

# API 653 Training Course

The API 653 Classes consist of "Pre-Course Home Study" materials and "5 days of Classroom" instructor lead training. Registration for the API 653 Training Course should be received 4 weeks prior to the start of the classroom portion of the course. Partial payment (\$400.00) for the course must also be received 4 weeks prior to the start of course.

Pre-Course Training modules consist of:

- Daily structured reading plans
- Key points that must be mastered from each paragraph/sub-paragraph
- End of chapter questions
- Flash cards

Two weeks of the 4 weeks of "Pre-Course Home Study" focuses on learning the API 653 Tank Inspection Code book. The reason for focusing two weeks of home study API 653 Code book is because approximately 53% of the API 653 examination comes from the API 653 Code book. During the 4 weeks of "Pre-Course Home Study" the student will gain knowledge from API 653, API 571, API 572, API 576, API 577 and ASME Section V\_2011.

The classroom training of the API 653 Training Course consists of 5 days of lecture. The classroom module includes 5 closed book exams and 4 open book exams.

Following is some of the content for the Classroom training:

- Calculations (Open and/or Closed Book Exam)
  - Metal Loss (including corrosion averaging)
  - Corrosion-rates
  - Remaining Corrosion Allowance
  - Remaining Life
  - Inspection Intervals
  - Next Inspection
- Joint Efficiencies
  - Joint types
  - Type and extent of radiography performed
  - Joint efficiency by reading Table 4-2

- NOTE: Determining joint efficiency may be part of a minimum thickness or maximum fill height problem since joint efficiency, "E", is used in the formulas for determining required thickness
- Maximum Fill Height (Hydrostatic testing)
  - Calculate minimum allowable thickness or maximum fill height in a localized corroded area.
  - Calculate minimum allowable thickness or maximum fill height for an entire shell course
- Weld Sizes for Shell & Roof Opening
  - Calculate size and spacing of welds for shell openings
- Hot Tapping
  - Must be familiar with hot tapping requirements
  - Calculate the minimum spacing between existing nozzle and new hot tap nozzle
- Settlement Evaluation
  - Edge Settlement
  - Bottom Settlement new tank shell
  - Localized bottom settlement remote from tank shell
- Number of Settlement Points
  - Calculate the number of survey points for determining tank settlement
- Impact Testing
  - Determine MDMT
  - Determine material group number for a plate
  - Determine if impact testing is required
  - Determine if impact test values are acceptable
- Minimum Thickness of Existing Tank
  - Calculate allowable stress "S"
  - Determine joint efficiency "E"
  - Determine liquid height "H"
  - Calculate minimum acceptable thickness
  - Calculate required thickness for continued service
- Minimum Thickness of Reconstructed Tank Shell
  - Determine minimum thickness
  - Determine allowable stress "Sd" for design condition
  - Determine allowable stress "St" for hydrostatic test condition

- Calculate design shell thickness “ $t_d$ ”
- Calculate hydrostatic test shell thickness “ $t$ ”
- Corroded Area –Tank Shell
  - Determine minimum thickness “ $t_2$ ”,exclusive of pits for a corroded area
  - Calculate critical length for a corroded area “ $L$ ”
  - Determine average thickness for a corroded area “ $t_1$ ”
  - Determine minimum thickness “ $t_{min}$ ” for corroded area “ $H$ ” and “ $E$ ”
  - Determine if “ $t_1$ ” and “ $t_2$ ” are acceptable
- Pitting –Tank Shell
  - Calculate maximum acceptable pit depth
  - Determine maximum length of pits in any 8” vertical length
- Bottom Plate Minimum Thickness
  - Determine if bottom plate is acceptable for continued service, by calculating
    - Minimum remaining thickness at next inspection (“ $MRT_1$ ” and “ $MRT_2$ ”)
    - Calculating maximum period of operation “ $O$ ”
- Replacement Plates
  - Determine minimum dimensions for replacement plates
- Lap Welded Patch Plates
  - Determine minimum thickness
  - Determine minimum weld size
  - Determine allowable size of patch plate
- ASME Section IX
  - WPS is in compliance with ASME Section VIII and API 510
  - Review will include one WPS and the Supporting PQR
  - Determine all required essential and non-essential variables are addressed
  - Determine if the number and type of mechanical tests are listed on PQR and if results are acceptable
    - Welding procedures could be SMAW, GTAW, GMAW or SAW
- API 650 Welding Requirements
  - Typical joints and definitions
  - Weld sizes
  - Restrictions on joints
  - Maximum Allowable Reinforcement
  - Inspection Requirements

- API 653 Welding Requirements
  - General rules as indicated in Section 11
  
- ASME Section V
  - General requirements
    - Scope
    - Rules of use of Section V as a referenced Code
    - Responsibilities of the Owner/User and subcontractors
    - Calibration
    - Definition of Inspection and Examination
    - Record keeping requirements
  - Article 2 –Radiography
    - Scope
    - General Requirements
    - Rules for;
      - Required marking
      - Type, selection, number and placement of IQI’s
      - Allowable density
      - Control of backscatter
      - Location markers
      - Records
    - Article 6 –Liquid Penetrant
      - Scope
      - General requirements;
      - Procedures
      - Contaminants
      - Techniques
      - Examinations
      - Interpretation
      - Documentation
      - Record Keeping
    - Article 7 –Magnetic Particle
      - Scope
      - General requirements;
        - Procedures
        - Techniques (yoke & Prod)
        - Calibration
        - Examination
        - Interpretation
        - Documentation and record keeping
      - Article 23 –Ultrasonic (SE 797only)

