DOCKETED

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Project Title:	2019 Building Energy Efficiency Standards PreRulemaking
TN #:	220314
Document Title:	Proposed Changes to 2019 Non-Residential Mechanical ATTC
Description:	California Code of Regulations, Title 24, Part 1 10-103.2-Nonresidential Mechanical Acceptance Test Training and Certification, Proposed changes to 2019 Building Energy Efficiency Standards
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Organization:	National Energy Management Institute Committee
Submitter Role:	Applicant
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NATIONAL ENERGY MANAGEMENT INSTITUTE COMMITTEE

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July 21, 2017

Attn: Dockets Unit (MS-14)
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Re: *California Code of Regulations, Title 24, Part 1 10-103.2 – Nonresidential Mechanical Acceptance Test Training and Certification, Proposed changes to the 2019 Building Energy Efficiency Standards*

Dear Dockets Unit:

The National Energy Management Institute Committee (NEMIC) in its role as a the California Energy Commission-approved Acceptance Test Technician Certification Provider submits the attached proposed changes to the 2019 Building Energy Efficiency Standards ("Standards") (see Attachment 1).

The proposed changes address Section10-103.2(c)3F removing the requirement for paper and onsite audits.

F. Quality Assurance and Accountability. The ATTCPs shall describe in their applications to the Energy Commission how their certification business practices include quality assurance and accountability measures, including but not limited to independent oversight of the certification processes and procedures, ~~visits to building sites where certified technicians are completing acceptance tests,~~ certification process evaluations, building department surveys to determine acceptance testing effectiveness, and expert review of the training curricula developed for Building Energy Efficiency Standards, Section 120.5. ~~The ATTCP shall review a random sample of no less than 1 percent of each Technician's completed compliance forms, and shall perform randomly selected on-site audits of no less than 1 percent of each Technician's completed acceptance tests. Independent oversight may be demonstrated by accreditation under the ISO/IEC 17024 standard~~.

NEMIC proposes to replace the requirement for paper and onsite audits by mandating a renewal of the ATT certification every three years; the said renewal mandating a hands-on assessment in a laboratory that meets the requirements of Section 10-103.2(c)3B(ii). See proposed new sections 10-103.2(c)3H and 10-103.2(c)3I in Attachment 1.

H. Duration of Certification. The Acceptance Test Technician certification shall be valid for three full years from the last day of the calendar 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, 2018.

I. Certification Renewal. The ATTCP shall send a renewal notice to Acceptance Test Technicians no later than 90 days before their certificates expire. At time of renewal the person holding the original

certificate must meet all qualifications and requirements mandatory for initial ATTCP certification. The ATTCP shall only renew an Acceptance Test Technician's certification after the candidate has passed one random selected acceptance test in a hands-on laboratory set-up. The laboratory shall meet the requirements of Section 10-103.2(c)3B(ii). The hands-on assessment must be completed no later than the last day of the calendar quarter in which the Acceptance Test Technician's certification expires. Should a candidate fail the initial hands-on assessment, the candidate must retest within 30 days. The ATTCP shall decertify a candidate who fails the second hands-on assessment. The candidate may start a new application for certification as an Mechanical Acceptance Test Technician after a waiting period of 30 days.

The rationale for the proposed changes is that, as currently stated, the audits are ambiguous, inconsequential, financially extremely burdensome to the facilities owners and operators, and in case of onsite audits, legally not enforceable.

