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California Energy Commission  
**STAFF REPORT**

**Mechanical Acceptance  
Test Technician  
Certification Provider  
Application Review:  
Refrigeration Service  
Engineers Society**

**California Energy Commission**

Edmund G. Brown Jr., Governor



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# California Energy Commission

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# ABSTRACT

This report presents the California Energy Commission’s staff evaluation of the Refrigeration Service Engineers Society’s application to become a nonresidential mechanical Acceptance Test Technician Certification Provider, pursuant to Section 10-103.2(e)1 of the *2016 Building Energy Efficiency Standards* (codified in Title 24, Part 1, Chapter 10, and Part 6 of the California Code of Regulations). The application, which was submitted on December 12, 2016, complies with the requirements of Section 10-103.2(c) of the *2016 Building Energy Efficiency Standards*, and will be recommended for approval with one condition by the full Commission at its next business meeting on May 10, 2017.

The condition is that the Refrigeration Service Engineers Society, which does not directly control any laboratory facilities capable of conducting the required hands-on training but has a memorandum of understanding with a technical school, shall notify the Energy Commission of any loss of access to the facilities within 10 business days and provide Commission-approved replacement facility(ies) within a reasonable amount of time.

**Keywords:** nonresidential mechanical Acceptance Test Technician Certification Provider, Refrigeration Service Engineers Society, HVAC, Title 24

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# TABLE OF CONTENTS

Abstract.....	i
Table of Contents.....	ii
List of Tables.....	iv
Executive Summary.....	5
CHAPTER 1: Introduction.....	6
CHAPTER 2: Qualifications and Approval of Certification Providers.....	7
Requirement in Section 10-103.2(c).....	7
Summary of Compliance Method for Applicant .....	7
Staff Assessment .....	7
CHAPTER 3: Applicant ATTCPs to Document Organizational Structure.....	8
Requirements in Section 10-103.2(c)1.....	8
Summary of Compliance Method for Applicant.....	8
Staff Assessment .....	9
CHAPTER 4: Certification of Employers.....	11
Requirement in Section 10-103.2(c)2.....	11
Summary of Compliance Method for Applicant .....	11
Staff Assessment .....	11
CHAPTER 5: Hands-On Experience and Training.....	13
Requirements in Section 10-103.2(c)3A.....	13
Summary of Compliance Method for Applicant .....	13
Staff Assessment .....	14
CHAPTER 6: Mechanical Acceptance Test Technician Training Curricula .....	15
Requirements in Sections 10-103.2(c)3B(i).....	15
Summary of Compliance Method for Applicant .....	16
Staff Assessment .....	16
CHAPTER 7: Hands-On Training.....	18
Requirement in Section 10-103.2(c)3B(ii) .....	18
Summary of Compliance Method for Applicant .....	18
Staff Assessment .....	19
CHAPTER 8: Prequalification.....	20
Requirement in Section 10-103.2(c)3B(iii).....	20
Summary of Compliance Method for Applicant .....	20
Staff Assessment .....	21

