DISCLAIMER

The International Training Institute for the Sheet Metal and Air Conditioning Industry (ITI) has compiled this manual with care, but ITI has not investigated, and ITI expressly disclaims any duty to investigate any product, process, procedure, design or like that, that may be described in this manual. ITI does not warrant that the information contained in this manual is free of errors. The user assumes the entire risk of the use of this manual.

NO PART OF THIS MANUAL MAY BE REPRODUCED, STORED IN A RETRIEVAL SYSTEM, OR TRANSMITTED IN ANY FORM OR BY ANY MEANS, ELECTRONIC, MECHANICAL, PHOTOCOPYING, RECORDING, SCANNING OR OTHERWISE WITHOUT PERMISSION IN WRITING FROM THE INTERNATIONAL TRAINING INSTITUTE FOR THE SHEET METAL AND AIR CONDITIONING INDUSTRY OR FROM THE ORIGINAL HOLDER OF THE COPYRIGHT AS INDICATED IN THE TEXT.
CONTENTS

PART 1 – GENERAL PROCEDURES AND REQUIREMENTS

1 INTRODUCTION TO ITI CERTIFICATION ..............................................1
  1.1 Definitions, Abbreviations and Acronyms ..................................... 1
  1.1.1 Definitions .............................................................................. 1
  1.1.2 Abbreviations .......................................................................... 1
  1.2 Purpose and Overview .................................................................... 2
  1.3 Amendments and Interpretation .................................................. 2
  1.4 The Meaning of Certification ....................................................... 2
  1.5 Contact Information ....................................................................... 2
  1.6 The International Certification Board .......................................... 3

2 THE CERTIFICATION PROCESS AND REQUIREMENTS ..................4
  2.1 Eligibility .................................................................................... 4
  2.2 Application .................................................................................. 4
  2.3 Certification Test ........................................................................ 4
    2.3.1 Administering the Written Test ............................................ 4
    2.3.2 Scoring the Written Test .................................................... 5
    2.3.3 Time Limits on Testing and Re-Testing .................................. 6
    2.3.4 Administering the Performance Test .................................... 6
  2.4 Certification Approval .................................................................... 7
  2.5 Certification Documents ............................................................. 7
  2.6 Length of Certification ................................................................. 7
  2.7 Renewal of Certification ............................................................... 8
  2.8 ICB Code of Conduct .................................................................... 8
  2.9 Decertification ............................................................................. 9
  2.10 Claims ...................................................................................... 9
PART 2 – SPECIALITY PROCEDURES AND REQUIREMENTS

3 ENERGY AUDIT TECHNICIAN CERTIFICATION .................. 13
  3.1 Purpose ...................................................................... 13
  3.2 Eligibility ................................................................... 13
  3.3 Renewal of Certification .............................................. 13
    3.3.1 Acceptable CEUs ................................................ 13
  3.4 Qualification ............................................................... 14
  3.5 Standards of Proficiency in Energy Audit ..................... 14

4 FUME HOOD PERFORMANCE TESTING TECHNICIAN CERTIFICATION 17
  4.1 Purpose ...................................................................... 17
  4.2 Eligibility ................................................................... 17
  4.3 Renewal of Certification .............................................. 17
    4.3.1 Acceptable CEUs ................................................ 17
  4.4 Qualification ............................................................... 18
  4.5 Standards of Proficiency in Fume Hood Performance Testing ...... 18
    4.5.1 Purpose ............................................................... 18
    4.5.2 Scope .................................................................... 18
    4.5.3 Definitions ........................................................... 18
    4.5.4 Instrumentation and Equipment ............................... 19
    4.5.5 Test Conditions ..................................................... 20
    4.5.6 Flow Visualization and Velocity Procedure ............... 21
    4.5.7 Tracer Gas Test Procedure ..................................... 21