1) The audits as currently stated are ambiguous.

a) The scope and purpose of the review of certificates of acceptance forms is undefined. Does the review focus solely on the completeness of the compliance form, i.e., are all required fields completed? Or does it consider if the provided values are correct? What other documents, if any, constitute the basis for the review, e.g., mechanical plans, mechanical specifications, or mechanical compliance forms (NRCC)?

b) The scope and purpose of the onsite audits is undefined. Is the auditor only to check that the correct form (NRCA) was completed or should the auditor verify the correctness of the functional test results as well? Assuming that the auditor is required to assess the correctness of the functional tests, what consequences are to derived if he or she arrives at different values than the Acceptance Test Technician? Building operating conditions change continuously, thus both the Acceptance Test Technician and the auditor readings could be correct.

c) The Standards state that "the ATTCP shall review a random sample of no less than 1 percent" of completed compliance forms and completed acceptance tests shall be audited. Assuming that the ATTCP elects to audit 1 percent of completed compliance forms and completed acceptance tests, the Acceptance Test Technician must have completed 100 acceptance tests before an audit can be performed. How many days, weeks or months can pass between the completion of the acceptance tests and the onsite audit? Let's assume that the actual acceptance test was performed during the cooling season but the onsite audit is conducted during the heating season, what validity exists between the two events? What if the building operator elects to operate the building differently than originally constructed? Is the audit still valid?

2) The audits as currently stated are inconsequential

a) The current Standards do not specify the criteria if an audit is passed or failed. Thus, if an Acceptance Test Technician has properly or improperly completed a certificate of acceptance (NRCA) or properly or improperly conducted the actual acceptance test itself, the outcome of the audit is the same: there are no pass/fail criteria. The outcome of either audit bears no consequences on the Acceptance Test Technician who performed the acceptance test.
In their current form the audits result in a "nice to know information" at extreme high costs to the building owners and operators (see point 3.a).

3) **The audits as currently stated are financially extremely burdensome to the facilities owners and operators and ultimately the leaseholder, renter and the public.**
   a) Attachment 2 presents a conservative estimate of the costs associated with conducting onsite audits of 300 Mechanical Acceptance Test Technicians performing 300,000 acceptance tests annually. The cost of the audits are estimated at $6,500,000 annually or approximately $2,200, or as much as an average of five acceptance tests performed by an Mechanical Acceptance Test Technician (see Attachment 2).
   b) The cost of conducting 3,000 compliance form audits must to be added to the above number. Assuming that the auditor can review one compliance form per hour, audit of compliance forms will require at a minimum two fulltime positions.
   c) A conservative estimate of the total annual cost of the audit program as currently stated in the Standards is $7,200,000. This estimate is based on a very conservative of the total number of acceptance tests performed annually. The actual number is most likely two or three time higher.
   d) Which party to the acceptance test process will carry these costs?
   e) As Attachment 3 demonstrates, mechanical acceptance tests are more comprehensive requiring more time and more instrumentation than lighting controls acceptance tests. Even a single packaged rooftop air-conditioner (with economizer), which is the most installed type of commercial air-conditioning equipment, requires four acceptance tests lasting between 4 to 8 hours.

4) **The onsite audits as currently stated are legally not enforceable.**
   a) The Standards states that "the ATTCP shall … perform randomly selected on-site audits of no less than 1 percent of each Technician's completed acceptance tests". As previously noted, there will be a time lag between when the acceptance test has been completed and the onsite audit. Not being a legal party to the construction process, any access to a building site would require the voluntary concurrence by the building owner. If the audit is to include a review of the functional test, the building would have to be shut down as well, thus, even more likely that access by the building owner or operator will be denied.
   b) If the onsite audit were to concur at the same time as the Acceptance Test Technician is conducting the acceptance test, the general contractor, the architect and/or engineer of record can refuse access to the construction site. As the auditor does not have the legal standing of a building code official, the audit is not enforceable. This option, however, does not meet the current Standard mandate of "perform randomly selected on-site audits of … completed acceptance tests." Conducting the audit in such a fashion would be predetermined and not random as the auditor will have to cooperate with the Acceptance Test Technician to be at the work site at the same time.

The proposed language resolves all of the above issues:

   a) It removes ambiguity as the Acceptance Test Technician must demonstrate his skill set in a controlled environment.
   b) All technicians required to renew certification on triennial cycle.
   c) It establishes consequences, i.e., if a hands-on assessment is failed it has to be repeated and if it is failed again, the Acceptance Test Technician loses his certification.
   d) The costs are held to a minimum, as the assessments are conducted in laboratories that have already been approved by the California Energy Commission.

e) The proposed approach removes all legal obstacle that a visit to a building presents. Furthermore, if California Energy Commission staff may want to witness the hands-on assessment, they can do so without any restrictions.

