CERTIFICATION MANUAL FOR TECHNICIANS

version 170909
As approved by the ITI Trustees in July 2016
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PART 1

General Procedures and Requirements
1 Introduction to ITI Certification

1.1 Definitions and Abbreviations

This document contains terminology which is defined in the *ICB Conformity Assessment Vocabulary* document (see Attachment 1). Words highlighted in bold, e.g., *appeal*, are defined in said document. Each person using this manual is strongly encouraged to familiarize herself/himself with the definitions listed in the *ICB Conformity Assessment Vocabulary* document.

1.2 Purpose and Overview

The International Training Institute for the Sheet Metal Industry (“ITI”) is a non-profit organization sponsored by the International Association of Sheet Metal, Air, Rail and Transportation Workers (SMART) and the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA). One of the functions of the ITI is to establish and direct a national certification program for technicians who work with various or all types of building environmental systems or components thereof.

This manual describes the process how one can become an ITI certified technician in a certification scheme. ITI certified technician status is available to technicians who qualify per Section 2 of this manual. Any questions regarding the certification process should be directed to ITI. Contact information is provided in Section 1.5.

This document is divided in two major parts:

- **Part 1** describes the basic process and general requirements for any and all certification schemes.
- **Certification schemes** start with Part 2 of this manual. The certification schemes sections provide additional information with respect to each certification scheme, which may include prerequisites or competencies that must be met in addition to the core requirements.

1.3 Amendments and Interpretation

ITI may at any time amend any part of this manual and standards, procedures, proficiency requirements, application forms, lists and other items to which this manual refers. An amendment may change certification requirements, and may affect current certifications, renewals and/or new applications for certification.

ITI alone will interpret and administer its standards and procedures, including those set forth in this manual. ITI may waive or modify any requirement at any time. ITI’s decisions are not subject to review. ICB will notify existing certification holders of any and all modifications to the certification requirements made.

ITI may at any time adopt, change or discard rules and guidelines for the ITI’s internal processes with respect to various certification-related activities, and/or set standards for the certification process.

1.4 The Meaning of Certification

Certification is a statement that the technician has met ITI’s standards of certification. The purpose of ITI’s certification is to demonstrate that ITI Certified Technicians are knowledgeable and skilled professionals.
1.5 Contact Information

Administrator
International Training Institute
8403 Arlington Blvd, Suite 200
Fairfax, VA 22031
Tel.: (703) 739-7200
Fax: (703) 683-7461
Website: www.iti-sheetmetal.org

1.6 The International Certification Board

The ICB establishes standards for international certification programs in the sheet metal industry. It also implements certification programs for technicians, supervisors and contractors. The ICB does so via particular bureaus. One of those bureaus is TABB. TABB establishes and directs an international certification program for technicians, supervisors and contractors engaged in testing, adjusting and balancing of all building environmental systems.

ICB does not independently certify technicians. ICB recognizes ITI certification of technicians. To become an ICB certified technician, please review the requirements as set forth in the ICB Certification manual. To obtain a copy of the ICB Certification manual please visit ICB’s website at www.icbcertified.org.
2 The Certification Process and Requirements

An ITI-certified technician is one who has:

- Met the qualifications and completed the general application requirements as described in this manual.
- Passed the written exam and if applicable the practical exam as set forth in this manual.

2.1 Eligibility

To be eligible for the ITI technician certification, the applicant must be an individual with respect to whom contributions are payable to the ITI, an instructor or part-time instructor with a JATC in the Sheet Metal Industry or other individual who qualifies as an ITI Participant.

Certain certification schemes, such as Fire Life Safety, have additional eligibility requirements. Please review the pertinent section of this manual for further information.

2.2 Application

1. Applicant completes the ITI technician application online.
2. Upon submission ITI will verify the eligibility of the applicant to be certified.
3. The applicant is notified of ITI action, including any request for additional documentation.
   a. If approved, the applicant will be notified in writing or by electronic communications.
   b. If not approved, the applicant will be notified in writing or by electronic communications. The applicant may appeal this decision as specified in Section 2.10 of this manual.

2.3 Certification Exam

The certification exam consists of a written test and, if applicable, a practical test. An applicant may not test until he or she has been notified that he or she is eligible to be certified per Section 2.2.

2.3.1 Administering the Written Exam

2.3.1.1 Online Format

1. Upon receiving written notification by ITI that the applicant has met the eligibility requirements, the candidate submits the eligibility notice to the local JATC coordinator.
2. The local JATC coordinator will designate a proctor.
3. The designated proctor requests a coupon code to administer the exam.
4. The ITI emails the coupon code, a proctor affidavit form and guidelines to the designated proctor.
5. The proctor administers the test according to the provided instructions. The exam must be completed in one sitting in a designated room and within the specified time limit.

The candidate may use any reference books or notebooks deemed appropriate by ITI.

The proctor will open the exam session and time the test to the specified time allowed.
- The proctor will provide the candidate with their exam code and start the testing session.
The Certification Process and Requirements

- At end of time allocated for test, the **candidate** is stopped and the **exam** is electronically submitted for grading. The system will provide immediate feedback to the **candidate** regarding his **exam** score results after which the **proctor** will close the testing session.

### 2.3.1.2 Written Format

1. Upon receiving written notification by ITI that the **applicant** has met the eligibility requirements, the **candidate** submits the eligibility notice to the local JATC coordinator.
2. The local JATC coordinator will designate a **proctor**.
3. The **proctor** requests an exam which the ITI mails to the designated **proctor** along with **proctor** guidelines. The **exam** and **proctor** information are in a sealed envelope.
4. The **proctor** administers the **exam** according to the instructions.
   - The seal on the **exam** must be opened by **candidate** only.
   - The **exam** must be completed in one sitting in a designated room and within the specified time limit.

The **candidate** may use any reference books or notebooks deemed appropriate by ITI.

The **proctor** will time the **exam** to the specified time allowed.

a. The **proctor** will record time started.

b. At end of time allocated for **exam**
   - The **candidate** is stopped.
   - Time ended entered by the **proctor**.

c. The proctor mails all testing materials in a sealed return envelope back to the ITI.

### 2.3.2 Scoring the Written Exam

#### 2.3.2.1 Online Format

The website will automatically score the **exam** and return an immediate result.

#### 2.3.2.2 Written Format

The ITI scores the **exam** and determines whether the score is passing.

- If the **candidate** passes the written **exam**, the ITI will either
  a) issue **certification** documents as described in **Section 2.5** of this **manual**; or
  b) if the **certification scheme** requires a practical **exam**, the **candidate** is approved for the practical **exam** and will be so notified.

- If the **candidate** fails the written **exam**, the ITI will notify the **candidate**. The **candidate** may retest in accordance with **Section 2.3.3** of this **manual**.

### 2.3.3 Time Limits on Testing and Re-Testing

The written **exam** must be passed within one year from ITI approval of the application, or the **candidate** must re-apply.

An **candidate** who fails the written **exam** may apply to re-test in a manner specified by ITI, but may re-test only after a waiting period of at least thirty (30) calendar days.
If required, the practical exam must be passed within two years from notification of eligibility to be certified, or the candidate must re-apply. An candidate who fails the practical exam may apply to re-test in a manner specified by ITI, but may re-test only after a waiting period of at least thirty (30) calendar days.

2.3.4 Administering the Practical Exam

If required by the certification scheme the candidate is seeking, upon passing the written exam, the candidate will receive a letter from the ITI stating their eligibility to take the practical exam. The ITI will notify the candidate when and where the practical exam is available.

Failure to attend a scheduled exam will be recorded as test incompletion.

A. The practical exam will be given at an ITI-certified testing facility.

B. An orientation session will be given prior to the day of the exam at the exam site. Attendance is required (except for those candidates taking a retest in the same location as the previous exam. Candidates taking a retest may skip the orientation session on the first day). This session will include explanation of:

- Exam procedures
- Instrumentation
- Time schedule
- Introduction of proctor and judges
- Tour of testing facility
- Answer questions the candidate may have

C. Exam projects will be taken from the respective certification scheme as described in the respective Section in Part 2 of this manual.

D. Scoring

Two judges will observe and score each candidate at each task. The judges are at a minimum to be ITI-certified technicians or recognized technical experts in the respective certification scheme. The proctor will be an ITI Regional Coordinator or a designee, who will be responsible for the administration of the practical exam.

E. Exam Security

The proctor shall be responsible for security of the exam and the envelope contents.

2.4 Certification Approval

The ITI will review each candidate's file after the practical exam is completed.

- If the candidate passes the practical exam, the ITI will issue certification documents as described in Section 2.5 of this manual.
- If the candidate fails the practical exam, the ITI will notify the candidate. The candidate may retest in accordance with Section 2.3.3 of this manual.

2.5 Certification Documents

On certification ITI will issue the following:

A certificate including:
The Certification Process and Requirements

- Date of certification
- The name of the technician
- The technician’s individualized certification number

**Certification scheme**

An identification card with the following:

- Name of the technician
- Expiration date
- Individualized certification number

**Certification scheme**

The technician may be issued an identification stamp when applicable. The technician must hold and use the stamp in accordance with the applicable *Integrity and Stamp Agreement*. Each certificate, card and stamp is paid for by and remains the property of ITI. A charge will be assessed to replace lost or damaged certification documents or stamps. Certification documents must be surrendered to ITI whenever ITI demands so. Misuse of, or misrepresentation concerning, any stamp or certificate may result in withdrawal of certification and repeal of the certificate, card and stamp.

Multiple specialty certifications may be reflected on a single identification card.

### 2.6 Code of Conduct

The ITI has adopted a [Code of Conduct](#). Every technician must comply with the Code of Conduct as a requirement for maintaining certification. Violations of the Code of Conduct are grounds for suspension, withdrawal or non-renewal of certification (see Section 2.9).
The International Training Institute
Code of Conduct

Each person certified by the ITI shall practice his or her profession consistent with the standards and procedures applicable to the certification, and the highest quality workmanship.

**ITI-certified Technicians**

- Technicians will perform their work in an orderly, systematic, well-documented and repeatable manner.
- Technicians will document all findings in an accurate and professional manner so that a supervisor can review a comprehensive and chronological history of the procedures followed.
- Technicians and supervisors will not make any statements that cannot be substantiated and verified by field measurements or observations.
- Technicians should improve their technical competence through continuing education, peer counseling and interaction with professionals in their field of expertise.
- Technicians must meet the standards and procedures set by the ITI, applicable to their particular certification(s), and adhere to all rules, regulations and obligations of the certification program.
- Technicians will work in a professional manner as to ensure their own safety and the safety of their fellow workers, while being respectful to the property of their employers, building owners and their representatives.
- Technicians will observe proper protocol when noting contract or installation deficiencies, errors or omissions by others. Notification should first go to the Supervisor for review, then to the employer, unless the employer has established a different protocol.