CHAPTER 9: Instructor-to-Trainee Ratio.....	22
Requirement in Section 10-103.2(c)3B(iv) .....	22
Summary of Compliance Method for Applicant .....	22
Staff Assessment .....	22
CHAPTER 10: Testing.....	23
Requirement in Section 10-103.2(c)3B(v) .....	23
Summary of Compliance Method for Applicant .....	23
Staff Assessment .....	23
CHAPTER 11: Recertification.....	25
Requirement in Section 10-103.2(c)3B(vi) .....	25
Summary of Compliance Method for Applicant .....	25
Staff Assessment .....	25
CHAPTER 12: Mechanical Acceptance Test Employer Training.....	27
Requirement in Section 10-103.2(c)3C.....	27
Summary of Compliance Method for Applicant .....	27
Staff Assessment .....	27
CHAPTER 13: Complaint Procedures.....	28
Requirement in Section 10-103.2(c)3D .....	<b>Error! Bookmark not defined.</b>
Summary of Compliance Method for Applicant .....	<b>Error! Bookmark not defined.</b>
Staff Assessment .....	<b>Error! Bookmark not defined.</b>
CHAPTER 14: Certification Revocation Procedures.....	30
Requirement in Section 10-103.2(c)3E.....	30
Summary of Compliance Method for Applicant .....	30
Staff Assessment .....	30
CHAPTER 15: Quality Assurance, Independent Oversight, and Accountability.....	32
Requirement in Section 10-103.2(c)3F.....	32
Summary of Compliance Method for Applicant .....	32
Desk Audits .....	32
On-Site Audits .....	33
Auditors.....	33
Staff Assessment .....	33
CHAPTER 16: Certification Identification Number and Verification of ATT Certification Status .....	35
Requirement in Section 10-103.2(c)3G.....	35
Summary of Compliance Method for Applicant .....	35
Staff Assessment .....	35

CHAPTER 17: Staff Recommendations.....	37
APPENDIX A: Proposed Condition of Approval.....	38
APPENDIX B: Glossary .....	40

## LIST OF TABLES

	Page
Table 1: Summary of Application Compliance for Section 10-103.2(c)1 .....	9
Table 2: Summary of Application Compliance for Section 10-103.2(c)2 .....	12
Table 3: Summary of Application Compliance for Section 10-103.2(c)3A .....	14
Table 4: Summary of Application Compliance for Section 10-103.2(c)3B(i) .....	16
Table 5: Summary of Application Compliance for Section 10-103.2(c)3B(ii) .....	19
Table 6: Summary of Application Compliance for Section 10-103.2(c)3B(iii) .....	21
Table 7: Summary of Application Compliance for Section 10-103.2(c)3B(iv) .....	22
Table 8: Summary of Application Compliance for Section 10-103.2(c)3B(v) .....	24
Table 9: Summary of Application Compliance for Section 10-103.2(c)3B(vi) .....	26
Table 10: Summary of Application Compliance for Section 10-103.2(c)3C.....	27
Table 11: Summary of Application Compliance for Section 10-103.2(c)3D.....	28
Table 12: Summary of Application Compliance for Section 10-103.2(c)3E.....	31
Table 13: Summary of Application Compliance for Section 10-103.2(c)3F.....	34
Table 14: Summary of Application Compliance for Section 10-103.2(c)3G.....	35

## EXECUTIVE SUMMARY

Acceptance testing for mechanical and lighting control systems in nonresidential buildings has been required by the California Energy Commission since the *2005 California Building Energy Efficiency Standards* (Standards) were adopted. Acceptance testing ensures that installed equipment, controls, and systems in nonresidential buildings operate as required by the Standards. The Acceptance Test Technician Certification Provider Program (adopted under the 2013 Standards) allows the Energy Commission to approve Acceptance Test Technician Certification Providers to provide training, certification, and oversight of Acceptance Test Technicians that perform the acceptance tests required by the Standards, as well as the Acceptance Test Employers that employ the technicians.

The Refrigeration Service Engineers Society (Society), a non-profit trade association, submitted an application to the Energy Commission for approval as a nonresidential mechanical Acceptance Test Technician Certification Provider on December 12, 2016. The Society proposes to launch a nonresidential mechanical Acceptance Test Technician Certification Provider program allowing technicians to certify on individual acceptance tests.

The Society does not directly control any laboratory facilities capable of conducting the hands-on training required by regulation. However, the Society has entered into a memorandum of understanding with Brownson Technical School to provide laboratory facilities. Brownson Technical School has two facilities in the greater Los Angeles area, which staff has visited and deemed capable of performing the required hands-on training and testing. Staff recommends as a condition of approval that the Society shall notify the Energy Commission within 10 days of loss of access to any laboratory for which a signed memorandum of understanding was in existence and be given 90 days to demonstrate a remedy.