There is already a stringent quality assurance ("QA") program by the NEMIC ATTCP in place. Candidates wishing to become NEMIC-certified as Mechanical Acceptance Test Technician must hold a current certification by the Testing, Adjusting and Balancing Bureau (TABB), a division of NEMIC. This is an ANSI-accredited certification under the ISO/ANSI Standard 17024. TABB-certified testing, adjusting and balancing technicians have demonstrated their skill sets in all the technologies as mandated by Standards Section 10-103.2(c)3B(i), which encompass all the mechanical acceptance tests (see Attachment 3). The TABB certification includes a QA program, which covers all the work that the TABB-certified technicians perform *including all mechanical acceptance tests*! The QA program assures the building owner/general contractor that, if found, that a TABB-certified technician did not perform his/her work to TABB standards, TABB will have the employer of the TABB-certified technician, here an Acceptance Test Employer, redo the work free of charge.

Sincerely,

David L. Bernett

David Bernett
NEMIC ATTCP Administrator

Attachments

Attachment 1: Proposed Language to 2019 Standards, Section 10-103.2 – Nonresidential Mechanical Acceptance Test Training And Certification

10-103.2 – NONRESIDENTIAL MECHANICAL ACCEPTANCE TEST TRAINING AND CERTIFICATION

(a) **Scope.** The requirements of this section apply to nonresidential mechanical Acceptance Test Technicians and Employers and the Certification Providers that train and certify them.

(b) **Industry Certification Threshold.** Mechanical Acceptance Test Technician and Employer certification requirements shall take effect when the Energy Commission finds that each of the following conditions are met. Until such time that Sections 10-103.2(b)1 and 10-103.2(b)2 are met, Field Technicians are allowed to complete the acceptance test requirements in Section 120.5 without completing the Acceptance Test Technician certification requirements.

1. **Number of Certified Acceptance Test Technicians.**

   A. There shall be no less than 300 Mechanical Acceptance Test Technicians certified to perform all of the acceptance tests in Building Energy Efficiency Standards, Section 120.5, except as provided in Subsection 10-103.2(b)1.B, below. The number of certified Mechanical Acceptance Test Technicians shall be demonstrated by Certification Provider-provided reports submitted to the Energy Commission.

   B. If there are less than 300 Mechanical Acceptance Test Technicians certified to perform all of the acceptance tests in Building Energy Efficiency Standards, Section 120.5, then there shall be at least 300 Mechanical Acceptance Test Technicians certified to complete the following tests:

      (i) NA7.5.1 Outdoor Air Ventilation Systems
      (ii) NA7.5.2 Constant Volume, Single Zone Unitary Air Conditioners and Heat Pumps
      (iii) NA7.5.4 Air Economizer Controls
      (iv) NA7.5.5 Demand Control Ventilation Systems
      (v) NA 7.5.6 Supply Fan Variable Flow Controls
      (vi) NA7.5.7, NA7.5.9 Hydronic System Variable Flow Controls
      (vii) NA7.5.10 Automatic Demand Shed Controls

      The number of certified Mechanical Acceptance Test Technicians shall be demonstrated by Certification Provider-provided reports submitted to the Energy Commission.

2. **Industry Coverage by Certification Provider(s).** The Mechanical Acceptance Test Technician Certification Provider(s) approved by the Energy Commission, in their entirety, provide reasonable access to certification for technicians representing the majority of the following industry groups: Professional engineers, licensed architects, HVAC installers, mechanical contractors, Testing and Balancing (TAB) certified technicians, controls installation and startup contractors and certified commissioning professionals who have verifiable training, experience and expertise in HVAC systems. The Energy Commission will determine reasonable access by considering factors such as certification costs commensurate with the complexity of the training being provided, certification marketing materials, prequalification criteria, class availability and curriculum.