**Protocol**

- Violations of this Code of Conduct shall immediately be reported to the ITI.
- This Code of Conduct remains subject to change by the ITI.
2.7 Duration of Certification

The ITI certification is valid for two full years from the last day of the quarter in which the candidate obtained the certification. For example, a certification that originally was issued on May 1, 2015 would expire on June 30, 2017.

2.8 Renewal of Certification

ICB will send a renewal notice to technicians approximately 120 days before certification expires. The Renewal Application forms, and all information required by those forms, must be submitted at least thirty (30) days before the certification expires.

At time of renewal the person holding the original certificate must meet all qualifications and requirements mandatory for initial certification.

2.9 Decertification

The ITI may withdraw the certification of any technician for one or more of the following reasons:

- Falsification of data and reports.
- Failure to maintain eligibility.
- Violation of the Code of Conduct.
- Other cause as determined by the ITI.

2.10 Procedure for Resolution of an Appeal

2.10.1 Exclusivity

By submitting an application for ITI certification each applicant agrees that any appeal will be resolved solely in accordance with the procedures as stated in this manual.

2.10.2 General Rules on Required Deliveries and Time Limits for the Same

In the following, certain items, such as an appeal, must be in writing, i.e., they must be typed, printed or legibly handwritten.

Whenever a delivery-time limit is given, namely the time period within which a document must have been physically delivered to the ITI, the time limit requirement will be met by any of the following conditions:

- The document has been delivered in person or by a courier service, such United Parcel Service (UPS) before the applicable time period expired; or
- The document has been delivered by the U.S. Postal Service and it is postmarked within the applicable time period.

Electronic submission of an appeal or any other document requested by the ITI is not permitted.

An appeal must be made to the proctor or any other ITI personnel or representative at the examination site. Proctors are allowed to only resolve issues which are not related to the content of the examination, e.g., room conditions, missing examination items, and similar matters. If the appeal is not addressed and resolved there, the candidate must submit the appeal in writing to the ITI within ten days after the examination date. Appeals that are not made within the said time limit will not be considered and will be dismissed.

The appeal must state in writing, in reasonable detail, the pertinent circumstances of and reasons for the appeal, and must be signed by the candidate.
2.10.3 Procedure for Resolution of an Appeal

The ITI will resolve any appeal in accordance with the following procedure. The ITI reserves the right to modify any particular procedure. The ITI will notify any materially affected party of such a modification in a timely manner but no later than ten working days after its adoption.

The ITI Administrator or his or her representative will act for the ITI on all matters concerning the appeal, including the conduct of a hearing, unless the ITI determines otherwise.

Figure 1 outlines the basic procedure.

1. **Applicant Appeals to Proctor at The Examination Site.** The proctor may resolve any appeal that is not related to the content of the examination, e.g., room conditions, missing examination items, and similar matters.

2. **The Appeal Was Resolved by The Proctor.** After the appeal is successfully resolved at the examination site, the proctor must file a record of the appeal with the ITI.

3. **The Appeal Was NOT Resolved by The Proctor.** The candidate must submit the appeal in writing to the ITI Administrator within ten days after the candidate made his initial appeal to the proctor. The written appeal must be mailed to the ITI Administrator at the address stated in Section 1.5 of this manual. Do not submit the appeal electronically. The written appeal should be labeled “NOTICE OF APPEAL.”

4. **Initial Review of the Appeal.** The ITI Administrator or his or her designated representative will review the appeal to determine if it merits investigation or further action. An ITI representative may contact the candidate to clarify any aspects of the written appeal or to obtain further information. The ITI Administrator will review the appeal within 14 days after its receipt.

5. **Initial Review by ITI Administrator Resolves Appeal.** If the ITI Administrator determines that no further review is warranted, the decision will be reported back to the candidate in writing.

6. **Reconsideration of ITI Administrator’s Decision by the Candidate.** The candidate may resubmit his or her appeal for reconsideration by the ITI. If the candidate does not resubmit his appeal for review by the ITI, the appeal is considered resolved and closed.

7. **Resubmittal of the Appeal for Review by The ITI Board of Trustees.** The candidate must submit her or his written appeal to the ITI Administrator within ten after the candidate was notified by the ITI Administrator that no further review was warranted by the ITI. The written appeal must be mailed to the ITI Administrator at the address stated in Section 1.6 of this manual. Do not submit the appeal electronically.

8. **Review by the ITI.** The ITI Trustees will review the appeal within thirty days after receiving the appeal from the ITI Administrator.

9. **ITI Hearing.** A hearing may be called by the ITI Trustee to resolve questions of fact. The hearing may be held in a face-to-face meeting with the applicant or electronically as a teleconference. The meeting date, time and the format of the hearing are determined solely by the ITI Trustees.

10. **ITI Decision.** The ITI Trustees will report their decision in writing to the candidate no later than 45 days after receiving the appeal from the ITI Administrator. The decisions of the ITI Trustees are final and binding on the candidate.
11. Document Retention. All written documents shall be scanned and electronic copies of the documents shall be stored on the ITI server. Copies of the appeal(s) and applicable decisions by the proctor, ITI Administrator and the ITI Trustees shall be stored in the applicant’s record.

The appeal is considered resolved if one of the following conditions is met:

a. The appeal has been resolved by the proctor at the examination site;

Figure 1. The basic process of resolving an appeal
b. The appeal has been resolved by the ITI Administrator after his initial review and the candidate did not resubmit the appeal for review by the ITI Trustees; or

c. The appeal has been resolved by the ITI Trustees after being resubmitted by the candidate.
PART 2

Certification Schemes
3 Building Envelope Installer Certification

3.1 Purpose
This manual states the regulations by which the ITI will certify Building Envelope Installer candidates. This manual sets forth the qualifications for eligibility for certification and specifies the areas of knowledge, skills and ability required of an ITI-certified Building Envelope Installer.

3.2 Eligibility
To be eligible for the ITI Building Envelope Installer certification, the applicant must meet the requirements of Section 2.1 of this manual.

3.3 Qualification
An ITI-certified Building Envelope Installer is one who has:

- Met the qualifications and completed the application requirements set forth in Sections 1 and 2 of this manual.
- Passed the Written Test as set forth in Section 2.3 of this manual.
- Demonstrated Building Envelope Installer standards of proficiency as set forth in this manual.

3.4 Renewal of Certification
The following documents are required to renew the Building Envelope Installer certification:

- Completed online renewal application. (See Section 2.2 of this manual).
- Documents showing that the technician has completed four (4) hours of continuing education units (CEUs) in the past two years.
- Signed copy of the Code of Conduct. (See also Section 2.6 of this manual).

Acceptable CEUs. One hour of training equals one CEU. CEUs will be accepted from the following:

- Any course endorsed by National SMACNA related to building envelope installations
- Any course sponsored by a local SMACNA chapter and related to building envelope installations
- Attendance of the Annual ICB Conference or any course/seminar offered during the event
- Any course put on by the National Energy Management Institute (NEMI) or the International Training Institute (ITI)
- Teaching a course in building envelope installations for a local JATC at least two (2) hours per year
- Presenting a seminar on a topic related to building envelope installations; a copy of the agenda and the presentation must be provided to receive credits
- Papers published on the topic of building envelope installations. Four (4) CEUs will be credited per paper. A copy of the paper and the publication must be provided to receive credits
- Any course or webinar related to building envelope installations
- Other as determined by ICB.
3.5 Standards of Proficiency for Certified Building Envelope Installers

An ITI-certified Building Envelope Installer must be proficient in all of the categories of this Section, as demonstrated by passing the written exam.

1. Expansion and Contraction
   a. Building expansion
      i. Colors
      ii. Location of panels
   b. Causes
      i. Thermal movement
      ii. Solar factors
      iii. Seismic movement
   c. Solutions
      i. Expansion joints
      ii. Cleats

2. Field Installation
   a. Planning
      i. Measuring and checking
      ii. Onsite inspection
   b. Staging
      i. Storage of materials
         1. Close to installation
         2. Safety
         3. Theft prevention
         4. Moisture control
   c. Distributing
      i. Distribution of job components
         1. Materials
         2. Fasteners
         3. tools
   d. Sectioning
      i. Determine starting point
      ii. Determine direction to continue installation
      iii. Prepare base
   e. Installing
      i. Many cautions
         1. Improper fasteners, capillary attraction, rosin paper, soldered joints, sealants
   f. Completing
      i. Job clean up
      ii. Protection of finished project

3. Fastening and Joining
   a. Types
      i. Nails
      ii. Screws
      iii. Rivets
      iv. Staples
      v. Powder actuated
      vi. Anchors
      vii. Adhesives
      viii. Welding
   b. Material compatibility
      i. Making sure fasteners are compatible with material being fastened
      ii. Fasteners compatibility to substrate
4. Flashing
   a. Purpose
      i. Ridges and valleys intersections
      ii. Roof penetrations
      iii. Roofing intersecting walls
      iv. Controlling moisture from
          1. Gravity
          2. Capillary action
          3. Wind
   b. Movement
      i. thermal movement in material or adjacent material
   c. Types
      i. Ridge
      ii. Hip
      iii. Valley
      iv. Counter flashings
      v. Base flashing
      vi. Roof to wall
      vii. Chimney
      viii. Saddles
      ix. Apron
      x. Roof penetrations
      xi. Through wall flashing
      xii.
   d. Method of securement
      i. Reglets
      ii. Thru wall flashing dowels ..........***

5. Shop Layout and Fabrication
   a. Field layout and fabrication

6. Moisture Control
   a. Water Movement
      i. Types
         1. Wind and Ice dam
         2. Capillary Action
         3. Differential Pressure
         4. Gravity
         5. Adhesion
         6.
      b. Systems installed to control moisture
         i. Underlayments
            1. Ice and water shield
            2. Asphalt saturated felt
            3. Synthetic felt
            4. Slip sheets
         ii. Roof and wall panels/siding
         iii. Solder
         iv. Sealants
         v. Vapor retarders
         vi. Flashings
         vii. Roof drainage systems
         viii. Rain screens

7. Measurements
   a. Field measurements
      i. Verify plumb/level/square of surfaces
      ii. Line of sight
iii. Measuring angles
   1. Techniques
      a. Sine, cosine, tangent
      b. 3-4-5

8. Material Handling
   a. Controlling moisture
   b. Storing safety
   c. Distribution

9. Materials
   a. Characteristics of Metals
      i. Steel
      ii. Stainless steel
      iii. Aluminum
      iv. Copper
      v. Lead
      vi. Zinc
      vii. other

10. Roof Drainage Systems
    a. Gutter
    b. Hangers
    c. Scuppers
       i. Overflows
    d. Leader/conductor head
    e. Downspouts (Thru wall drains)
       i. Sizing
    f. Design factors
       i. Expansion

