs in that section are excluded.

The exam consists of two parts. The closed-book part tests the candidate on knowledge and tasks requiring everyday working knowledge of API Standard 570 and the applicable reference documents. The open-book portion of the exam requires the use of more detailed information that the inspector is expected to be able to find in the documents but would not normally be committed to memory. During the exam, applicants will be expected to choose the best answer from the options provided.

REFERENCE PUBLICATIONS:

A. API Publications:

API 570, Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems
API Recommended Practice 571, Damage Mechanisms Affecting Fixed Equipment in the Refining Industry
API Recommended Practice 574, Inspection Practices for Piping System Components
API Recommended Practice 576, Inspection of Pressure-relieving Devices
API Recommended Practice 577, Welding Processes, Inspection, and Metallurgy
API Recommended Practice 578, Guidelines for a Material Verification Program (MVP) for New and Existing Assets

B. ASME Publications:

American Society of Mechanical Engineers (ASME) *Boiler and Pressure Vessel Code*:
Section V, Nondestructive Examination
Section IX, Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and
Welding, Brazing, and Fusing Operators

B16.5, Pipe Flanges and Flanged Fittings: NPS ½ Through NPS 24 Metric/Inch Standard

B31.3, Process Piping

PCC-2, Repair of Pressure Equipment and Piping (Newly Added)

Note: Refer to the Publications Effectivity Sheet on the ICP Website (www.api.org/ICP) for a list of specific editions, addenda, and supplements of the reference publications that are effective for your exam date.

I. CALCULATIONS FOR EVALUATING THICKNESS MEASUREMENTS, INSPECTION INTERVALS, AND PIPING INTEGRITY

- A.** Code calculation questions will be oriented toward existing in-service piping, not new piping. API Authorized Piping Inspectors should be able to check and perform calculations relative to in-service deterioration, repairs, rerates, or alterations, such as those included in the following eight categories.

Note: Candidates are expected to understand the US customary units (inches, feet, PSI, etc.) and the SI units (metric system) and to use both system formulas.

1. CORROSION RATES AND INSPECTION INTERVALS

The Inspector should be able to understand inspection data and determine the thickness measurement and visual external inspection intervals.

The Inspector must be able to calculate:

- a) Corrosion Rates (API 570, 7.1.2)
- b) Remaining Life (API 570, 7.2)
- c) Inspection Interval (API 570, 6.3.3 & Table 1)

The formulas for performing the above calculations and rules for setting the inspection intervals may be "closed-book" during the exam.

2. WELD JOINT QUALITY FACTORS AND CASTING QUALITY FACTORS

The inspector should be able to determine the weld joint quality factor " E_j " of a longitudinal pipe weld joint. The inspector should be able to determine:

- a) Casting Quality factor, E_c from ASME B31.3, 302.3.3(b) and Table A-1A
- b) Weld Joint Quality factors from ASME B31.3, 302.3.4 and Table A-1B;
- c) Increased Joint Quality Factors by performing supplemental NDE from ASME B31.3, Table 302.3.4;

Determining weld joint quality factor may be part of an internal pressure problem since the joint factor E_j is used in the formulas for determining required thickness or internal design pressure.

3. INTERNAL PRESSURE / MINIMUM THICKNESS OF PIPE

The inspector should be able to determine:

- a) The minimum required thickness or pressure design thickness of a straight pipe section for internal pressure only (ASME B31.3, 304.1.1 and 304.1.2);
- b) The minimum required thickness of a permanent blank for a given design pressure (ASME B31.3, 304.5.3);
- c) The "MAWP" of corroded pipe, compensating for expected corrosion loss at the next inspection (API 570, 7.5)

The inspector should also be able to compensate for the corrosion allowance. (Add or subtract based on requirements from the exam problem).

4. PRESSURE TESTING

The inspector should be able to:

- a) Demonstrate knowledge concerning hydrostatic leak testing (ASME B31.3, 345.4)
- b) Demonstrate knowledge concerning pneumatic leak testing (ASME B31.3, 345.5)
- c) Calculate a hydrostatic or pneumatic leak test pressure (ASME B31.3, 345.4 and 345.5)

5. IMPACT TESTING

The inspector should be able to:

- a) Determine the minimum metal temperature of a material, which is exempt from impact testing (ASME B31.3, 323.2.2, Figure 323.2.2A and Table A-1).
- b) Determine the minimum required Charpy V-notch impact values of a given material. (ASME B31.3, 323.3 and Table 323.3.5)

6. PREHEATING AND HEAT TREATMENT REQUIREMENTS

The inspector should be able to determine which weld sizes require preheating and/or heat treatment. The inspector also should be able to determine what is the required or recommended preheat temperature (ASME B31.3, 330 and Table 330.1.1).