(c) **Qualifications and Approval of Certification Providers.** The Acceptance Test Technician Certification Providers (ATTCPs) shall submit a written application to the Energy Commission with a summary and the necessary background documents to explain how the following criteria and procedures have been met:

1. **Requirements for Applicant ATTCPs to Document Organizational Structure.** ATTCPs shall provide written explanations of the organization type, by-laws, and ownership structure. ATTCPs shall explain in writing how their certification program meets the qualifications of Building Energy Efficiency Standards, Section 10-103.2(c). ATTCPs shall explain in their application to the Energy Commission their organizational structure and their procedures for independent oversight, quality assurance, supervision and support of the acceptance test training and certification processes.

2. **Requirement for Certification of Employers.** The ATTCPs shall provide written explanations of their certification and oversight of Acceptance Test Employers. This explanation shall document how the

ATTCP ensures that the Employers are providing quality control and appropriate supervision and support for their Acceptance Test Technicians.

3. **Requirements for Applicant ATTCPs to Document Training and Certification Procedures.** ATTCPs shall include with their application a complete copy of all training and testing procedures, manuals, handbooks and materials. ATTCPs shall explain in writing how their training and certification procedures include, but are not limited to, the following:

   A. **Training Scope.** The scope of the training shall include both hands-on experience and theoretical training to certify competency in the technologies and skills necessary to perform the acceptance tests.

   B. **Mechanical Acceptance Test Technician Training.**

      (i) **Curricula**. Acceptance Test Technician Certification Provider training curricula for Mechanical Acceptance Test Technicians shall include, but not be limited to, the analysis, theory, and practical application of the following:

         a) Constant volume system controls;

         b) Variable volume system controls;

         c) Air-side economizers;

         d) Air distribution system leakage;

         e) Demand controlled ventilation with CO_2 sensors;

         f) Demand controlled ventilation with occupancy sensors;

         g) Automatic demand shed controls;

         h) Hydronic valve leakage;

         i) Hydronic system variable flow controls;

         j) Supply air temperature reset controls;

         k) Condenser water temperature reset controls;

         l) Outdoor air ventilation systems;

         m) Supply fan variable flow controls;

         n) Boiler and chiller isolation controls;

         o) Fault detection and diagnostics for packaged direct-expansion units;

         p) Automatic fault detection and diagnostics for air handling units and zone terminal units;

         q) Distributed energy storage direct-expansion air conditioning systems;

         r) Thermal energy storage systems;

         s) Building Energy Efficiency Standards mechanical acceptance testing procedures; and

         t) Building Energy Efficiency Standards acceptance testing compliance documentation for mechanical systems.

      (ii) **Hands-on training.** The ATTCP shall describe in their application the design and technical specifications of the laboratory boards, equipment and other elements that will be used to meet the hands-on requirements of the training and certification.

      (iii) **Prequalification.** Participation in the technician certification program shall be limited to persons who have at least three years of professional experience and expertise in mechanical controls and systems as determined by the Mechanical ATTCPs.

(iv) **Instructor to Trainee Ratio.** The ATTCP shall document in its application to the Energy Commission why its instructor to trainee ratio is sufficient to ensure the integrity and efficacy of the curriculum and program based on industry standards and other relevant information.

(v) **Tests.** The ATTCP shall describe the written and practical tests used to demonstrate each certification applicant's competence in all specified subjects. The ATTCPs shall retain all results of these tests for five years from the date of the test.

(vi) **Recertification.** The ATTCP shall recertify all Acceptance Test Technicians and Acceptance Test Employers prior to the implementation of each adopted update to the Building Energy Efficiency Standards as these updates affect the acceptance test requirements.. Recertification requirements and procedures shall only apply to those specific elements that are new or modified in future updates to Building Energy Efficiency Standards.