Staff completed its evaluation of the Refrigeration Service Engineers Society's Acceptance Test Technician Certification Provider application pursuant to Section 10-103.2(e)1. The Society's application is complete and meets the requirements of Section 10-103.2(c). Staff recommends that the Energy Commission approve the Refrigeration Service Engineers Society to be a nonresidential mechanical Acceptance Test Technician Certification Provider in accordance with the 2016 Standards, with the noted condition of approval (Appendix A).



# CHAPTER 1: Introduction

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The Acceptance Test Technician Certification Provider (ATTCP) Program provides training, certification, and oversight of Acceptance Test Technicians<sup>1</sup> (ATT) who perform the acceptance tests required by California's *2016 Building Energy Efficiency Standards*<sup>2</sup> (Standards), as well as Acceptance Test Employers<sup>3</sup> (ATE) that employ ATTs. ATTCPs are professional organizations that provide training curriculum for technicians and their employers, certification procedures, complaint resolution (including disciplinary procedures), quality assurance, and accountability measures.

Acceptance testing ensures code compliance and promotes the optimal efficiency and performance of nonresidential buildings. These tests determine whether specific building components, equipment, and systems interfaces conform to criteria set forth in the Standards. Chapter 13 of the *2016 Nonresidential Compliance Manual* contains more information about acceptance testing.

The Refrigeration Service Engineers Society (RSES) submitted an application to the California Energy Commission for approval as a nonresidential mechanical ATTCP on December 12, 2016. RSES is a non-profit trade association that provides opportunities for enhanced technical competence by offering training, education, and certification to members and the Heating, Ventilation, Air Conditioning, and Refrigeration (HVACR) industry. RSES has members in the United States and Canada, and provides training material to non-member technicians in more than 50 countries.

Staff received and evaluated RSES's application in accordance with Section 10-103.2(c). This report is organized in the same order as Section 10-103.2(c) in the 2016 Standards.

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<sup>1</sup> Acceptance Test Technician is a Field Technician as defined in Title 24, Part 1, Chapter 10, Section 10-102 of the California Building Code that is certified by an authorized Acceptance Test Technician Certification Provider pursuant to the requirements of Sections 10-103.1 or 10-103.2.

<sup>2</sup> All references hereafter are to the *2016 Building Energy Efficiency Standards* (codified in Title 24, Part 6 of the California Code of Regulations) unless otherwise specified.

<sup>3</sup> Acceptance Test Employer is a person or entity who employs an Acceptance Test Technician and is certified by an authorized Acceptance Test Technician Certification Provider pursuant to the requirements of Sections 10-103.1 or 10-103.2.

# **CHAPTER 2: Qualifications and Approval of Certification Providers**

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## **Requirement in Section 10-103.2(c)**

Prospective 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:

- Documentation of organization structure
- Certification procedures for employers
- Training and certificate procedures for technicians

## **Summary of Compliance Method for Applicant**

RSES submitted an application to the Energy Commission for approval as a nonresidential mechanical ATTCP on December 12, 2016.

The application included information and disclosures regarding organizational structure, certification procedures for employers, and training and certification procedures for technicians.

On December 21, 2016, the Energy Commission approved RSES' request for confidentiality for curriculum and testing materials as part of its efforts to become a nonresidential mechanical ATTCP.<sup>4</sup> The confidential material consists of training curriculum and modules addressing technical areas in which an ATT and an ATE would need to demonstrate competence before being certified.

## **Staff Assessment**

On January 18, 2017, staff reviewed and validated the confidential and non-confidential portions of the application, and determined that the application contained sufficient information to be evaluated in accordance with Section 10-103.2(e)1) to determine compliance with the requirements in Section 10-103.2(c). This report discusses how the application meets the requirements of that section.