11. Roof Systems
    a. Different slopes
       i. Low
       ii. Medium
       iii. High
    b. Hydrostatic/hydrokinetic
    c. Cold/warm
    d. Types of seams
    e. Structural
    f. Nonstructural
       i. Substrate
       ii. Insulation
       iii. Underlayment
       iv. Slip sheet
    g. Controlling condensation and ice damming
    h. Fasteners
       i. Metal panel types
          i. Flat seam
          ii. Standing seam
          iii. Batten seam
          iv. Bermuda
          v. Mansard
          vi. Domes and conical
          vii. Brake shape/corrugated
    j. Minimize oil canning
    k. Roofing accessories
    l.
12. Special ASM
   a. Typical Misc work
   b. Restoration

13. Sealants
   a. Types
   b. Functions
   c. Uses
   d. Application
   e. Compatibility with the metal, glass or coatings

14. Soldering
   a. Solder types
   b. Flux and acids
   c. Irons
   d. Materials
   e. Safety
   f. Clean up

15. Seams, Locks and Edges
   a. Purpose
   b. Lap and Butt seams
   c. Interlocking
      i. Standing seam
      ii. Flat lock
      iii. Clips and cleats
   d. Edges
   e. Radius edges

16. Supports and Substrates
   a. Structure
      i. Pre-inspection
   b. Underlayment
      i. Must be compatible with panel and substrate
      ii. Sheds moisture
      iii. Slip sheets allow movement

17. Tools and Equipment
   a. Hand Tools
   b. Power tools

18. Wall Systems
   a. Need to add ACM (Aluminum Composite Material)
   b. Types
      i. Typical wall panel system
      ii. Pre-Engineered
   c. Handling
   d. Storing
      i. Manufacturers recommendations
   e. Components
   f. Field cutting
   g. Materials and styles
   h. Installation
      i. Plan order of installation
      ii. Check structure for square, plumb and level
      iii. Check manufacturers recommendations
         1. Fastener locations and types
      iv. Flashing installations
      v. Sealants

19. Safety
   a. Electrical
i. Overhead electrical power
ii. Power tools
iii. Lockout tagout
iv. Extension cords
b. Personal protective equipment
c. Ladders, scaffolding, lifts
d. Fall hazards
e. Fall protection
   i. Lanyards
   ii. Perimeter protections
4 Fume Hood Performance Testing Technician Certification

4.1 Purpose

This manual states the regulations by which the ITI will certify Fume Hood Performance Testing Technicians. This manual sets forth the qualifications for eligibility for certification and specifies the areas of knowledge, skills and ability required of an ITI-certified Fume Hood Performance Testing Technician.

4.2 Eligibility

To be eligible for the ITI Technician certification in Fume Hood Performance Testing, the applicant must meet the requirements of Section 2.1 of this manual.

4.3 Qualification

An ITI-certified Fume Hood Performance Testing Technician is one who has:

- Met the qualifications and completed the application requirements set forth in Sections 1 and 2 of this manual;
- Passed the Written Test as set forth in Section 2.3 of this manual;
- Demonstrated Fume Hood Performance Testing standards of proficiency as set forth in this manual; and
- Holds a current ITI Certification in Testing, Adjusting and Balancing.

4.4 Renewal of Certification

The following documents are required to renew the Fume Hood Performance Testing Technician certification:

- Completed online renewal application. (See Section 2.2 of this manual);
- Documents showing that the technician has completed four (4) hours of continuing education units (CEUs) in the past two years;
- Signed copy of the Code of Conduct. (See also Section 2.6 of this manual);
- Holds a current ITI Certification in Testing, Adjusting and Balancing;

Acceptable CEUs. One hour of training equals one CEU. CEUs will be accepted from the following:

- Any course endorsed by National SMACNA related to fume hood performance testing;
- Any course sponsored by a local SMACNA chapter and related to fume hood performance testing;
- Attendance of the Annual ICB Conference or any course/seminar offered during the event;
- Any course put on by the National Energy Management Institute (NEMI) or the International Training Institute (ITI);
- Any course by the American Society of Heating, Refrigerating and Air-Conditioning Engineers on fume hood performance testing;
- Teaching a course in fume hood performance testing for a local JATC at least two (2) hours per year;
- Presenting a seminar on a topic related to fume hood performance testing; a copy of the agenda and the presentation must be provided to receive credits;
- Papers published on the topic of fume hood performance testing. Four (4) CEUs will be credited per paper. A copy of the paper and the publication must be provided to receive credits;
- Any course or webinar related to fume hood performance testing;
- Other as determined by ICB.

### 4.5 Standards of Proficiency in Fume Hood Performance Testing

An ITI-certified Fume Hood Performance Testing Technician must be proficient in all of the categories of this Section, as demonstrated by passing the written exam.


#### 4.5.1 Purpose

An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about quantitative and qualitative test methods for evaluating the fume containment of chemical fume hoods as well as their limitations.

#### 4.5.2 Scope

- This method of testing applies to conventional, bypass, auxiliary air, and VAV chemical fume hoods.
- This method of testing is intended primarily for manufacturer’s testing but may be used as an aid in evaluating as-installed or as-used performance.

#### 4.5.3 Definitions

An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about the following definitions and how they pertain to fume hood performance testing.

- **Air supply fixtures:**
  - Grille
  - Register
  - Diffuser
  - Perforated ceiling
- Auxiliary air
- Conditioned environment
- Control level
- Cross-drafts
- Face velocity
- Fume hood system
- Hood face
- Internal obstructions
- Lpm
- Laboratory fume hood
4.5.4 Instrumentation and Equipment

An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about all instruments and equipment necessary and required to conduct an “as-installed” or “as-used” fume hood performance test according to ANSI/ASHRAE Standard 110-1995.

4.5.4.1 Tracer Gas

An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about the proper selection of the tracer gas for the performance test as well as any local, state or federal regulation pertaining to its use.

4.5.4.2 Ejector System

An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about the proper ejector system, its set-up and operation.

4.5.4.3 Critical Orifice

An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about the selection, calibration, installation, and operation of the proper critical orifice to accurately determine the flow rate of the tracer gas.

4.5.4.4 Detector Instruments

An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about the selection, calibration, installation, and operation of the proper detector instruments to accurately measure and record the concentration of the tracer gas.

4.5.4.5 Recorder

An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about the required accuracy of the recording equipment.

4.5.4.6 Manikin

An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about the proper selection, installation and operation of the three-dimensional manikin to accurately measure and record the concentration of the tracer gas.
4.5.4.7 Face Velocity Measuring Instruments

4.5.4.8 Smoke

4.5.5 Test Conditions
4.5.5.1 Room Ventilation
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about the required room conditions before and during the testing procedure in accordance with ANSI/ASHRAE Standard 110-1995.

4.5.5.2 Hood Condition
- Sash Position. An ITI Certified Fume Hood Performance Testing Technician shall be knowledgeable about the required sash position(s) during the testing procedure in accordance with ANSI/ASHRAE Standard 110-1995.

4.5.5.3 Other Activity
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable about any other activity within the testing space during the testing procedure in accordance with ANSI/ASHRAE Standard 110-1995.

4.5.5.4 Background Level
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable in determining the background level of any contaminants and any actions resulting from the presence of said contaminants.

4.5.5.5 Preliminary Data
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable regarding the type of information and data that shall be recorded prior to testing of the fume hoods.

4.5.6 Flow Visualization and Velocity Procedure
4.5.6.1 Flow Visualization
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable regarding the purpose of the flow visualization procedure and the means and the processes by which it is carried out.
- Local Visualization Challenge. An ITI Certified Fume Hood Performance Testing Technician shall be knowledgeable how to conduct the local visualization challenge and the associated pass/fail criterion.
Fume Hood Performance Testing Technician Certification

- Large-Volume Visualization Challenge. An ITI Certified Fume Hood Performance Testing Technician shall be knowledgeable how to conduct the large-volume visualization challenge and the associated pass/fail criterion.

4.5.6.2 Face Velocity Measurements
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable how to conduct face velocity measurements and how to properly record and interpret the measurement results.

4.5.6.3 Test Method for Variable-Air-Volume (VAV) Fume Hoods
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable how to conduct face velocity measurements for VAV fume hoods and how to properly record and interpret the measurement results.

4.5.6.4 VAV Response Test
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable how to conduct the response test for VAV fume hoods, including selection of the proper instruments, and how to properly record and interpret the measurement results.

4.5.7 Tracer Gas Test Procedure
4.5.7.1 Determining the Performance Rating
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable how to prepare for, set-up and conduct the tracer gas test for fume hoods in accordance with ANSI/ASHRAE Standard 110-1995. He or she shall be capable to determine the performance rating according to ANSI/ASHRAE Standard 110-1995.

4.5.7.2 Sash Movement Effect
An ITI-certified Fume Hood Performance Testing Technician shall be knowledgeable how to prepare for, set-up and conduct the procedure to determine the sash movement effect of fume hoods in accordance with ANSI/ASHRAE Standard 110-1995. He or she shall be capable to determine the sash movement performance rating according to ANSI/ASHRAE Standard 110-1995.
5 HVAC Fire Life Safety Level One Technician Certification

5.1 Purpose

This manual states the regulations by which the ITI will certify HVAC Fire Life Safety Level One (FLS1) Technicians. This manual sets forth the qualifications for eligibility for certification and specifies the areas of knowledge, skills and ability required of an ITI Certified FLS1 Technician.

5.2 Eligibility

To be eligible for the ITI Technician certification in HVAC FLS1, the applicant must meet the requirements of Section 2.1 of this manual.

5.3 Qualification

An ITI-certified FLS1 Technician is one who has:

- Met the qualifications and completed the application requirements set forth in Sections 1 and 2 of this manual;
- Passed the Written Test as set forth in Section 2.3 of this manual;
- Demonstrated FLS1 standards of proficiency as set forth in this manual.

5.4 Renewal of Certification

The following documents are required to renew the Fire Life Safety Level One Technician certification:

- Completed online renewal application. (See Section 2.2 of this manual);
- Documents showing that the technician has completed four (4) hours of continuing education units (CEUs) in the past two years;
- Signed copy of the Code of Conduct. (See also Section 2.6 of this manual).

Acceptable CEUs. One hour of training equals one CEU. CEUs will be accepted from the following:

- Any course endorsed by National SMACNA related to HVAC fire life safety;
- Any course sponsored by a local SMACNA chapter and related to HVAC fire life safety;
- Attendance of the annual ICB Conference or any course/seminar offered during the event;
- Any course put on by the National Energy Management Institute (NEMI) or the International Training Institute (ITI);
- Any course by the National Fire Protection Association on HVAC fire life safety;
- Teaching a course in HVAC fire life safety for a local JATC at least two (2) hours per year;
- Presenting a seminar on a topic related to HVAC fire life safety; a copy of the agenda and the presentation must be provided to receive credits;
- Papers published on the topic of HVAC fire life safety. Four (4) CEUs will be credited per paper. A copy of the paper and the publication must be provided to receive credits;
- Any course or webinar related to HVAC fire life safety;
Other as determined by ICB.

5.5 Standards of Proficiency in Fire Life Safety Level One

An ITI-certified FLS1 Technician must be proficient in all of the categories of this Section, as demonstrated by passing the written exam.