- Scope
  - General requirements
  - Specific procedures (par 7)
- NDE –General requirements of API 650 and API 653
  - General rules in API 650 (section 8)
  - General rules in API 653 (section 12)
- API 571
  - Be familiar with;
    - Common terms and abbreviations
    - Be able to locate definitions for following damage mechanisms;
      - Brittle Fracture
      - Mechanical Fatigue
      - Atmospheric Corrosion
      - Corrosion under Insulation (CUI)
      - Microbiological Induced Corrosion (MIC)
      - Soil Corrosion
      - Caustic Corrosion
      - Chloride Stress Corrosion Cracking (Cl-SCC)
      - Caustic Stress Corrosion Cracking (Caustic Embrittlement)
      - Sulfuric Acid Corrosion
- API 575
  - Types of tanks covered
  - Procedures to perform internal and external inspection
  - The types of external and internal inspections
  - Procedures to determine suitability for continued service
  - Evaluation change-of-service effects on suitability for continued service
  - Evaluation and general condition of;
    - distortions, flaws, windgirders, stiffeners, welds, and nozzles
    - tank bottoms
    - tank foundations
    - causes of corrosion, leaks, cracks, and mechanical deterioration
    - auxiliary equipment.
    - anchor bolts, pipe connections, ground connections
    - insulation.
    - shells and roofs
- API 577
  - Definitions
  - Welding Inspection

- Welding Processes
- Welding procedure
- Welding Materials
- Welder qualifications
- Non-destructive examination
- Metallurgy
- Refinery and Petrochemical Plant Welding Issues
- Terminology and symbols
- Actions to Address improperly made production welds
- Welding procedure review
- Guide to common filler metal selection
- Example report of RT results
  
- API 653
  - General inspection practices
    - types of tanks covered
    - applicable inspection tasks for internal and external inspection (e.g., API Standard 653, Appendix C, Checklists for Tank Inspection).
    - safe working practices
    - thickness and dimensional measurements and tolerances
    - requirements of external and internal inspections
    - frequencies and intervals for external and internal inspection
    - alternatives to the required internal inspection intervals
    - NDE procedures and NDE personnel qualification requirements
    - types of roofs and seals and types of deterioration
    - reasons for inspection and causes of deterioration of storage tanks
    - procedures to check or test storage tanks for leaks
    - tools and equipment for tank inspection
    - failure assessment and deterioration of auxiliary equipment
    - suitability for continued service.
    - change-of-service effects on suitability for continued service
    - evaluation of tank bottom conditions
    - evaluate tank foundation conditions
    - risk of failure due to brittle fracture
    - evaluate the causes of corrosion, leaks, cracks, and mechanical deterioration.
    - evaluate the condition of anchor bolts, pipe connections, ground connections, and insulation
  - Calculations;
    - actual and minimum required thickness for shell plates
    - maximum allowable fill height
    - required thickness for hydrotesting and for elevated tem

- peratures
  - evaluation of corroded areas and pits on shell plate min, corrosion rate, inspection interval and remaining corrosion allowance
  - distortions, flaws, welds, and nozzles.
  - minimum thickness for tank bottoms and annular plate rings and shell rings
  - evaluate the effects of tank bottom settlement and acceptable limits
  - evaluate the condition of tank shells and roofs.
  - weld size at roof-to-shell and bottom-to-shell junctions per design requirements
- Requirements for performing repairs/alterations;
  - definitions of repairs and alterations
  - repairs to foundations, shell plates, welds, tank bottoms, nozzles & penetrations, roofs, seals,
  - knowledge of the repair/alteration material and toughness requirements
  - use of unidentified materials for repairs/alterations
  - hot tap requirements and procedures
  - inspection and NDE requirements for repairs and alterations
  - hydrostatic and leak testing requirements
  - lap welded patch plates (API-653, 9-3)
  - new bottoms supported by grillage API-650, Appendix I, Excluding calculations)
- Requirements for recording inspection data for inspection, repairs and alterations;
  - nameplate requirements
  - record-keeping requirements
  - reports for inspection, repair and alterations
- API 651 (sections 1, 2, 3, 4, 5, 6, 8 and 11)
  - Understanding of;
    - Corrosion of above ground Steel Storage Tanks
    - Determination of need for Cathodic Protection
    - Methods of Cathodic Protection for corrosion control
    - Operation and Maintenance of Cathodic protection systems
- API 652
  - Understanding of;
    - considerations for recommending tank bottom linings
    - causes of tank bottom lining failures
    - types of tank bottom lining materials

- surface preparation requirements for the installation of tank bottom linings
- issues affecting the application of a tank bottom lining

### **Documents Required for CLASSROOM**

Each participant must bring the following electronic code books (pdf files) to the classroom:

- ASME Section V (2013 Edition)
- ASME Section VIII Div 1, (2013 Edition)
- ASME Section IX, (2013 Edition)
- API 650 (2014 Edition)
- API 571 (2011 Edition)
- API 575 (2014 Edition)
- API 577 (2013 Edition)
- API 651 (Jan 2014 edition)
- API 652 (2014 edition)
- API 653 (2014 edition)

Code books can be purchased from either [www.global.ihs.com](http://www.global.ihs.com) or [www.techstreet.com](http://www.techstreet.com)

Instructions for getting the books from [www.global.ihs.com](http://www.global.ihs.com) is as follows:

- Click on "Training & Certification",
- Then click on "API ICP Certification Exam Packages",
- Then scroll down until you see the API exam you are interested in (i.e. "API Cert 570 Program SEPT" or "API Cert 570 Program DEC")

Instructions for getting the books from [www.techstreet.com](http://www.techstreet.com) is as follows;

- Click on "Shop by Publisher"
- Click on "API Certification Exam Packs"
- Scroll down until you see the API exam pack you are interested in (i.e "API ICP 570 Exam Pack")