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<sup>4</sup> Approval of confidentiality docketed 13-ATTCP-01, TN 214967, December 21, 2016.

# **CHAPTER 3:**

## **Applicant ATTCPs to Document Organizational Structure**

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### **Requirements in Section 10-103.2(c)1**

The ATTCP shall provide written explanations of the organization type, bylaws, and ownership structure. The ATTCP shall explain in writing how its certification program meets the qualifications of Section 10-103.2(c), and how its organizational structure and procedures include independent oversight, quality assurance, supervision, and support of the acceptance test training and certification processes.

### **Summary of Compliance Method for Applicant**

RSES is a 501(c)(6) organization with chapter members in the United States and Canada, and non-member technicians that routinely use its training material in 50 countries across six continents.

Since 1933, RSES has been a leader in training and education for professional HVACR technicians and contractors. The Society's vision is to be the definitive industry leader in all segments of the HVACR industry by providing superior educational training. Its mission is to provide opportunities for enhanced technical competence by offering comprehensive, cutting-edge education and certification to its members and the HVACR industry. RSES purports to advance the professionalism and proficiency of the industry through alliances with other HVACR associations.

RSES' "Title 24 Oversight and Accountability Program" aims to provide independent oversight and accountability measures for certification processes and procedures, computer generated reports for certified employers and technicians, auditor site-visits to locations where technicians are completing acceptance tests, certification process evaluations, building department surveys to determine testing effectiveness, and expert review of the training curriculum that covers Section 120.5 of Title 24.

RSES requires that:

1. All employers and technicians use the mechanical registry for completing and submitting Certificates of Acceptance Test compliance documents.
2. All technicians carry photographic identification and a certification card when performing acceptance testing.
3. Each certification card has a unique identification number.

In an agreement with RSES, the ESCO Group will provide data management services necessary for completing Nonresidential Certifications of Acceptance (NRCA)<sup>5</sup> compliance documents for submittal to enforcement agencies. The ESCO Group provides custom software development, certification (professional, industry, and government), and professional development to educators and trainers in the HVACR industry. Additionally, the ESCO Group will use proprietary software to aid in distributing the workload to available certified technicians and employers.

## Staff Assessment

RSES is a non-profit trade association—Employer Identification Number (EIN) 41-6037520—that is tax exempt under IRS Code Section 501(c)(6). Staff has verified that the EIN is registered to RSES, and that RSES is a 501(c)(6) an exempt organization in good standing.

RSES' bylaws are consistent with serving industry interests that assure quality products and services. Its organizational structure, which includes standing committees, a board of directors, and appointed officers, meets the requirements of Section 10-103.2(c)1. A summary of the application sections that demonstrate compliance with Section 10-103.2(c)1 is provided in **Table 1**.

**Table 1: Summary of Application Compliance for Section 10-103.2(c)1**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Organization	501(c)(6) Non-Profit Trade Association	X	
Ownership Structure	Non-Profit	X	
Bylaws	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Bylaws (pp. 2-18)	X	
Quality Assurance of the Certification Process	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Annual Audit (p. 27)	X	

<sup>5</sup> The California Energy Commission provides residential and nonresidential compliance documents that are used to demonstrate compliance with the Standards. The (NRCA) series includes the acceptance testing for mechanical systems required in Section 120.5.

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Independent Oversight	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: CEC Title 24 Oversight and Accountability Program (pages 19-20)	X	
Supervision	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: CEC Title 24 Oversight and Accountability Program (page 19)	X	
Support of Acceptance Test Training and Certification Processes	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider	X	

Source: California Energy Commission.

# CHAPTER 4:

## Certification of Employers

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### Requirement in Section 10-103.2(c)2

The ATTCP shall provide a written explanation of how its program includes certification and oversight of ATEs. This explanation shall document how the ATTCP ensures that the ATEs are providing quality control and appropriate supervision and support for ATTs.