5.5.1 Design, Plans and Specifications

An ITI-certified FLS1 Technician must be knowledgeable about the responsibilities of the architects, mechanical engineers and fire protection engineers including:

1. Purpose of fire and smoke dampers for life safety and protection of property
2. Terminology commonly used in conjunction with fire and smoke dampers.
3. Symbols, definitions, and abbreviations commonly used on plans for HVAC systems
4. Specifications for HVAC systems in SpecText and MasterSpec

5.5.2 Basic Construction

An ITI-certified FLS1 Technician must be knowledgeable of types of construction and the principals of fire resistant construction, structural protection, and fire and smoke containment by barriers

5.5.3 Code Requirements

An ITI-certified FLS1 Technician must be knowledgeable of the duties and powers of the “ Authorities Having Jurisdiction” (AHJ) and codes

- Fire code
- Mechanical code
- Building code
- Life safety code

5.5.4 Standards and UL Tests for Dampers

An ITI-certified FLS1 Technician must be knowledgeable of UL procedures for product testing

- Knowledge of testing procedure for rating dampers
- Listing
- Classification
- Component recognition
- Product labeling

An ITI-certified FLS1 Technician must be knowledgeable about damper testing and rating requirements in

- UL 555 Fire Dampers
- UL 555S (Smoke) Damper
- UL 555C Ceiling Radiation Dampers

5.5.5 Damper Installation manuals and Guidelines

An ITI-certified FLS1 Technician must be knowledgeable of various sources of damper installation manuals and guidelines from:

5.5.6 Features and Components of Fire Dampers
An ITI-certified FLS1 Technician must be knowledgeable of the process of fire damper selection including:
- Hourly fire resistance rating
- Operability
- Dynamic closure
- Mounting orientation
- Pressure drop
- Space envelope

An ITI-certified FLS1 Technician must be knowledgeable of the function of fire damper accessories:
- Sleeves
- Heat responsive devices
- Duct access doors
- Locking quadrants
- Mullions
- Blade position indicator
- Retaining angles
- Solenoid release
- Carbon dioxide (CO₂) release

5.5.7 Features and Components of Smoke Dampers
An ITI-certified FLS1 Technician must be knowledgeable of the process of smoke damper selection including:
- Leakage rating
- Temperature rating
- Operability under heat
- Flow and pressure
- Control function
- Actuating device

5.5.8 Features and Components of Combination Fire/Smoke Dampers
An ITI-certified FLS1 Technician must be knowledgeable of the process of combination fire/smoke damper selection including:
- Hourly fire resistance rating
- Leakage
- Temperature and operational ratings
- Blade styles
- Space envelope
An ITI-certified FLS1 Technician must be knowledgeable of the various combination fire/smoke and smoke (leakage rated) damper accessories available including:

- Actuator
- Override package
- EP switch (electro-pneumatic or solenoid valve)

5.5.9 Features and Components of Ceiling Radiation Dampers

An ITI-certified FLS1 Technician must be knowledgeable of the process of ceiling (radiation) damper selection including:

- Floor/ceiling or roof/ceiling assembly design
- Types of ceiling dampers
- Space envelope
- Mounting configuration

An ITI-certified FLS1 Technician must be knowledgeable of the function of ceiling (radiation) damper accessories:

- Thermal blanket
- Volume control/balancing devices
- Fusible links

5.5.10 Installation Methods of Dampers

An ITI-certified FLS1 Technician must be knowledgeable of the proper installation of dampers:

- Using illustrations provided by manufacturer
- Appropriate fire separation clearances
- Sleeves
  - Sleeve length
  - Sleeve thickness
  - Sleeve connection to duct
  - Damper attachment to sleeve
  - Rigid connection
  - Breakaway connection
- Actuators
- Retaining (mounting) angles
- Damper types
  - Rectangular
  - Round
  - Flat oval
- Airflow direction
- Access doors
5.5.11 Inspection and System Acceptance Testing

An ITI-certified FLS1 Technician must be knowledgeable with regard to damper acceptance testing.

- System objectives
- Inspection
- Component testing
- Functional testing
- Performance testing
- Documentation

5.5.12 Process of Repairing Dampers and Documentation

An ITI-certified FLS1 Technician must be knowledgeable of periodic damper inspection mandates as well as maintenance and repair requirements

- Tools
- Safety procedures and safe work practices
6 HVAC Fire Life Safety Level Two Technician Certification

6.1 Purpose
This manual states the regulations by which the ITI will certify HVAC Fire Life Safety Level Two (FLS2) Technicians. This manual sets forth the qualifications for eligibility for certification and specifies the areas of knowledge, skills and ability required of an ITI-certified FLS2 Technician.

6.2 Eligibility
To be eligible for the ITI Technician certification in HVAC Fire Life Safety Level Two, the applicant must meet the requirements of Section 2.1 of this manual as well as be an ITI-certified HVAC FLS Level One Technician.

6.3 Qualification
An ITI-certified FLS2 Technician is one who has:
- Met the qualifications and completed the application requirements set forth in Sections 1 and 2 of this manual;
- Passed the written exam as set forth in Section 2.3 of this manual;
- Demonstrated FLS2 standards of proficiency as set forth in this manual; and
- ITI-certified HVAC FLS Level One Technician.

6.4 Renewal of Certification
The following documents are required to renew the HVAC Fire Life Safety Level Two Technician certification:
- Completed online renewal application. (See Section 2.2 of this manual);
- Documents showing that the technician has completed four (4) hours of continuing education units (CEUs) in the past two years;
- Signed copy of the ICB Code of Conduct. (See also Section 2.6 of this manual).

Acceptable CEUs. One hour of training equals one CEU. CEUs will be accepted from the following:
- Any course endorsed by National SMACNA related to HVAC fire life safety;
- Any course sponsored by a local SMACNA chapter and related to HVAC fire life safety;
- Attendance of the Annual ICB/TABB Conference or any course/seminar offered during the event ;
- Any course put on by the National Energy Management Institute (NEMI) or the International Training Institute (ITI);
- Any course by the National Fire Protection Association on HVAC fire life safety;
- Teaching a course in HVAC fire life safety for a local JATC at least two (2) hours per year;
- Presenting a seminar on a topic related to HVAC fire life safety; a copy of the agenda and the presentation must be provided to receive credits;
Papers published on the topic of HVAC fire life safety. Four (4) CEUs will be credited per paper. A copy of the paper and the publication must be provided to receive credits;

- Any course or webinar related to HVAC fire life safety;
- Other as determined by ICB.

6.5 Standards of Proficiency in HVAC Fire Life Safety Level Two

An ITI-certified FLS2 Technician must be proficient in all of the categories of this Section as demonstrated by passing the written exam.

6.5.1.1 Design, Plans and Specifications

An ITI-certified FLS2 Technician must be knowledgeable about the responsibilities of the architects, mechanical engineers and fire protection engineers:

- Purpose of smoke management systems for life safety and protection of property
- Purpose of fire and smoke dampers for life safety and protection of property
- Terminology commonly used in conjunction with smoke management systems and with fire and smoke dampers
- Symbols, definitions, and abbreviations commonly used on plans for HVAC systems, and life safety systems
- Ability to read and understand plans and specifications for HVAC systems and life safety systems

6.5.1.2 Basic Construction

An ITI-certified FLS2 Technician must be knowledgeable of types of construction as defined by building codes, the principals of fire resistant construction, structural protection, fire and smoke containment barriers and occupancy classification by code.

6.5.1.3 Code Requirements

An ITI-certified FLS2 Technician must be knowledgeable of the duties and powers of the "Authorities Having Jurisdiction" (AHJ) and knowledge of code requirements for smoke management systems and fire and smoke dampers installed in HVAC systems.

- Fire code
- Mechanical code
- Building code and awareness of occupancy design and current use
- Life safety code

6.5.1.4 Standards and UL Tests for Dampers

An ITI-certified FLS2 Technician must be knowledgeable of UL procedures for product testing

- Knowledge of testing procedure for rating dampers
- Listing
- Classification
- Component recognition
- Product labeling
An ITI-certified FLS2 Technician must be knowledgeable about damper testing and rating requirements in:

- UL 555 Fire Dampers
- UL 555S (Smoke) Damper
- UL 555C Ceiling Radiation Dampers

6.5.1.5 Damper Installation Manuals and Guidelines

An ITI-certified FLS2 Technician must be knowledgeable of various sources of damper installation manuals and guidelines from:

- AMCA: Publication 503-03 Fire, Ceiling (Radiation), Smoke and Fire/Smoke Dampers Application Manual
- Manufacturer’s installation guidelines
- International Code Council (ICC) (current editions):
  - International Building Code and its commentary
  - International Mechanical Code
  - International Fire Code
- ASHRAE (current editions):
  - ASHRAE Guideline Commissioning Smoke Management Systems
  - Principals of Smoke Management
  - HVAC Systems and Equipment Handbook
- NFPA (current editions):
  - NFPA 70 National Electrical Code
  - NFPA 80 Standard for Fire Doors and Other Opening Protectives
  - NFPA 90A Standard for Installation for Air Conditioning and Ventilation Systems
  - NFPA 92A Recommended Practice for Smoke-Control Systems
  - NFPA 92B Standard for Smoke Management Systems in Malls, Atria and Large Spaces
  - NFPA 110 Standard for Emergency and Stand-by Power Systems
  - NFPA 221 Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls.
  - NFPA 5000 Building Construction and Safety Code
- Underwriters Laboratories
  - Directory, Fire Resistance, Volumes 1, 2A and 3.
  - UL 864 Standard for Safety Control Units and Accessories for Fire Alarm Systems
- ITI manuals
  - HVAC Fire Life Safety, Level One Technician
  - HVAC Fire Life Safety, Level Two Technician
  - HVAC Fire Life Safety, Supervisor
  - Fans - Environmental Technician Module Series 2002
  - TAB HVAC Systems Testing Adjusting and Balancing
  - TABB Supervisor Home Study Course
- ASTM Standard E 814,2006
6.5.1.6 Features and Components of Fire Dampers

An ITI-certified FLS2 Technician must be knowledgeable of the process of fire damper selection including:

- Hourly fire resistance rating
- Operability
- Dynamic closure
- Mounting orientation
- Pressure drop
- Space envelope

An ITI-certified FLS2 Technician must be knowledgeable of the function of fire damper accessories:

- Sleeves
- Heat responsive devices
- Duct access doors
- Locking quadrants
- Mullions
- Blade position indicator
- Retaining angles
- Solenoid release
- Carbon dioxide (CO2) release

6.5.1.7 Features and Components of Smoke Dampers

An ITI-certified FLS2 Technician must be knowledgeable of the process of smoke damper selection including:

- Leakage rating
- Temperature rating
- Operability under heat
- Flow and pressure
- Control function
- Actuating device

6.5.1.8 Features and Components of Combination Fire/Smoke Dampers

An ITI-certified FLS2 Technician must be knowledgeable of the process of combination fire/smoke damper selection including:

- Hourly fire resistance rating
- Leakage
- Temperature and operational ratings
- Blade styles
- Space envelope

An ITI-certified FLS2 Technician must be knowledgeable of the various combination fire/smoke and smoke (leakage rated) damper accessories available including:

- Actuator
- Override package
- EP switch (electro-pneumatic or solenoid valve)

6.5.1.9 Features and Components of Ceiling Radiation Dampers

An ITI-certified FLS2 Technician must be knowledgeable of the process of ceiling (radiation) damper selection including:

- Floor/ceiling or roof/ceiling assembly design
- Types of ceiling dampers
- Space envelope
- Mounting configuration
An ITI-certified FLS2 Technician must be knowledgeable of the function of ceiling (radiation) damper accessories:

- Thermal blanket
- Volume control/balancing devices
- Fusible links

6.5.1.10 Installation Methods of Dampers

An ITI-certified FLS2 Technician must be knowledgeable of the proper installation of dampers:

- Using illustrations provided by manufacturer
- Appropriate fire separation clearances
- Sleeves
  - Sleeve length
  - Sleeve thickness
  - Sleeve connection to duct
  - Damper attachment to sleeve
  - Rigid connection
  - Breakaway connection
- Actuators
- Retaining (mounting) angles
- Damper types
  - Rectangular
  - Round
  - Flat oval
- Airflow direction
- Access doors

6.5.1.11 Damper Inspection and System Acceptance Testing

An ITI-certified FLS2 Technician must be knowledgeable with regard to damper acceptance testing.