7. THERMAL EXPANSION

The inspector should be able to determine the total thermal expansion of a material between temperatures (ASME B31.3, Appendix C, Table C-1).

8. MINIMUM WALL THICKNESS & WORKING PRESSURES FOR FLANGES

The inspector should be able to determine the minimum wall thickness and working pressure requirements for flanges.

The inspector should also be able to:

- a) Determine the working pressure and minimum/maximum system hydrostatic test pressure for a flange of specified material and temperature (ASME B16.5, Section 2 and Table 1.1-1 and Tables 2-1.1 through 2-3.19 and Tables 2-1.1C through 2-3.19C).
- b) Determine the minimum dimensions of a given flange (ASME B16.5, Tables 7 through 22 and Tables 7C through 22C).
- c) Determine maximum working pressure of a flange when given the design temperature, flange material and flange class.
- d) Determine maximum temperature of a flange when given the design pressure, flange material and flange class.
- e) Determine most cost-effective flange when given the design pressure, design temperature, and flange material.

9. MINIMUM REQUIRED THICKNESS OF A PERMANENT BLANK (ASME B31.3, 304.5.3)

B. The following are the ASME B31.3 code engineering requirements that are excluded from the examination and that the API Authorized Piping Inspectors will NOT be expected to know for the purposes of certification testing.

1. 302- Design criteria – (All except for 302.3.3 Casting Quality Factor, E_c , and 302.3.4, Weld Joint Quality Factor, E_j)
2. 304.1.3- Straight Pipe Under External Pressure
3. 304.2- Curved and Mitered Segments of Pipe
4. 304.3- Branch Connections
5. 304.4- Closures
6. 304.5- Pressure Design of Flanges and Blanks (All except 304.5.3, Blanks)
7. 304.6- Reducers
8. 304.7- Pressure Design of Other Components
9. 315- Tubing Joints
10. 316- Caulked Joints
11. 317- Soldered and Brazed Joints
12. 318- Special Joints
13. 319.4- Flexibility Analysis
14. 319.5- Reactions
15. 319.6- Calculation of Movements
16. 319.7- Means of Increasing Flexibility
17. 322.3- Instrument Piping
18. Chap.VII- Nonmetallic Piping and Piping Lined With Nonmetals
19. Chap.VIII- Piping for Category M Fluid Service
20. Chap.IX- High Pressure Piping
21. App.B- Stress Tables and Allowable Pressure Tables for Nonmetals
22. App.D- Flexibility and Stress Intensification Factors
23. App.E- Reference Standards
24. App.G- Safeguarding
25. App.H- Sample Calculations for Branch Reinforcement
26. App.J- Nomenclature
27. App.K- Allowable Stresses for High Pressure Piping
28. App R - Use of Alternative Ultrasonic Acceptance Criteria
29. App.X- Metallic Bellows Expansion Joints
30. App.Z- Preparation of Technical Inquiries

II. WELDING PROCEDURE AND QUALIFICATION EVALUATION

A. ASME BPVC SECTION IX

The inspector should have the knowledge and skills required to review a Procedure Qualification Record, Welding Procedure Specification and Welder Performance Qualification to determine the following:

1. Determine if procedure and qualification records are in compliance with applicable ASME Boiler and Pressure Vessel Code and any additional requirements of API 570. The weld procedure review will include:
 - Weld Procedure Specification (WPS)
 - Procedure Qualification Record (PQR)
 - Welder Performance Qualification (WPQ)
2. Determine if all required essential and non-essential variables have been properly addressed. (Supplemental essential variables will not be a part of the WPS/PQR)
3. Determine that the number and type of mechanical tests that are listed on PQR are the proper tests, and whether the results are acceptable.
4. Determine that the welder is qualified to make a production weld according to the WPS

WELD PROCEDURE REVIEW MAY INCLUDE SMAW, GTAW, GMAW, OR SAW, WITH THE FOLLOWING LIMITATIONS:

1. No more than one process will be included on a single WPS, PQR or WPQ and the WPS to be reviewed will be supported by a single PQR.
2. Filler metals will be limited to one-per-process for SMAW, GTAW, GMAW, or SAW
3. The PQR will be the supporting PQR for the WPS.
4. The WPQ test coupon is to be welded in accordance with a qualified WPS.
5. Base metals will be limited to P-No. 1, P-No. 3, P-No. 4, P-No. 5, and P-No. 8.
6. Dissimilar base metal joints, and dissimilar thicknesses of base metals will be excluded.
7. Special weld processes such as corrosion-resistant weld metal overlay, hard-facing overlay, and dissimilar metal welds with buttering of ferritic member will be excluded.
8. For P-No. 1, P-No. 3, P-No. 4, and P-No. 5, for the purpose of the exam the lower transition temperature will be 1330°F and the upper transformation temperature will be 1600°F.

B. ASME B31.3

The inspector should be familiar with and understand the general rules for welding in ASME B31.3, Chapter V such as:

1. Typical joints and definitions
2. Weld sizes
3. Restrictions on joints
4. Maximum allowable reinforcement
5. Inspection requirements
6. Preheating and Heat Treatment

C. API 570

The inspector should be familiar with and understand any rules for welding in API 570. Any rules for welding given in API-570 shall take precedence over those covering the same areas in ASME, B31.3.

Note: "Editorial" and non-technical requirements for the welding subject matter, the candidate is to be tested on, are excluded. This includes items such as the revision level of the WPS, company name, WPS number and date, and name of testing lab. However, the API Authorized Piping Inspector should know that the PQR and WPQ must be signed and dated.

D. The inspector shall be familiar with all the requirements of and information in API RP 577.

III. NONDESTRUCTIVE EXAMINATION

A. ASME Section V, Nondestructive Examination

Note: The exam will cover only the main body of each referenced Article, except as noted.

1. Article 1, General Requirements:

The inspector should be familiar with and understand;

- a) The Scope of Section V
- b) Rules for use of Section V as a referenced Code
- c) Responsibilities of the Owner / User, and of subcontractors
- d) Calibration
- e) Definitions of "inspection" and examination"
- f) Record keeping requirements

2. Article 2, Radiographic Examination:

The inspector should be familiar with and understand;

- a) The Scope of Article 2 and general requirements,
- b) The rules for radiography as typically applied on butt welded seams such as, but not limited to:
 - Required marking
 - Type, selection, number, and placement of IQI's,
 - Allowable density and density ranges
 - Control of backscatter radiation
- c) Records

3. Article 6, Liquid Penetrant Examination (Including mandatory appendices II and III):

The inspector should be familiar with and understand the general rules for applying and using the liquid penetrant method, including but not limited to the following:

- a) The Scope of Article 6,
- b) General requirements such as but not limited to:
 - Procedures
 - Contaminants
 - Techniques
 - Examination
 - Interpretation
 - Documentation and record keeping

4. Article 7, Magnetic Particle Examination (Yoke and Prod techniques only):

The inspector should be familiar with and understand the general rules for applying and using the magnetic particle method including, but not limited to the following:

- a) The Scope of Article 7,
- b) General requirements such as but not limited to:
 - Procedures
 - Techniques (Yoke and Prod only)
 - Calibration
 - Examination
 - Interpretation
- c) Documentation and record keeping

5. Article 9, Visual Examination:

The inspector should be familiar with and understand the general rules for applying and using the visual examination method including, but not limited to the following:

- a) The scope of Article 9,
- b) General requirements such as but not limited to:
 - Procedures
 - Physical requirements
 - Procedure/technique
 - Evaluation
- c) Documentation and record keeping

6. Article 10, Leak Testing (Including Mandatory Appendix I Bubble Test –Direct Pressure Technique):

The inspector should be familiar with and understand the general rules for applying and using the leak testing method including, but not limited to the following:

- a) The scope of Article 10,
- b) General requirements such as but not limited to:
 - Procedures
 - Equipment
 - Calibration
 - Test
 - Evaluation
- c) Documentation and record keeping

7. Article 23, Ultrasonic Standards, **Section SE-797 only** – Standard practice for measuring thickness by manual ultrasonic pulse-echo contact method:

The inspector should be familiar with and understand;

- a) The Scope of Article 23, SE-797,
- b) The general rules for applying and using the Ultrasonic method
- c) The specific procedures for Ultrasonic thickness measurement as contained in paragraph 7.