5 HVAC FIRE LIFE SAFETY LEVEL 1 TECHNICIAN CERTIFICATION .. 23
  5.1 Purpose ...................................................................... 23
  5.2 Eligibility ................................................................... 23
  5.3 Renewal of Certification .............................................. 23
    5.3.1 Acceptable CEUs ................................................ 23
  5.4 Qualification ............................................................... 24
  5.5 Standards of Proficiency in Fire Life Safety Level One .......... 24
    5.5.1 Design, Plans and Specifications ............................... 24
    5.5.2 Basic Construction ................................................ 24
    5.5.3 Code Requirements ................................................. 24
    5.5.4 Standards and UL Tests for Dampers .......................... 24
    5.5.5 Damper Installation Manuals and Guidelines .............. 25
    5.5.6 Features and Components of Fire Dampers ................ 25
    5.5.7 Features and Components of Smoke Dampers ............. 26
    5.5.8 Features and Components of Combination Fire/Smoke Dampers .............................................. 26
    5.5.9 Features and Components of Ceiling Radiation Dampers 26
    5.5.10 Installation Methods of Dampers ............................. 27
PART 1

General Procedures and Requirements
1 INTRODUCTION TO ITI CERTIFICATION

1.1 Definitions, Abbreviations and Acronyms

Certain terms, abbreviations and acronyms are defined in this section and are applicable to all sections of this manual.

1.1.1 Definitions

Certification ...... In the context of this manual it always refers to the ITI certification
Manual........... In the context of this document this refers to this document in its entirety.
Technician........ In the context of this manual it always refers to an ITI certified technician

1.1.2 Abbreviations

CEU.................. Continuing Education Unit
FLS.................. Fire Life Safety
FLS_L1.............. Fire Life Safety Level 1
IAQ ................. Indoor Air Quality
ICB.................. The International Certification Board
ITI .................. The International Training Institute for the Sheet Metal and Air Conditioning Industry
JATC................. Joint Apprenticeship Training Committee
NEMI ............... National Energy Management Institute
NEMIC ............. National Energy Management Institute Committee of the Sheet Metal Industry
SMACNA........... Sheet Metal and Air Conditioning Contractors' National Association
SMWIA............. Sheet Metal Workers' International Association
TAB .................. testing, adjusting and balancing
TABB ............... Testing, Adjusting and Balancing Bureau
1.2 Purpose and Overview

The International Training Institute for the Sheet Metal Industry ("ITI") is a non-profit organization sponsored by the Sheet Metal Workers' International Association (SMWIA) 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 specialty area. 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 specialty certification(s).
- Specialty certifications start with Part 2 of this Manual. The specialty sections provide additional information for specific certifications. These specialty competencies must be met in addition to the general 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](http://www.icbcertified.org).
## 2 THE CERTIFICATION PROCESS AND REQUIREMENTS

A Certified ITI Technician is one who has:

- Met the qualifications and completed the general application requirements as described in this Manual.
- Passed the Written Test and if applicable the Performance Test 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 specialty areas, such as Fire Life Safety, have additional eligibility requirements. Please review the pertinent section of this Manual for further information.

### 2.2 Application

A. Applicant completes the ITI Technician application online.

B. Upon submission ITI will verify the eligibility of the applicant to be certified.

C. 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 Test

The Certification Test consists of a Written Test and, if applicable, a Performance 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 Test

##### 2.3.1.1 Online Format

1. Upon receiving written notification by ITI 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 designated proctor requests a coupon code to administer the test.

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 test must be completed in one sitting in a designated room and within the specified time limit.

The applicant may use:

- Any reference books or notebooks deemed appropriate by ITI.

The test proctor will open the testing session and time the test to the specified time allowed.

- The test proctor will provide the examinee with their test code and start the testing session.
- At end of time allocated for test, the applicant is stopped and the exam is electronically submitted for grading. The system will provide immediate feedback to the examinee regarding his test 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 applicant submits the eligibility notice to the local JATC coordinator.
2. The local JATC coordinator will designate a proctor.
3. The proctor requests a test which the ITI mails to the designated proctor along with proctor guidelines. The tests and proctor information are in a sealed envelope.
4. The test proctor administers the test according to the instructions.
   - The seal on the test must be opened by applicant only.
   - The test must be completed in one sitting in a designated room and within the specified time limit.

The applicant may use:

- Any reference books or notebooks deemed appropriate by ITI.