- System objectives
- Inspection
- Component testing
- Functional testing
- Performance testing
- Documentation

6.5.1.12 Process of Repairing Dampers and Documentation

An ITI-certified FLS2 Technician must be knowledgeable of periodic damper inspection mandates as well as maintenance and repair requirements

- Record keeping
- Suitability of replacement or repair
- Manufacturer’s Standard Operating Procedures
- Safety procedures and safe work practices
6.5.1.13 Smoke Management Systems Manuals and Guidelines

An ITI-certified FLS2 Technician must be aware of various sources of smoke management systems manuals and guidelines from:

- SMACNA
  - Fire Smoke and Radiation Damper Guide for HVAC Systems
  - HVAC Systems Duct Design
  - HVAC Systems - Applications

- AMCA

- ASHRAE
  - Commissioning Smoke Management Systems
  - Principles of Smoke Management Systems

- NFPA
  - NFPA 90A, Standard for the Installation of Air Conditioning and Ventilating Systems
  - NFPA 92A, Recommended Practice for Smoke-Control
  - NFPA 92B, Guide for Smoke Management Systems in Malls, Atria and Large Areas
  - NFPA 204, Guide for Smoke and Heat Venting
  - NFPA 252, Standard Methods of Fire tests of Door Assemblies

- International Building Code

- International Fire Code

6.5.1.14 Features and Components of Smoke Management Systems

An ITI-certified FLS2 Technician must be knowledgeable of the equipment and features of the smoke management systems:

- Fans: Type of fans and fan curves
- Doors
  - Capacity
  - Type
  - Fire rating
  - Mercantile occupancies
- Dampers
- Smoke Barriers
- Passive and active controls

6.5.1.15 Knowledge of Smoke Management Systems

An ITI-certified FLS2 Technician must be knowledgeable of the smoke management systems:

- Electrical systems interface with smoke management
  - Regular
  - Emergency
- Fire Alarm Systems
  - Smoke Detectors in duct work
  - Sounds Alarms
  - Operate smoke control dampers
  - Activate fire suppression equipment
  - Active smoke control functions
Energy Management Systems
Automatic Sprinkler Systems
  ✓ Sprinklers without air movement systems
  ✓ Sprinklers with air movement systems
HVAC Systems used active smoke control system

6.5.1.16 Knowledge of Types of Smoke Management
An ITI-certified FLS2 Technician must be knowledgeable of the types of smoke management systems
- Dedicated systems
- Non-dedicated systems
- Stairwell pressurization
- Elevator smoke control
- Zoned smoke control

6.5.1.17 Smoke Control System Inspection and Acceptance Survey
An ITI-certified FLS2 Technician must be knowledgeable of following subsystems to the extent that they affect the operation of the smoke-control system:
- Fire Alarm System
- Energy management system
- Building management system
- HVAC equipment
- Electrical equipment
- Temperature control equipment
- Power sources
- Standby power
- Automatic fire suppression system
- Automatic operating doors and closers
- Dedicated smoke-control systems
- Non-dedicated smoke-control systems
- Emergency elevator operation
- Stairwell Pressurization

6.5.1.18 Test Equipment
- Calibrated instruments to read pressure differences:
  ✓ Differential pressure gauges
  ✓ Inclined water manometers or electronic manometers
- Spring scale
- Anemometer
- Flow measuring hood
- Door wedges
HVAC Fire Life Safety Level Two Technician Certification

- Hand tools
- Tool bag
- Screwdrivers
- Pliers
- Scratch awls
- Hand tongs
- Wrenches
- Hammer
- Aviation snips
- Drill motor
- Extension cord
- Ground fault for electrical cords
- Light
- Clip board and binder
- Safety equipment

6.5.1.19  Safe Working Practices

- Skills in the proper handling of tools
- Identification of unsafe working conditions.
- Confined spaces
7 Indoor Air Quality Technician Certification

7.1 Purpose
This manual states the regulations by which the ITI will certify Indoor Air Quality (IAQ) Technicians. This manual sets forth the qualifications for eligibility for certification and specifies the areas of knowledge, skills and ability required of an ITI Certified IAQ Technician.

7.2 Eligibility
To be eligible for the ITI Technician certification in IAQ, the applicant must meet the requirements of Section 2.1 of this manual.

7.3 Qualification
An ITI-certified IAQ Technician is one who has:
- Met the qualifications and completed the application requirements set forth in Section 2 of this manual;
- Passed both the written and performance tests as set forth in Section 2.3 of this manual;
- Demonstrated IAQ standards of proficiency as set forth in this manual.

7.4 Renewal of Certification
The following documents are required to renew the ITI IAQ Technician certification:
- Completed online renewal application. (See Section 2.2 of this manual);
- Documents showing that the technician has completed four (4) hours of continuing education units (CEUs) in the past two years;
- Signed copy of the ICB Code of Conduct. (See also Section 2.6 of this manual).

Acceptable CEUs. One hour of training equals one CEU. CEUs will be accepted from the following:
- Any course endorsed by National SMACNA related to IAQ;
- Any course sponsored by a local SMACNA chapter and related to IAQ;
- Attendance of the Annual ICB/TABB Conference or any course/seminar offered during the event;
- Any course put on by the National Energy Management Institute (NEMI) or the International Training Institute (ITI);
- Any course by the American Society of Heating, Refrigerating and Air-Conditioning Engineers on IAQ;
- Teaching a course in IAQ for a local JATC at least two (2) hours per year;
- Presenting a seminar on a topic related to IAQ; a copy of the agenda and the presentation must be provided to receive credits;
- Papers published on the topic of IAQ. Four (4) CEUs will be credited per paper. A copy of the paper and the publication must be provided to receive credits;
- Any course or webinar related to IAQ;
- Other as determined by ICB.
7.5 Standards of Proficiency in IAQ

An ITI-certified IAQ Technician must be proficient in all of the categories of this Section, as demonstrated by passing the written exam.

7.5.1.1 HVAC Systems

- Air handler
  - Heating coils
  - Velocity measurement
  - Dampers
    - Outside
    - Return
  - Condensate pans
    - Drain pitch
    - Determining P-trap height
  - Chilled water coils
  - Filters
  - Minimum OSA measurement
  - DX coils
  - Static pressure profiling

- Package units
  - DX coils
  - Condensate pans
    - Drain pitch
    - Determining P-trap height
  - Filters
  - Dampers
    - Outside
    - Return
  - Velocity measurement
  - Minimum OSA measurement
  - Chilled water coils
  - Static pressure profiling

- Controls
  - CO₂ monitors
  - Thermostat
  - Humidistat
  - Building Automated Systems (BAS)
    - Direct Digital Control (DDC)
    - Pneumatic
✓ Energy Management
✓ Building Pressurization

- Hydronics
  ✓ Chiller
  ✓ Boiler
  ✓ Pumps
  ✓ Heat exchanger
  ✓ Cooling tower
  ✓ Control valves
  ✓ Safety relief valves
  ✓ Pressure reducing valve (PRVs)
  ✓ Automatic vents
  ✓ Access ports
  ✓ Humidifiers

- Ductwork
  ✓ Leakage
  ✓ Cleaning

- Psychrometrics
  ✓ Absolute humidity
  ✓ Dew point
    - Chart
    - Winter and summer

- UV Lighting
  ✓ Cooling coil applications
  ✓ Upper room UV applications
  ✓ Lamp selection

- HVAC system hygiene

7.5.1.2 Health/IAQ

- Productivity
- Volatile Organic Compounds (VOCs)

- Filtration
  ✓ Minimum Efficiency Rating Value (MERV) rating
  ✓ Particle

- Sizes
- Sources
- Control
  ✓ ASHRAE 52
- Minimum filter efficiency
  ✓ Pressure drop
- Sick Building Syndrome (SBS) vs. Building Related Illnesses (BRI)
- Air cleaning
7.5.1.3 Documentation

- Data gathering
  - Tools for Schools (EPA)
  - I-Beam (EPA)

- Observation
  - Occupant complaints
  - Walk through
    - Inside
    - Outside
  - HVAC check list
  - Listening skills
  - Call in professionals
  - Photographs
  - Before and after repairs (if any)
  - Building checklist

- Communication
  - Chain of command
  - Communication
    - Technician
    - Customer/client
    - Design professional

- Interpret Plan & Specifications

7.5.1.4 Testing Guidelines

- Codes
  - Local
  - Model

- Standards of Care reference material
  - ASHRAE 62.1
    - Breathing zone
    - IAQ definitions
    - Ventilation rates
    - Air quality standards/guidelines
  - ASHRAE 62.2
    - Breathing zone
    - IAQ definitions
    - Ventilation rates
    - Air quality standards/guidelines
  - ASHRAE 55-2004
    - Acceptable ranges
      - Humidity
  - Temperature

- Federal guidelines
7.5.1.5 Instruments

- Particle meter
- Infrared Camera
- Voltage meters
  - Averaging
  - True RMS
  - Multi-meters
- Thermometers
  - Analog
  - Infrared
  - Contact
  - Digital
- Moisture meter
  - Intrusive pin-type
  - Non-destructive radiofrequency
- Borescope
  - Rigid
  - Flexible
- CO₂ meter
  - Range
  - Accuracy
  - Resolution
  - Response time
- Camera
- Calibration issues
  - Sensor range
  - Accuracy
  - Drift
  - Calibration
- Testing, adjusting and balancing
8 Infection Control Awareness Certification

8.1 Purpose
This manual states the regulations how ITI will certify technicians in Infection Control Awareness (ICA). This manual sets forth the qualifications for eligibility for certification and specifies the areas of knowledge, skills and ability required of an ITI-certified ICA technician.