B. ASME B31.3 and API 570: General nondestructive exam requirements:

ASME B31.3: The inspector should be familiar with and understand the general rules for NDE (Chapter VI).

API 570: The inspector should be familiar with and understand the general rules for NDE in API 570.

IV. PRACTICAL KNOWLEDGE - GENERAL

The following topics may be covered:

1. Organization and Certification Requirements.
2. Types and Definitions of Maintenance Inspections.
3. Welding on Piping
4. Corrosion and Minimum Thickness Evaluation.
5. Estimated Remaining Life.
6. Inspection Interval Determination and Issues Affecting Intervals.
7. Maintenance Inspection Safety Practices.
8. Inspection Records and Reports.
9. Repairs/Alterations/Reratings to Piping.
10. Rerating Piping.
11. Pressure Testing After Repairs, Alterations, or Rerating
12. Pressure Temperature Ratings
13. Markings
14. Materials
15. Dimensions
16. Test
17. Limiting Dimensions of Gaskets
18. Methods for Establishing Pressure-Temperature Ratings
19. Methods of performing positive material identification and related record keeping.

More information relative to each of the categories is contained in section "V. PRACTICAL KNOWLEDGE - SPECIFIC" where each reference publication applicable for study for the exam has been listed with relevant topics that may be covered on the exam.

V. PRACTICAL KNOWLEDGE - SPECIFIC

- **API 570, Piping Inspection Code: In-Service Inspection, Rating, Repair, and Alteration of Piping Systems** – Entire document is subject to testing
- **API RP 571, Damage Mechanisms Affecting Fixed Equipment in the Refining Industry**
ATTN: Exam questions will be based on the following portions of the document only:
 - Section 2 Definitions
 - Par. 3.3 Amine Stress Corrosion Cracking
 - 3.8 Atmospheric Corrosion
 - 3.9 Boiler Water and Stream Condensate Corrosion
 - 3.14 Caustic Corrosion
 - 3.15 Caustic Stress Corrosion Cracking
 - 3.17 Chloride Stress Corrosion Cracking
 - 3.22 Corrosion Under Insulation
 - 3.27 Erosion/Erosion – Corrosion
 - 3.31 Galvanic Corrosion
 - 3.37 Hydrochloric Acid Corrosion
 - 3.43 Mechanical Fatigue (Including Vibration-induced Fatigue)
 - 3.45 Microbiologically Influenced Corrosion
 - 3.57 Soil Corrosion
 - 3.58 Sour Water Corrosion (Acidic)
 - 3.61 Sulfidation
- **API RP 574, Inspection Practices for Piping System Components** – Entire document is subject to testing
- **API RP 576, Inspection of Pressure-relieving Devices**
ATTN: Exam questions will be based on the following portions of the document only:
 - Sections 5
 - Sections 6.1-6.3
 - Section 8
 - Sections 10.1-10.3
- **API RP 577, Welding Processes, Inspection, and Metallurgy** – Entire document is subject to testing
- **API RP 578, Guidelines for a Material Verification Program (MVP) for New and Existing Assets** - Entire document is subject to testing
- **ASME B16.5, Pipe Flanges and Flanged Fittings: NPS ½ Through NPS 24 Metric/Inch Standard**
 - Scope
 - Pressure Temperature Ratings
 - Markings
 - Materials
 - Dimensions
 - Test
 - Limiting Dimensions of Gaskets
 - Methods for Establishing Pressure-Temperature Ratings
- **ASME PCC-2, Repair of Pressure Equipment and Piping**
ATTN: The examination will cover each referenced Article and its Appendices.
 - Article 201: Butt-Welded Insert Plates in Pressure Components
 - Article 206: Full Encirclement Steel Reinforcing Sleeves for Piping

Article 209: Alternatives to Postweld Heat Treatment
Article 210: In-Service Welding on to Carbon Steel Pressure Components or Pipelines
Article 211: Weld Buildup, Weld Overlay, and Clad Restoration
Article 212: Fillet Welded Patches
Article 304: Flaw Excavation and Weld Repair
Article 305: Flange Repair and Conversion
Article 306: Mechanical Clamp Repair
Article 501: Pressure and Tightness of Piping and Equipment
Article 502: Nondestructive Examination in Lieu of Pressure Testing for Repairs and Alternations