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

a. The test proctor will record time started.
b. At end of time allocated for test
   1. The applicant is stopped.
   2. Time ended entered by the test proctor.
c. The test proctor mails all testing materials in a sealed return envelope back to the ITI.

2.3.2 Scoring the Written Test

2.3.2.1 Online Format

The website will automatically score the test and return an immediate result.
2.3.2.2 Written Format

The ITI scores the test and determines whether the score is passing.

- If the applicant passes the Written Test, the ITI will either
  a) issue certification documents as described in Section 2.5 of this Manual; or
  b) if the specialty area requires a Performance Test, the applicant is approved for the Performance Test and will be so notified.

- If the Applicant fails the Written Test, the ITI will notify the applicant. The applicant may retest in accordance with Section 2.3.3 of this Manual.

2.3.3 Time Limits on Testing and Re-Testing

The Written Test must be passed within one year from ITI approval of the application, or the applicant must re-apply.

An applicant who fails the Written Test 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 Performance Test must be passed within two years from notification of eligibility to be certified, or the applicant must re-apply. An applicant who fails the Performance Test 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 Performance Test

If required by the certification specialty the applicant is seeking, upon passing the Written Test, applicants will receive a letter from the ITI stating their eligibility to take the Performance Test. The ITI will notify the applicant when and where Performance Tests are available.

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

A. The Performance Test will be given at an ITI Certified Testing Facility.

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

- Test procedures
- Instrumentation
- Time schedule
- Introduction of proctor and judges
- Tour of test facility
- Answer questions the applicant may have

C. Test projects will be taken from the respective specialty area as described in the respective Section in Part 2 of this Manual.

D. Scoring
Two judges will observe and score each applicant at each task. The judges are to be ITI Certified Technicians or recognized technical experts in the respective specialty area. The proctor will be an ITI Regional Coordinator or a designee, who will be responsible for the administration of the Performance Test.

E. Test Security
The proctor shall be responsible for test security and for the envelope contents.

2.4 Certification Approval
The ITI will review each applicant's file after the Performance Test is completed.

- If the applicant passes the Performance Tests, the ITI will issue certification documents as described in Section 2.5 of this Manual.
- If the Applicant fails the Performance Tests, the ITI will notify the applicant. The applicant 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:
- Date of certification
- The name of the Technician
- The Technician’s individualized certification number
- Specialty area

An identification card with the following:
- Name of the Technician
- Expiration date
- Individualized certification number
- Specialty area

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 Length of Certification
Certification will be for two calendar years expiring on December 31 on the second year after the certification.
2.7 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 applicant must meet all qualifications and requirements as for initial certification.

The ICB may postpone the expiration date up to a year to synchronize expiration dates of two or more ICB certifications an applicant may hold. The following picture illustrates an example of such synchronization.

This example demonstrates how ICB synchronizes two or more certifications to be renewed on the same date. In this example, the original TAB certification was issued on December 1, 2009. The TAB certification is then renewed on December 31st, 2011. A second certification in HVAC Fire Life Safety Level 1 (FLS 1) was issued on September 1st, 2010. Its renewal date would be December 31st, 2012. To synchronize the two certifications, the HVAC FLS 1 renewal is pushed back for a year to be in line the TAB one on December 31st, 2013.

2.8 ICB Code of Conduct

The ICB has adopted a Code of Conduct which is stated on page 11. Every contractor, supervisor or 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.
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.
- Other cause as determined by the ITI.

2.10 Claims

An applicant ("claimant") who believes he or she has been improperly considered ineligible; has an objection to any ITI testing or certification decision; or ITI withdrawal of his or her certification may make a claim as follows:

1. Submittal of Written Claim by the Applicant or Technician. The claimant may initiate a claim by submitting a written claim to the ITI Administrator. The written claim must be mailed to the ITI Administrator at the address stated in Section 1.5 of this Manual. Do not submit a claim electronically. The written claim should be labeled “NOTICE OF CLAIM.”

2. Timing of Response. The ITI Administrator shall respond to the claimant within 90 days after receiving the claim. If the ITI Administrator determines that special circumstances require additional time for processing the claim, the ITI Administrator can extend the response period by an additional 90 days by so notifying the claimant in writing, prior to the end of the initial 90-day period. The notice of extension must set forth the special circumstances and the date by which the ITI Administrator expects to render his decision.