8.2 Eligibility
To be eligible for the ITI certification in ICA, the applicant must meet the requirements of Section 2.1 of this manual.

8.3 Qualification
An ITI-certified technician in Infection Control Awareness is one who has:
- Met the qualifications and completed the application requirements set forth in Section 2 of this manual;
- Passed the written exam as set forth in Section 2.3 of this manual;
- Demonstrated standards of proficiency as set forth in this manual.

8.4 Renewal of Certification
The following documents are required to renew the ITI certification as an ITI-certified technician in Infection Control Awareness:
- Completed online renewal application. (See Section 2.2 of this manual);
- Documents showing that the worker has completed four (4) hours of continuing education units (CEUs) in the past two years;
- Signed copy of the Code of Conduct. (See also Section 2.6 of this manual).

Acceptable CEUs. One hour of training equals one CEU. CEUs will be accepted from the following:
- Any course endorsed by National SMACNA related to healthcare environment;
- Any course sponsored by a local SMACNA chapter and related to healthcare environment;
- Attendance of the annual ICB Conference or any course/seminar offered during the event;
- Any course put on by the National Energy Management Institute (NEMI) or the International Training Institute (ITI);
- Any course by the American Society Healthcare Engineers (ASHE);
- Any course by the American Medical Association (ASHE);
- Teaching a course in healthcare environment for a local JATC at least two (2) hours per year;
- Presenting a seminar on a topic related to healthcare environment; a copy of the agenda and the presentation must be provided to receive credits;
- Papers published on the topic of healthcare environment. Four (4) CEUs will be credited per paper. A copy of the paper and the publication must be provided to receive credits;
- Any course or webinar related to healthcare environment;
8.5 Standards of Proficiency for the Certification in Infection Control Awareness

An ITI-certified Infection Control Awareness Worker must be proficient in all of the categories of this Section, as demonstrated by passing the written exam.

8.5.1 References

The following documents shall serve as references:


8.5.1.1 The Need for Infection Control [4][10]

8.5.1.1 Understanding how infections are spread in a Hospital (HAI).

- Patient to Patient
- Visitor to Patient
- Staff to Patient
- Vendor to patient
- Unsterile conditions
- Airborne Pathogen

8.5.1.2 Who is at risk of infection?

- Hospital Patients
- Visitors
- Staff
- Vendors

8.5.1.3 Who is at highest risk of infection?

- Transplant patients
- Chemotherapy patients
- Infants and Elderly

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1 Pertinent references for this section:


Other immuno-compromised patients

8.5.1.4 Why is the risk greater?
- Immune systems of sick patients more susceptible
- Hospital are treating formerly incurable conditions

8.5.1.5 How are infections acquired/ transmitted?
- Contact
- Direct
- Indirect
- Droplet
- Non-contact
- Airborne
- Vehicle
- Vector-borne

8.5.1.6 Understanding the benefits of a good Infection Control program
- Better patient outcome
- Lower recidivism
- Reduction of infections
- Economic benefits

8.5.1.7 Understanding who participates in Infection Control
- Hospital Patients
- Visitors
- Staff
- Vendors
8.5.1.2 Application of Infection Control [1][2][3][5][12]

8.5.1.2.1 Education

8.5.1.2.2 Patients
- Limitations on where they can go in the hospital
- Medical condition specific precautions

8.5.1.2.3 Visitors
- PPE
- Standard Precautions
- Contact Precautions
- Droplet Precautions
- Airborne Precautions
- Signage
- Hand Hygiene
- Visitor Limitations
- Patient Interaction

8.5.1.2.4 Staff
- Patient Transport
- Hand Hygiene
- PPE
- Standard Precautions
- Contact Precautions
- Droplet Precautions
- Airborne Precautions
- Patient Interaction
- Standard Precautions
- Barrier Protocol
- Continuing Education

8.5.1.2.5 Vendors
- PPE
- Precautions for patient areas
  - Standard Precautions
  - Contact Precautions
  - Droplet Precautions
  - Airborne Precautions
- PPE for construction areas
  - Contaminate Control
  - Walk-off Mats
- Construction specific PPE
- Hand Hygiene
- Barrier Protocol
- Signage
- Continuing Education
- Interaction with others in the HCE

8.5.1.2.6 Policy and Procedure review and revisions
- Required procedures are specific to the HCF
- Policies and Procedures are ‘living documents’

8.5.1.2.7 Hospital’s Responsible Party (Infection Control Officer)
- Final decision maker related to infection control
- Resource for education/ training
- Establishes policy and protocol

8.5.1.2.8 Infection Control Risk Assessment
- Pre-construction assessment
- Construction oversight
- Post-construction clean-up

8.5.1.2.9 Medical surveillance
- Collecting and reviewing data associated with HAIs
- Monitoring trends within the HCF
- Establishing best-practices for prevention of HAIs

8.5.1.2.10 Outbreak investigation
- Identifying infectious agent
- Determining transmission path
- Eliminating transmission paths
8.5.1.3 The Chain of Infection [1][2][10][13]

8.5.1.3.1 Six links of the infection chain
- Infectious Agent
- Reservoir
- Portal of Exit
- Mode of Transmission
- Portal of Entry
- Susceptible Host

8.5.1.3.2 Breakable links
- Portal of Exit
- Mode of Transmission
- Portal of Entry

8.5.1.3.3 Unbreakable links
- Infectious Agent
- Reservoir
- Susceptible Host

8.5.1.3.4 The role of construction in the infection chain
- Minimizing Reservoirs
- Controlling portals of exit
- Avoiding becoming a mode of transmission

8.5.1.3.5 Infectious Agents commonly related to construction activities
- Fungus i.e. Aspergillus, (mold)
- Bacteria i.e. Legionella
- Viruses
8.5.1.4  Infectious Control Awareness [2][8]

8.5.1.4.1  Understanding the Infectious Control Matrix
- Type of Construction activities
  - Type A
  - Type B
  - Type C
  - Type D
- Related to patient Risk Groups
  - Low Risk
  - Medium Risk
  - High Risk
  - Highest Risk

8.5.1.4.2  Infection control classification based on combination of patient risk and construction
- Class I
- Class II
- Class III
- Class IV

8.5.1.4.3  Understanding the required precautions based on infection control level
- Pre-construction
- During Construction
- Post-Construction

8.5.1.4.4  The principle of isolation and containment
- Pressure Differential
- Negative air machines
  - Identify
  - Proper operation
8.5.1.5 Barriers [1][2][8]

8.5.1.5.1 Containment Barrier Types
- Short-term (soft wall)
- Long-term (hard wall)
- Usage will be site and project specific

8.5.1.5.2 Working inside the barrier
- Entry/Exit procedures
- Dust control
- Trash Control/Housekeeping
- Build Clean Protocol

8.5.1.5.3 Barrier Maintenance
- Barrier Inspection
- Breach Repair

8.5.1.5.4 Ante Rooms
- Purpose
- Where required
- Entry/Exit Procedures
- Gowning/De-gowning Procedures
- HEPA Vacuum

8.5.1.5.5 Understanding Barrier Pressurizations
- Pressure Monitors/Gauge
- Soft Wall Visual Inspection

8.5.1.5.6 Portable Containment Units (Control Cube)
- Site policy dictates usage
- Can be used for dust control or containment
- Used outside of the typical construction barrier

8.5.1.5.7 Erection and removal of barriers
- Stages of erection and removal
- Determined by infection control classification and hospital policy

8.5.1.5.8 Means of pressurization
- Negative air machines
- ‘In-house’ HVAC systems
  - Modified systems
  - Additional filtration
- Dedicated Systems

8.5.1.5.9 Barrier Breaches and risks involved
- Unintended Breaches
8.5.1.6 Healthcare Specific Project Conditions and Considerations [1][4][9]

8.5.1.6.1 Health Insurance Portability and Accountability Act (HIPAA)
- Protecting patient information
- Protecting patient privacy

8.5.1.6.2 Chain of Command
- Understanding who you are working for
- Communicating through channels
- Following hospital communication protocols

8.5.1.6.3 Permits
- Above Ceiling Permits
- Hot Work Permits
- Breach Permit
- Shutdown Permits
- Confined Space Permits

8.5.1.6.4 Material Handling and Deliveries
- Acceptable Hours
- Minimizing interference with hospital operations
- Routes
  - Delivery
  - Personnel
- Staging of material
- Loading Dock Schedules

8.5.1.6.5 Schedules and Hours
- Non-traditional work hours
- Aggressive project schedules
- Shut-downs

8.5.1.6.6 Noise Policies
- Scheduled loud work hours
- Radios/ Site noise
- Alternative methods
8.5.1.6.7 Productivity Expectations
- Compliance with guidelines increases time requirements
- Additional labor may be required to meet schedules

8.5.1.6.8 Incident Reporting
- All incidents, regardless of severity, need to be reported
- Documentation should follow HCF protocols

8.5.1.6.9 Site Health and Safety
- Recognize how your personal health can impact others onsite
- Recognize sites may have requirements such as flu shots/ vaccinations before beginning work.
- Recognize how you can avoid being a mode of transmission

8.5.1.6.10 Interim Life Safety Measures (ILSM)
- Exit Signs
- Pathways to Egress
- Fire Protection Systems
  - Smoke Detectors
  - Fire Suppression
  - Fire Extinguishers
  - Fire Alarm Systems
- Smoke Barriers
- Emergency Evacuation Plans
9 Mechanical Acceptance Test Technician Certification

At this time, the mechanical acceptance test certification is only mandated by the State of California under California Code of Regulations Title 24, Part 1, Sections 10-102 And 10-103-B, As Well As Part 6, Sections 120.5. The following requirements for technicians to be certified as a Mechanical Acceptance Test Technician (MATT) are identical to that of the National Energy Management Institute Committee (NEMIC) in its Certification Manual for Nonresidential Mechanical Acceptance Test Technician And Employers Under California Code Of Regulations 2013 Title 24, Part 1, Sections 10-102 And 10-103-B, As Well As Part 6, Sections 120.5. For further details, please consult www.attcp.org.

9.1 Eligibility

To be eligible for the MATT (mechanical acceptance test technician) certification, the applicant must be:

- An individual with respect to whom contributions are payable to the NEMIC; or an instructor with a JATC in the Sheet Metal Industry; or other individual who qualifies as an NEMIC Participant.
- ICB/TABB-certified in testing, adjusting and balancing
- Holds an ITI certificate of completion of having received training on mechanical acceptance testing mandates and procedures as specified by the latest version of the California Building Energy Efficiency Standards.

9.2 Application

1. Applicant completes the MATT application online.
2. Upon submission the ATTCP will verify the eligibility of the applicant to be certified.
3. The applicant is notified of ATTCP action, including any request for additional documentation.
   a. If approved, the applicant will be notified in writing or by electronic communications.
   b. If not approved, the applicant will be notified in writing or by electronic communications. The applicant may appeal this decision as specified in Section 2.5.5.2 of the NEMIC ATTCP Certification Manual.