C. Mechanical Acceptance Test Employer Training. Training for Mechanical Acceptance Test Employers shall consist of a single class or webinar consisting of at least four hours of instruction that covers the scope and process of the acceptance tests in Building Energy Efficiency Standards, Section 120.5.

D. Complaint Procedures. Procedures described in writing for notifying building departments and the public that the Acceptance Test Certification Provider will accept complaints regarding the performance of any certified acceptance test technician or employer, and procedures for how the Provider will address these complaints.

E. Certification Revocation Procedures. Procedures described in writing for revoking their certification of Acceptance Test Technicians and Employers based upon poor quality or ineffective work, failure to perform acceptance tests, falsification of documents, failure to comply with the documentation requirements of these regulations or other specified actions that justify decertification.

F. Quality Assurance and Accountability. The ATTCPs shall describe in their applications to the Energy Commission how their certification business practices include quality assurance and accountability measures, including but not limited to independent oversight of the certification processes and procedures, ~~visits to building sites where certified technicians are completing acceptance tests~~, certification process evaluations, building department surveys to determine acceptance testing effectiveness, and expert review of the training curricula developed for Building Energy Efficiency Standards, Section 120.5. ~~The ATTCP shall review a random sample of no less than 1 percent of each Technician's completed compliance forms, and shall perform randomly selected on-site audits of no less than 1 percent of each Technician's completed acceptance tests. Independent oversight may be demonstrated by accreditation under the ISO/IEC 17024 standard.~~

G. Certification Identification Number and Verification of ATT Certification Status. Upon certification of an ATT, the ATTCP shall issue a unique certification identification number to the ATT. The ATTCP shall maintain an accurate record of the certification status for all ATTs that the ATTCP has certified. The ATTCP shall provide verification of current ATT certification status upon request to authorized document Registration Provider personnel or enforcement agency personnel to determine the ATT's eligibility to sign Certificate of Acceptance documentation according to all applicable requirements in Sections 10-103.2, 10-102, 10-103(a)4, and Reference Joint Appendix JA7.

H. Duration of Certification. The Acceptance Test Technician certification shall be valid for three full years from the last day of the calendar 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, 2018.

I. Certification Renewal. The ATTCP shall send a renewal notice to Acceptance Test Technicians no later than 90 days before their certificates expire. At time of renewal the person holding the original certificate must meet all qualifications and requirements mandatory for initial ATTCP certification. The ATTCP shall only renew an Acceptance Test Technician's certification after the candidate has passed one random selected acceptance test in a hands-on laboratory set-up. The laboratory shall meet the requirements of Section 10-103.2(c)3B(ii). The hands-on assessment must be completed no later than the last day of the calendar quarter in which the Acceptance Test Technician's certification expires. Should a candidate fail the initial hands-on assessment, the candidate must retest within 30 days. The ATTCP shall decertify a candidate who fails the second hands-on assessment. The candidate may start a new application for certification as an Mechanical Acceptance Test Technician after a waiting period of 30 days.

(d) **Requirements for ATTCPs to Provide Regular Reports.** The ATTCP shall provide the following regular reports to the Energy Commission:

1. Annual Report: The ATTCP shall provide an annual report to the Energy Commission summarizing the certification services provided over the reporting period, including the total number of Acceptance Test Technicians and Employers certified by the agency (i) during the reporting period and (ii) to date. The annual report shall include a summary of all actions taken against any Acceptance Test Technician or Employer as a result of the complaint or quality assurance procedures described by the ATTCP as required under Section 10-103.2(c)(3)(D) and 10-103.2(c)(3)(F).

2. Update Report: The ATTCP shall have no less than six months following the adoption of an update to the Building Energy Efficiency Standards to prepare an Update Report. The ATTCP shall submit an Update Report to the Energy Commission no less than six months prior to the effective date of any newly adopted update to the Building Energy Efficiency Standards, The ATTCP shall report to the Energy Commission what adjustments have been made to the training curricula, if any, to address changes to the Building Energy Efficiency Standards Acceptance Testing requirements, adopted updates to the Building Energy Efficiency Standards or to ensure training is reflective of the variety of mechanical equipment and systems currently encountered in the field. All required update reports shall contain a signed certification that the ATTCP has met all requirements under Section 10-103.2(c). Update reports shall be approved through the Amendment Process provided under Section 10-103.2(f).

