



## **BODY OF KNOWLEDGE FOR API 936 REFRACTORY PERSONNEL CERTIFICATION EXAMINATION**

**Effective April – December 2018** (Replaces October 2009)

API certified 936 refractory personnel must have knowledge of installation, inspection, testing and repair of refractory linings. The API 936 Refractory Personnel Certification Examination is designed to identify applicants possessing the required knowledge.

The examination consists of 75 multiple choice questions; and runs for 4 hours; no reference information is permitted on the exam.

The examination focuses on the content of API STD 936 and other referenced publications.

### **REFERENCE PUBLICATIONS:**

#### **A. API Publications:**

**API Standard 936**, *Refractory Installation Quality Control Guidelines – Inspection and Testing Monolithic Refractory Linings and Materials*

#### **B. ASTM (American Society for Testing and Materials) Publications:**

**C113-14** – Standard Test Method for Reheat Change of Refractory Brick

**C133-97 (2015)** – Standard Test Methods for Cold Crushing Strength and Modulus of Rupture of Refractories

**C181-11** – Standard Test Method for Workability Index of Fireclay and High-Alumina Plastic Refractories

**C704-15** -Standard Test Method for Abrasion Resistance of Refractory Materials at Room Temperatures



**Candidates are expected to demonstrate knowledge in the following categories:**

### **1. Laboratory Testing Procedures**

The test questions may be based on the following topics:

1. Terms and definitions
2. Test methods (e.g., C704, CCS, PLC, Density) and related calculations
3. Material Qualification
4. Testingequipment, sample preparation techniques, dimensional requirements for test specimens
5. Various materials utilized (for example, plastic, ceramic fiber, anchor, metal fiber, corrosion coatings, etc.)
6. Curing and firing procedures
7. Acceptance/rejection criteria
8. Responsibilities of personnel and documentation requirements.

### **2. Applicator and Material Qualification**

The test questions may be based on the following topics:

1. Installationmethods (e.g., gunning, casting, ramming, and hand packing)
2. Sampling and sample preparation procedures
3. Terms and definitions
4. Procedures for determining optimal water content and mixing
5. Applicable formulation and manufacturing information
6. Applicable knowledge of equipment and qualification process
7. Applicable test panel/mockup requirements
8. Applicable environmental controls
9. Surface preparation requirements
10. Responsibilities of personnel and documentation requirements

### **3. Installation**

The test questions may be based on the following topics:

1. Terms and definitions
2. Responsibilities of personnel and documentation requirements
3. Knowledgeof detailedexecution planincluding design details and quality standards
4. Packaging and storage requirements
5. Surface preparation and cleanliness requirements
6. Anchor: welding, layouts, patterns, materials
7. Frequency andmethods of production sampling: gunning, casting, hand packing
8. Water addition: quantity and temperature, mixing procedures
9. Fiber addition: percentage, material, mixing
10. Installationenvironmental controls (minimum andmaximum temperatures)
11. Gunite procedures andequipment, including variables that affect gunite quality (i.e., air pressure, humidity, temperature, aging, water pressure, water purity, additives)
12. Knowledge of flash set
13. Casting procedures and equipment (e.g., air vibrator, vibrator frequency, vibrator sizing, forming, setup)
14. Ramming / Hand packed procedures and equipment



#### **4. Inspection**

The test questions may be based on the following topics:

1. Terminology, job specifications, application standards
2. Inspection and data collection procedures
3. Lining design and installation requirements
4. Visual and nondestructive test methods and qualification testing methods
5. Application/limitation for various inspection techniques (for example, hammer testing, sonic testing, radiography, core sampling, portable abrasion testing)
6. Material verification and traceability
7. Acceptance and rejection criteria
8. Repair procedures
9. Curing and dry out procedures
10. Inspectors' and contractors' responsibilities
11. Record keeping systems and requirements

#### **5. Post-Installation**

The test questions may be based on the following topics:

1. Terms and definitions
2. Responsibilities of personnel and documentation requirements
3. Knowledge of dryout requirements
4. Sealing requirements (for example, water mist, covering, membrane, curing)
5. Application and time limits for applying membrane curing compounds
6. Environmental conditions required for curing
7. Heating equipment, methods and procedures (e.g., gas fired burner, stress relieving heating elements)
8. Placement of temperature sensing probes
9. Knowledge of manufacturer's recommended heatup and cooldown schedules
10. Applicable heating rates for various classes of refractories
11. Lining integrity inspection techniques