9.3 Certification Exam

The certification exam consists of a written test. The exam encompasses 80 question. The MATT candidate is given 4 hours to answer the questions.

An applicant may not test until he or she has been notified that he or she is eligible to be certified per Section 9.1.

1. Upon receiving written notification by ATTCP that the applicant has met the eligibility requirements, the applicant submits the eligibility notice to the local JATC coordinator.
2. The local JATC coordinator will designate a proctor.
3. The proctor requests the certification exam which the ATTCP mails to the designated proctor along with proctor guidelines. The exam and proctor information are in a sealed envelope.

4. The test proctor administers the exam according to the instructions.
   ✓ The seal on the exam must be opened by candidate only.
   ✓ The exam must be completed in one sitting in a designated room and within the specified time limit.

The candidate may use any reference books or notebooks deemed appropriate by the ATTCP.

The exam proctor will time the test to the specified time allowed.

   a. The proctor will record time started.
   b. At end of time allocated for test
      i. The candidate is stopped.
      ii. Time ended entered by the proctor.
   c. The proctor mails all exam materials in a sealed return envelope back to the ATTCP.

9.3.1 Scoring the Certification Exam

The ATTCP scores the exam and determines whether the score is passing.

- If the candidate passes the certification exam, the ATTCP will issue certification documents as described in Section 2.5 of this manual; or
- If the candidate fails the certification exam, the ATTCP will notify the candidate. The candidate may retest in accordance with Section 9.3.2 of this manual.

9.3.2 Time Limits on Testing and Re-Testing

The certification exam must be passed within one year from ATTCP approval of the application, or the applicant must re-apply.

A candidate who fails the certification exam may apply to re-test in a manner specified by ATTCP, but may re-test only after a waiting period of at least thirty (30) calendar days.

9.4 Certification Documents

On certification ATTCP will issue a certificate including:

- Date of certification
- The name of the technician
- The technician’s individualized certification number

9.5 Decertification

The ATTCP may withdraw the certification of any ATT for one or more of the following reasons:

- Falsification of data and reports.
- Failure to maintain eligibility.
- Failure to meet the Code of Conduct
9.6 Technician Certification Obligations and Code of Conduct

A NEMIC-certified Acceptance Testing Technician must comply with the following obligations and Code of Conduct as a requirement for maintaining certification. Violations of the Code of Conduct or failure to meet any of the following obligations are grounds for suspension, withdrawal or non-renewal of certification.

To maintain NEMIC ATTCP certification the NEMIC-certified Acceptance Testing Technician shall:

a. Adhere to the NEMIC ATTCP Code of Conduct for Technicians,
b. Adhere to any and all NEMIC ATTCP protocols and regulations.
c. Adhere to all mandates of the California Code of Regulations Title 24, particularly as they pertain to mechanical acceptance testing
d. Meet all applicable registration, insurance, licensing, and bonding State or local mandates and regulations
e. Maintain proof of registration, insurance, licensing, and bonding that meet any and all State or local mandates and regulations.
f. Be employed by an employer who is signatory to a collective bargaining agreement that provides for contributions on behalf of its members directly to NEMIC.

9.7 Appeal

An applicant who believes he or she has been improperly considered ineligible; has an appeal to any ATTCP examination or certification decision; or ATTCP withdrawal of his or her certification may make an appeal as stated in Section 2.5.5 of the NEMIC ATTCP Certification Manual.

9.8 Renewal of Certification

The following documents are required to renew the MATT certification:

1. Completed online renewal application
2. Holds a current ICB/TABB certification in testing, adjusting and balancing
3. Holds an ITI certificate of completion of having received training on mechanical acceptance testing mandates and procedures as specified by the latest version of the Standards.
9.9 Standards of Proficiency for Mechanical Acceptance Testing Technicians

A NEMIC-certified MATT must be proficient in all of the categories of this Section, as demonstrated by passing the written exam.

9.9.1 Reference Materials

- SMACNA HVAC Systems Application
- SMACNA HVAC Systems Testing, Adjusting and Balancing
- SMACNA TAB Procedural Guide
- TABB TAB Procedural Guide
- SMACNA HVAC Air Duct Leakage Test Manual
- SMACNA HVAC Systems Duct Design
- California Code of Regulation Title 24 Part 1 Section 10-102, 10-103 and 10-103B as well as Part 6 section 120.5
- The latest version of the California Energy Code
- The latest version of the Nonresidential Appendix NA 7 – Installation and Acceptance Requirements for Nonresidential Buildings and Covered Processes including Mechanical Systems Compliance Forms and Mechanical Systems Acceptance Forms
- The latest version of the Nonresidential Compliance Manual Section 13. Acceptance Requirements

9.9.2 California Code of Regulations Title 24

A NEMIC-certified MATT must be knowledgeable about

- California Code of Regulation Title 24 Part 1 Section 10-102 and 10-103B as well as Part 6 section 120.5
- The latest version of the California Energy Code
- The latest version of the Nonresidential Appendix NA 7 – Installation and Acceptance Requirements for Nonresidential Buildings and Covered Processes including Mechanical Systems Compliance Forms and Mechanical Systems Acceptance Forms

9.9.3 NA7.5.1 Outdoor Air: Variable Air and Constant Volume Systems

A NEMIC-certified MATT must be knowledgeable about the purpose of these tests, the use of proper instrumentation to execute them, the conditions under which these test need to be performed, the acceptance criteria and potential issues when doing these tests. In particular, a NEMIC-certified MATT must be knowledgeable about how to do:

- Construction inspection for both CAV and VAV systems
- Identify the proper dynamic control method:
  - ✔ Dual Minimum Setpoint Design
  - ✔ Energy Balance Method
  - ✔ Return Fan Tracking
  - ✔ Airflow Measurement of the Entire Outdoor Air Inlet
Mechanical Acceptance Test Technician Certification

- Injection Fan Method
- Dedicated Minimum Ventilation Damper with Pressure Control
  - Functional testing for both CAV and VAV systems
  - Complete the pertinent Certificate of Acceptance
9.9.4 NA7.5.2 Constant Volume, Single-zone, Unitary Air Conditioner and Heat Pump Systems Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the conditions under which this test needs to be performed, and the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about how to do:

- Construction inspection
- Complete the pertinent Certificate of Acceptance

9.9.5 NA7.5.3 Air Distribution Systems Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- The qualifications the technician must have to perform these tests
- The scope of the requirements when these tests must be performed
- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance

9.9.6 NA7.5.4 Air Economizer Controls Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to do the construction inspection based upon the pertinent section of the California Energy Code
- How to conduct the functional testing for the most common type of packaged unitary air conditioners, controllers and DDC systems
- How to complete the pertinent Certificate of Acceptance

9.9.7 NA7.5.5 Demand Control Ventilation (DCV) Systems Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- The applicability of the test
- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance
9.9.8 NA7.5.6 Supply Fan Variable Flow Controls Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance

9.9.9 NA7.5.7 Valve Leakage Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- The applicability of the test
- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance

9.9.10 NA7.5.8 Supply Water Temperature Reset Controls Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- The applicability of the test
- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance

9.9.11 NA7.5.9 Hydronic System Variable Flow Control Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance
9.9.12 NA7.5.10 Automatic Demand Shed Control Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance

9.9.13 NA7.5.11 Fault Detection & Diagnostics (FDD) for Packaged Direct Expansion Units

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to conduct the functional testing of air handlings units
- How to conduct the functional testing of zone terminal units
- How to complete the pertinent Certificate of Acceptance

9.9.14 NA7.5.12 FDD for Air Handling Units and Zone Terminal Units Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to conduct the functional testing of air handlings units
- How to conduct the functional testing of zone terminal units
- How to complete the pertinent Certificate of Acceptance

9.9.15 NA7.5.13 Distributed Energy Storage DX AC System Acceptance

A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to do the construction inspection
- How to conduct the functional testing
- 1. How to complete the pertinent Certificate of Acceptance
9.9.16 NA7.5.14 Thermal Energy Storage (TES) System Acceptance
A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to do the construction inspection on various types of TES systems, including but not limited to:
  - Chilled Water Storage
  - Ice-on-Coil
  - CHS
  - Ice Harvester
  - Brine
  - Ice-Slurry
  - Eutectic Salt
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance

9.9.17 NA7.5.15 Supply Air Temperature Reset Controls Acceptance
A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance

9.9.18 NA7.5.16 Condenser Water Temperature Reset Controls Acceptance
A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the use of proper instrumentation to execute it, the conditions under which this test needs to be performed, a NEMIC-certified MATT Acceptance Testing Technician must be knowledgeable about:

- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance

9.9.19 NA7.5.17 Energy Management Control System Acceptance
A NEMIC-certified MATT must be knowledgeable about the purpose of this test, the conditions under which this test needs to be performed, the acceptance criteria and potential issues when doing this test. In particular, a NEMIC-certified MATT must be knowledgeable about:

- How to do the construction inspection
- How to conduct the functional testing
- How to complete the pertinent Certificate of Acceptance
10 Testing, Adjusting and Balancing Technician Certification

10.1 Purpose
This manual states the regulations by which the ITI will certify Testing, Adjusting and Balancing (TAB) Technicians. This manual sets forth the qualifications for eligibility for certification and specifies the areas of knowledge, skills and ability required of an ITI Certified TAB Technician.

10.2 Eligibility
To be eligible for the ITI Technician certification in TAB, the applicant must meet the requirements of Section 2.1 of this manual.

10.3 Qualification
An ITI Certified TAB Technician is one who has:
- Met the qualifications and completed the application requirements set forth in Section 2 of this manual.
- Passed both the written and practical exams as set forth in Section 2.3 of this manual.
- Demonstrated TAB standards of proficiency as set forth in this manual.

10.4 Renewal of Certification
The following documents are required to renew the TAB Technician certification:
- Completed online renewal application. (See Section 2.2 of this manual).
- Documents showing that the technician has completed four (4) hours of continuing education units (CEUs) in the past two years.
- Signed copy of the Code of Conduct. (See also Section 2.6 of this manual).

Acceptable CEUs. One hour of training equals one CEU. CEUs will be accepted from the following:
- Any course endorsed by National SMACNA that is related to TAB;
- Any course related to TAB or HVAC Fire Life Safety that is recognized by TABB;
- Any course sponsored by a local SMACNA chapter that is related to TAB;
- Attendance of the Annual ICB Conference or any course/seminar sponsored during the event;
- Any course sponsored by an affiliate of TABB;
- ASHRAE courses on TAB topics;
- Teaching a course on HVAC for a local JATC at least 2 hours per year;
- Presenting a seminar on a topic that is related to TAB;
- Papers published on the topic of TAB. Four (4) CEUs will be credited per paper. A copy of the paper and the publication must be provided to receive credits;
- Any webinar related to TAB;
- Other as determined by TABB.
10.5 Standards of Proficiency in TAB

An ITI-certified TAB Technician must be proficient in all of the categories of this Section, as demonstrated by passing written and practical exams.