3. Notice of Decision. If the ITI Administrator denies a part or the entire claim, the ITI Administrator shall so notify the claimant in writing of such denial. The ITI Administrator shall write the notification in a manner calculated to be understood by the claimant. The notification shall set forth:

   a. The specific reasons for the denial;
   b. A reference to the specific provisions of this Manual on which the denial is based;
   c. A description of any additional information or material necessary for the claimant to perfect the claim and an explanation of why it is needed;
   d. An explanation of the review procedures and the time limits applicable to such procedures; and
   e. Other information that the ITI Administrator deems pertinent or to be required.
The International Certification Board Code of Conduct

Each person certified by ICB or an ICB bureau (all categories being “ICB professionals”) is expected to practice his or her profession consistent with the standards and procedures applicable to the certification, and the highest quality workmanship.

Certified Technicians and Supervisors:

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

Certified Contractors:

- A Certified Contractor will ensure that a Certified Supervisor oversees and coordinates projects involving work in the area of certification (e.g., TAB, Sound & Vibration, Commissioning, IAQ, HVAC Fire Life Safety etc.), and that those projects are performed in accordance with standards and procedures.
- Certified Contractors must employ Certified Technicians and Certified Supervisors to the extent required for certification, and should seek to employ enough Certified Technicians and Certified Supervisors to perform all work in the area of certification (e.g., TAB, Sound & Vibration, Commissioning, etc.).
- Certified Supervisors and Certified Contractors shall only certify projects where the work was performed by certified technicians employed by their own firm.

Protocol:

- Violations of this code of conduct shall be reported to ICB.
- This code of conduct remains subject to change by ICB.
PART 2

Specialty Procedures and Requirements
3 TOTAL BUILDING ENERGY AUDIT TECHNICIAN CERTIFICATION

3.1 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.

3.2 Eligibility
To be eligible for the ITI Technician certification in energy audit, the applicant must meet the requirements of Section 2.1 of this Manual.

3.3 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 ICB Code of Conduct. (See also Section 2.8 of this Manual).

3.3.1 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/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 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.
- Any course or webinar related to total building energy audits
- Other as determined by ICB
3.4 **Qualification**

A 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 Test as set forth in Section 2.3 of this Manual.
- Demonstrated energy audit standards of proficiency as set forth in this Manual.

3.5 **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.

3.5.1.1 **General**


3.5.1.2 **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

3.5.1.3 **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
3.5.1.4 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

3.5.1.5 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
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 Commissioning 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 and be an ICB Certified TAB Technician or Supervisor.

4.3 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 ICB Code of Conduct. (See also Section 2.8 of this Manual).

4.3.1 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/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 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.
- Any course or webinar related to fume hood performance testing
- Other as determined by ICB.
4.4 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.
- Holds a current ITI Certification in Testing, Adjusting and Balancing

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 Test.


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
Performance rating
Positional sash movement effect
Positional control level
ppm
Rate of response
Release Rate
Sash movement effect
Sash movement performance rating
Sash position
Specified rating
Thermal challenge
Titanium tetrachloride
Work procedures

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 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.
- 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 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 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 1 TECHNICIAN CERTIFICATION

5.1 Purpose
This Manual states the regulations by which the ITI will certify HVAC Fire Life Safety Level One (FLS_L1) 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 FLS_L1 Technician.

5.2 Eligibility
To be eligible for the ITI Technician certification in HVAC Fire Life Safety Level One, the applicant must meet the requirements of Section 2.1 of this Manual.

5.3 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 ICB Code of Conduct. (See also Section 2.8 of this Manual).

5.3.1 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.
- Any course or webinar related to HVAC fire life safety
- Other as determined by ICB.
5.4 Qualification

An ITI Certified FLS_L1 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 FLS_L1 standards of proficiency as set forth in this Manual.

5.5 Standards of Proficiency in Fire Life Safety Level One

An ITI Certified FLS_L1 Technician must be proficient in all of the categories of this Section, as demonstrated by passing the Written Test.