   All required reports shall contain a signed certification that the ATTCP has met all requirements for this program.

(e) **Application Review and Determination.** The Energy Commission shall review Acceptance Test Technician Certification Provider applications according to the criteria and procedures in Section 10-103.2(c) to determine if such providers meet the specified requirements for providing acceptance testing certification services.

1. Energy Commission staff will review and validate all information received on Acceptance Test Technician Certification Provider applications, and determine whether the application is complete and contains sufficient information to be evaluated by staff. Complete applications shall be evaluated by staff based on their contents.
2. The Executive Director may require that the applicant provide additional information as required by staff to fully evaluate the Provider application.
3. The Executive Director shall provide a copy of the staff evaluation to interested persons and provide an opportunity for public comment.
4. The Executive Director shall issue a written recommendation that the Energy Commission designate the applicant as an authorized Mechanical Acceptance Tester Certification Provider or deny the Provider application.
5. The Energy Commission shall make a final decision on the application at a publicly noticed hearing.

(e) **Amendment Process.**

The ATTCP may amend a submitted or approved application as described in this Section.

1. **Amendment Scope.**

   A. **Nonsubstantive Changes.** A nonsubstantive change is a change that does not substantively alter the requirements of the application materials for the ATTCP, ATT, or ATT Employer. For amendments making only nonsubstantive changes, the ATTCP shall submit a letter describing the change to the Energy Commission as an addendum to the application.

   B. **Substantive Changes.** A substantive change is a change that substantively alters the requirements of the application materials for the ATTCP, ATT, or ATT Employer. For amendments making any substantive changes, the ATTCP shall submit the following:

      (i) A document describing the scope of the change to the application, the reason for the change and the potential impact to the ATTCP, ATT, and ATT Employer as an addendum to the application;

      (ii) A replacement copy of the affected sections of the ATTCP application with the changes incorporated; and

      (iii) A copy of the affected sections of the ATTCP application showing the changes in underline and strikeout format.

2. **Amendment Review.** Amendments submitted prior to approval of an ATTCP application shall be included in the application's Application Review and Determination process specified in Section 10-103.2(e). Amendments submitted after approval of an ATTCP's application that contain only nonsubstantive changes shall be reviewed by the Executive Director for consistency with Section 10-103.2. Amendments determined to be consistent with this Section shall be incorporated into the approval as errata.

   Amendments submitted after approval of an ATTCP's application that contain any substantive changes shall be subject to the Application Review and Determination process specified in Section 10-103.2(e). If the Energy Commission finds that the amended application does not meet the requirements of Section 10-103.2, then the ATTCP shall either abide by the terms of their previously approved application or have their approval suspended.

(g) **Review by the Energy Commission.**

If the Energy Commission determines there is a violation of these regulations or that an Acceptance Test Technician Certification Provider is no longer providing adequate certification services, the Energy Commission may revoke the authorization of the Acceptance Test Technician Certification Provider pursuant to Section 1230 et. seq. of Title 20 of the California Code of Regulations.

NOTE: Authority: Sections 25402, 25402.1, 25213, Public Resources Code. Reference: Sections 25007, 25402(a)-(b), 25402.1, 25402.4, 25402.5, 25402.8 and 25910, Public Resources Code.