10.5.1 Mathematics

The ITI-certified TAB Technician must be able to perform the following functions:

- Addition
- Subtraction
- Multiplication
- Square root
- Cube root
- Ratios
- Percentages
- Equations
- Decimals

The ITI-certified TAB Technician must be able to apply and solve equations related to testing, adjusting and balancing work.

10.5.2 Fluid Flow

The ITI-certified TAB Technician must be able to apply the following basic principles of fluid flow to testing, adjusting and balancing work:

- Pressure (static, velocity and total)
- Resistance (friction and dynamic loss)
- Velocity
- Density
- Quantity

10.5.3 Heat Transfer

The ITI-certified TAB Technician must be able to apply the following basic principles of heat transfer to testing, adjusting and balancing work:

- Heat transfer including conduction, convection, and radiation
- Temperature
- Insulation
- Liquids and gasses
- Latent heat
- Specific heat
- Heat exchangers
10.5.4 Psychrometrics

The ITI-certified TAB Technician must be able to plot and understand the following properties of air:

- Dry bulb temperature
- Wet bulb temperature
- Dew point temperature
- Relative humidity
- Specific humidity
- Density
- Enthalpy

10.5.5 Project Documents

The ITI-certified TAB Technician will understand how systems are intended to perform and must be able to read and interpret contract drawings including:

- Mechanical drawings
- Specifications
- Submittal data
- Addenda and alterations
- Shop Drawings

10.5.6 Air Distribution Systems

The ITI-certified TAB Technician will be able to use the following items regarding air distribution systems in testing, adjusting and balancing air systems:

- Know the purpose for each component in an air system and how these components interact.
- Know the effect of duct leakage, friction loss and dynamic loss on balancing, as related to system operating pressure.
- Know the function of the following in air distribution systems:
  - Fan laws
  - Fans
  - V-belt drive
- Explain the function of each component in the following air distribution systems:
  - Supply
  - Return/exhaust
  - Single-zone
  - Multi-zone
  - Reheat or recool systems
  - Induction boxes
  - Dual duct
  - Variable air volume
  - Terminal devices
10.5.7 Hydronic Distribution Systems

- The ITI-certified TAB Technician will be able to explain the purpose of each component in a hydronic distribution system and how these components interact with each other.
- The ITI-certified TAB Technician will be able to apply pump laws and the effect(s) on pumps when balancing a system.
- The ITI-certified TAB Technician will be able to explain the function of each component in the following hydronic systems:
  - Two-pipe
  - Three-pipe
  - Four-pipe
  - Direct return
  - Reverse return
  - Hot water heating
  - Chilled water
  - Condensing water
  - Variable flow system
- The ITI-certified TAB Technician will be able to explain the purpose for each component in a steam system and how these components interact.

10.5.8 Automatic Control Systems

The ITI-certified TAB Technician will have the ability to understand the sequence of operation of the systems that are related to TAB.

10.5.9 Electrical Systems

The ITI-certified TAB Technician will be able to apply the basic principles of electricity to TAB problems including:
- Definitions of voltage, current, resistance, reactance, capacitance
- Ohm's Law
- Bhp

10.5.10 Instrumentation

The ITI-certified TAB Technician will be able to gather accurate, repeatable, and reliable data using the instruments listed in this section. For all the instruments listed in this section, the ITI Certified TAB Technician will be able to:
- Supervise other testing, adjusting and balancing technicians in the proper use of these instruments.
- Select the proper instrument for the task to be performed.
- Properly care for and use the Temperature, Electrical, Rotating, Air Pressure, Air Velocity, Air Volume, Humidity and Hydronic Pressure Measuring Instruments whose use is covered in the ITI TAB curriculum.
10.5.11 Computer Skills

The ITI-certified TAB Technician will be proficient in the following computer skills:

- Direct Digital Controls – basic principles
- Analog In/Analog Out
- Digital In/Digital Out
- Proportional integral derivative loop sequence

10.5.12 Preliminary TAB Procedures

The ITI-certified TAB Technician will be able to perform preliminary TAB procedures including:

- Initial planning
- Preliminary procedures
  - Procurement of data
  - Study of systems and data
  - Report forms
- Air distribution system inspection
  - Fans
  - Air conditioning units
  - Terminal unit/devices
  - Duct systems
- Hydronic distribution system inspection
  - Pumps
  - Boilers
  - Coils and heat exchangers
  - Refrigeration equipment
  - Condenser and cooling towers
  - Piping systems
- Automatic control system

10.5.13 Air System TAB Procedures

The ITI-certified TAB Technician will be able to balance a system without on-the-job supervision. The ITI Certified TAB Technician will be able to use both of the methods listed in this section. Regardless of the procedure used, the least possible resistance must be imposed on the balanced system to meet the design objectives. The two methods are:

- Proportionate balancing
- Sequential balancing
Specific Air System Procedures

The ITI-certified TAB Technician will be able to balance the systems listed in this section, using the most appropriate procedures that will result in the least possible resistance imposed on the balanced system.

- Supply air systems
- Return, exhaust and relief air systems
- Dual duct and single duct (constant volume systems)
- Dual duct pressure dependent systems
- Variable air volume systems
  - Pressure dependent
  - Pressure independent
  - Induction
  - Fan powered terminals
- Induction systems

Hydronic System TAB Procedures

The ITI-certified TAB Technician will be able to balance the hydronic systems listed in this section, using the most appropriate procedures that will result in the last possible resistance imposed to meet the design objectives on the balanced system.

- Open system
- Closed system
- Two-pipe system
- Three-pipe system
- Primary-secondary system
- Primary-secondary-tertiary system

The ITI-certified TAB Technician will be able to balance hydronic systems using either of the two methods listed below:

- Differential pressure
- Temperature difference

Considerations for TAB

The ITI-certified TAB Technician will be able to perform the following functions in a professional manner:

- Problem solving
- Interaction with customer representatives and others on the work site.
- Safety
- Data gathering
- Report writing
Task scheduling

10.5.17 ................................................................. Reference Data

The ITI-certified TAB Technician will be able to locate and use all reference and submittal data required for performing TAB work.
11 Total Building Energy Audit Technician Certification

11.1 Purpose
This manual states the regulations by which the ITI will certify Total Building Energy Audit (EA) Technicians. This manual sets forth the qualifications for eligibility for certification and specifies the areas of knowledge, skills and ability required of an ITI Certified Total Building Energy Audit Technician.

11.2 Eligibility
To be eligible for the ITI Technician certification in total building energy audit, the applicant must meet the requirements of Section 2.1 of this manual.

11.3 Qualification
An ITI-certified Total Building Energy Audit Technician is one who has:
- Met the qualifications and completed the application requirements set forth in Sections 1 and 2 of this manual;
- Passed the written exam as set forth in Section 2.3 of this manual;
- Demonstrated energy audit standards of proficiency as set forth in this manual.

11.4 Renewal of Certification
The following documents are required to renew the Total Building Energy Audit Technician certification:
- Completed online renewal application. (See Section 2.2 of this manual);
- Documents showing that the technician has completed four (4) hours of continuing education units (CEUs) in the past two years;
- Signed copy of the Code of Conduct. (See also Section 2.6 of this manual).

Acceptable CEUs. One hour of training equals one CEU. CEUs will be accepted from the following:
- Any course endorsed by National SMACNA related to total building energy audit;
- Any course sponsored by a local SMACNA chapter and related to total building energy audit;
- Attendance of the annual ICB Conference or any course/seminar offered during the event;
- Any course put on by the National Energy Management Institute (NEMI) or the International Training Institute (ITI);
- Any course by the American Society of Heating, Refrigerating and Air-Conditioning Engineers on total building energy audit;
- Teaching a course in total building energy auditing for a local JATC at least two (2) hours per year;
- Presenting a seminar on a topic related to total building energy audits; a copy of the agenda and the presentation must be provided to receive credits;
- Papers published on the topic of total building energy audits. Four (4) CEUs will be credited per paper. A copy of the paper and the publication must be provided to receive credits;
- Any course or webinar related to total building energy audits;
- Other as determined by ICB.
11.5 Standards of Proficiency in Total Building Energy Audit

An ITI-certified Total Building Energy Audit Technician must be proficient in all of the categories of this Section, as demonstrated by passing the Written Test.

11.5.1 Reference


11.5.2 Purpose & Scope

An ITI-certified Total Building Energy Audit Technician shall be knowledgeable about the purpose and scope of measures and expressions of building energy performance.

- **Purpose.** Provide commonality in reporting the energy performance of existing buildings to facilitate comparison, design and operation improvements as well as a consistent method of measuring, expressing, and comparing the energy performance of buildings.

- **Scope**
  - Levels of Compliance
    - Basic Level: Only the total energy index of the building is determined
    - Intermediate Level: Additional energy performance indices and factors are determined
  - Data Summaries
    - Basic Building Characteristics
    - Energy Performance Summary

11.5.3 Definitions

An ITI-certified Total Building Energy Audit Technician shall be knowledgeable about the following definitions as they pertain to building characteristics and building energy performance measures

- Conditioned
- Degree-day (Kelvin-day)
- Depletable (non-renewable) energy
- Energy
- Energy Form
- Energy Performance
- Existing Building
- Energy Intensity
- Gross Floor Area
- Gross Conditioned Floor Area
- Heating Value
- New Building
- Net Energy
- Non-depletable Energy
- Normalization Factors/Parameters
- Proposed Building
11.5.1.4 Basic Measurements

An ITI-certified Total Building Energy Audit Technician shall be knowledgeable about the following measures as they pertain to building energy performance and must be able to obtain and record them.

- Data gathering to determine Total Annual Energy Costs
- Data gathering of Basic Building Characteristics
- Gross Floor Area
- Energy Consumption
- Source of Energy Data
  - Utility bill or meter
  - Installed Meter
  - Estimate
  - Other, i.e., photo voltaic, wind power, onsite renewable energy, coal, fuel oil
- Conversion Factors
  - The conversion factor to convert Electricity from kWh to kBTU is 3.412 kBTU/kWh
  - Need to be versed in the conversion factors of other fuels such as:
    - Natural Gas
    - Fuel Oil
    - Coal
    - Liquid Petroleum (LPG)
    - Heat Supplied
- Energy Costs
  - Energy Costs and Indices
  - Ability to Adjust Energy Use to a 365 Day Year
- Water Usage
  - Sources of Water Usage
  - HVAC
  - Domestic Potable Water
  - Landscape

11.5.1.5 Data Recording and Reporting

- Recording
  - An ITI Certified Total Building Energy Audit Technician shall be able to properly use instruments to determine the energy performance of building subsystems, i.e., HVAC.
- Reporting
  - An ITI Certified Total Building Energy Audit Technician shall be able to properly document and report results
  - An ITI Certified Total Building Energy Audit Technician shall be able to properly benchmark basic building energy performance
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