5.5.1 Design, Plans and Specifications

An ITI Certified FLS_L1 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 FLS_L1 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 FLS_L1 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 FLS_L1 Technician must be knowledgeable of UL procedures for product testing

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

A Certified FLS_L1 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

A Certified FLS_L1 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

5.5.6 Features and Components of Fire Dampers

A Certified FLS_L1 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

A Certified FLS_L1 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 FLS_L1 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 FLS_L1 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 FLS_L1 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 FLS_L1 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 FLS_L1 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 FLS_L1 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 FLS_L1 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 FLS_L1 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 2 TECHNICIAN CERTIFICATION

6.1 Purpose

This Manual states the regulations by which the ITI will certify HVAC Fire Life Safety Level Two (FLS_L2) 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 FLS_L2 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 ITI Certified HVAC FLS Level One Technician.

6.3 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 2.8 of this Manual).

6.3.1 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.
- Any course or webinar related to HVAC fire life safety
- Other as determined by ICB.
6.4 Qualification
An ITI Certified FLS_L2 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 FLS_L2 standards of proficiency as set forth in this Manual.
- ITI Certified HVAC FLS Level One Technician.

6.5 Standards of Proficiency in HVAC Fire Life Safety Level Two
An ITI Certified FLS_L2 Technician must be proficient in all of the categories of this Section as demonstrated by passing the Written Test.

6.5.1.1 Design, Plans and Specifications
An ITI Certified FLS_L2 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 FLS_L2 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 FLS_L2 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 FLS_L2 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 FLS_L2 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 FLS_L2 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 101 Life Safety Code
    ✓ NFPA 110 Standard for Emergency and Stand-by Power Systems
    ✓ NFPA 221 Standard for High Challenge Fire Walls, Fire Walls and Fire Barrier Walls.
6.5.1.6 **Features and Components of Fire Dampers**

An ITI Certified FLS_L2 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 FLS_L2 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 FLS_L2 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 FLS_L2 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 FLS_L1 Supervisor 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 FLS_L2 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 FLS_L1 Supervisor 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 FLS_L2 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 FLS_L2 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 FLS_L2 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 FLS_L2 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 FLS_L2 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
  • 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 FLS_L2 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 FLS_L2 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
  - 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 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 2.8 of this Manual).

7.3.1 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.
- Any course or webinar related to IAQ
- Other as determined by ICB
7.4 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.

7.5 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 Test.

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
  - Gases and odors

### 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 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
    ✓ I-Beam (EPA)
    ✓ Tools for Schools (EPA)

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 TESTING, ADJUSTING AND BALANCING TECHNICIAN CERTIFICATION

8.1 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.

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

8.3 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 ICB Code of Conduct. (See also Section 2.8 of this Manual).

8.3.1 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 or HVAC Fire Life Safety
- 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 or HVAC Fire Life Safety
- Attendance of the Annual ICB/TABB Conference or any course/seminar sponsored during the event
- Any course sponsored by an affiliate of TABB
- ASHRAE courses on IAQ, HVAC, TAB topics, HVAC Fire Life Safety or HVAC controls
- 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 or HVAC Fire Life Safety
- Writing an article that is published by TABB in the TABB Talk newsletter (this will count for one renewal cycle worth of CEU requirements)
- Papers published on the topic of TAB or HVAC Fire Life Safety (this will count for one renewal cycle worth of CEU requirements)
- Any webinar related to TAB or HVAC Fire Life Safety
- Other as determined by TABB
8.4 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 performance tests as set forth in Section 2.3 of this Manual.
- Demonstrated TAB standards of proficiency as set forth in this Manual.

8.5 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 Performance Tests.

8.5.1 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.

8.5.2 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
8.5.3 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

8.5.4 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

8.5.5 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

8.5.6 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

8.5.7 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.
8.5.8 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.

8.5.9 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

8.5.10 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.

8.5.11 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

8.5.12 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
8.5.13 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

8.5.14 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
8.5.15 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

8.5.16 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

8.5.17 Reference Data

The ITI Certified TAB Technician will be able to locate and use all reference and submittal data required for performing TAB work.