Attachment 2: Estimate of Annual Costs of Onsite Audits

ASSUMPTIONS				
a)	Number of Mechanical Acceptance Test Technicians =		300	
b)	Number of annual acceptance tests =		300,000	
c)	Annual number of onsite audits (at 1% level) =		3,000	
d)	Annual working hours =		1,600	hours
e)	Number of review an auditor can perform per day =		1	(due to logistics)
	= # hours per audit =		8	hours
f)	Average fully burdened hourly auditor rate =	$	200	(based on current CA wage sheets)
g)	Average fully burdened hourly support staff rate =	$	100	
h)	General overhead rate		30	percent

CALCULATIONS				
[1]	**Minimum number of fulltime auditors:**			
	(# annual onsite audits) / (# annual working hours / (# hours per audit) =			
	= (3,000) / (1600) / (8) =		15	auditors
[2]	**Total annual costs of auditors & staff:**			
	(# auditors) * (annual working hours) * (hourly rate) =			
	= (15) * (1600) * ($200) =	$	4,800,000	
	+ Annual office support staff cost =	$	160,000	
	Total annual costs of auditors & staff =	$	4,960,000	
	30% general overhead =	$	1,488,000	
	Total annual cost of onsite audits =	$	**6,448,000**	

Attachment 3: Comparison of Mechanical vs Lighting Control Systems Acceptance Requirements for The 2016 Building Energy Efficiency Standards

Comparison of Mechanical vs Lighting Control Systems Acceptance Requirements for The 2016 Building Energy Efficiency Standards

Mechanical System Acceptance Requirements				Lighting Control System Acceptance Requirements		
Acceptance Test	Instrumentation	Time to Complete hours / test		Acceptance Test	Instrumentation	Time to Complete hours / test
NA7.5.1 Outdoor Air	• Airflow measurement probe • Watch	1.5 – 5		NA7.6.1 Automatic Daylighting Control	Light meter	1.5 - 4
NA7.5.2 Constant Volume, Single-Zone, Unitary Air Conditioner and Heat Pumps Systems	• Temperature probe • Amp meter	1.5 - 3		NA7.6.2 Shut-off Controls	None	0.75 – 1.5
NA7.5.3 Air Distribution Systems	• Fan flowmeter • Digital manometer	3.5 - 8		NA7.6.2.4 and NA7.6.2.5 Automatic Time Switch Lighting Controls Acceptance	None	2.5 – 8
NA7.5.4 Air Economizer Controls	• Temperature probe • Device capable of calculating enthalpy • 1.2 kOhm resistor • 620 Ohm resistor	1 – 3 per unit		NA 7.6.3 Demand Responsive Controls	Illuminance meter	0.75 – 1.5
NA7.5.5 Demand Control Ventilation (DCV) Systems	• Hand-held reference CO_2 probe calibrated to ±10 ppm • Manufacturer's calibration kit • Calibrated CO_2/air mixtures	1.5 – 3		NA7.8 Outdoor Lighting Shut-off Controls	None	1 – 4
NA7.5.6 Supply Fan Variable Flow Controls	• Differential pressure gauge • Pitot tube • Drill	1.5 – 3.5				
NA7.5.7 Valve Leakage Acceptance	• Hydronic manometer	1 - 5				
NA7.5.8 Supply Water Temperature Reset Controls	• Air & water temperature probes	1.5 – 3				

Mechanical System Acceptance Requirements [continued]		
Acceptance Test	• Instrumentation	Time to Complete hours / test
NA7.5.9 Hydronic System Variable Flow Control	• Hydronic manometer	2.5 – 5
NA7.5.10 Automatic Demand Shed Control	• The front end computer to the DDC system	1 – 1.5
NA7.5.11 Fault Detection and Diagnostics (FDD) for Packaged Direct-Expansion (DX) Units	• Calibrated refrigerant gauge	1.5 – 2.5
NA7.5.12 Automatic Fault Detection Diagnostics (FDD) for Air Handling Units and Zone Terminal Units	None	1 – 2 per unit
NA7.5.13 Distributed Energy Storage DX AC	None	2.5
NA7.5.14 Thermal Energy Storage (TES) System	None	2.5
NA7.5.15 Supply Air Temperature Reset Controls	• Temperature probe	1 – 2
NA7.5.16 Condenser Water Supply Temperature Reset Controls	• Temperature • Psychrometer	3 – 8
Energy Management Control System Acceptance	None	1 – 2