### Summary of Compliance Method for Applicant

RSES's application describes the eligibility requirements for becoming a nonresidential mechanical ATE. Each ATE must agree to comply with the Standards and adhere to any regulations pertaining to the Standards that are adopted by the Energy Commission. The ATE applicant must complete a minimum of four hours of instruction covering the scope and process of the acceptance tests in Section 120.5.

In advance of the class or webinar, applicants are required to read a summary of all of the Standards related to the specific acceptance tests in which they are seeking certification.<sup>6</sup> The class will review the acceptance tests, their purpose, when and under what circumstances they are applicable, and the specific sections in the Standards related to each acceptance test, as well as the employer's administrative responsibility. Once RSES has determined that the applicant has complied with the requirements, an employer certification exam will be administered. The exam is a two part written test: one part, which is "open book," contains questions relating to the Standards as it pertains to acceptance testing. The second part, which is "closed book," contains questions related to the employer's administrative responsibilities and RSES oversight policies.

### Staff Assessment

The proposed training for ATEs encompasses sections of the Standards relevant to mechanical acceptance testing, including Sections 10-103, 10-103.2, 120.5 and the Reference Appendices NA7.5. The training also includes a summary of Chapter 13 of the Compliance Manual. The scope of the instructional material is a sufficient overview of the acceptance test requirements to allow for an understanding of the duties and responsibilities of both the ATE and ATT. Although the proposed testing includes an open-book section, the questions are sufficiently difficult to demonstrate the ATE's acquired knowledge.

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<sup>6</sup> These coded sections include Section 10-103.2, 120.5, the Reference Appendices NA7.5. This also includes Chapter 13 of the Compliance Manual although the Compliance Manual is not regulation, but advisory.

For ATE certifications , staff concluded that RSES' application meets the requirements in Section 10-103.2(c)2. A summary of the application sections that demonstrate compliance with Section 10-103.2(c)2 is provided in **Table 2**.

**Table 2: Summary of Application Compliance for Section 10-103.2(c)2**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Certification of ATE	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Employer Certification (p. 22) Presentation - California Energy Commission Title 24, Part 6 Acceptance Testing Employer Training.pdf	X	
Oversight of ATE	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Complaints (p. 23)	X	

Source: California Energy Commission.

# CHAPTER 5: Hands-On Experience and Training

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## Requirements in Section 10-103.2(c)3A

ATTCPs shall include a complete copy of all training and testing procedures, manuals, handbooks, and materials with their application. ATTCPs shall explain in writing how their training and certification procedures include, but are not limited to, the scope of the training. The scope of training shall include both hands-on experience and theoretical training to certify competency in the technologies and skills necessary to perform the acceptance tests.

## Summary of Compliance Method for Applicant

The proposed training program allows technicians to certify on each acceptance test. This approach is sensitive to the needs of the small HVAC contractor who would not benefit from training in all 17 acceptance tests that they may not use or require for their business models. The cost of training and certifying a technician in all protocols may result in the exclusion of California's small HVAC contractors from the marketplace. Light, or small, commercial work is generally completed by contractors who do not possess experience or knowledge of working with hydronics, chillers, and thermal storage, or building and energy management systems. By developing a program that allows contractors to certify on only those acceptance tests that they will actually use, RSES is responsive to its membership and inclusive of the small HVAC commercial contractor.

Technicians will select the desired acceptance test(s) and submit an application for that test to RSES. Prior to admittance, applicants must demonstrate understanding of the material by passing a prequalification exam. After receiving instruction on the test concepts and procedures, the ATT will take an exit exam. A passing score (as determined by RSES) certifies the ATT to perform that test.

RSES relies on an online data registry to monitor certified technicians and employers that restricts them to the acceptance tests for which they possess certification. Certification requires that all applicants pass an entrance exam, complete the necessary training, and pass an exit exam for both classroom and laboratory curricula for each mechanical acceptance test.

RSES' proposed program includes classroom training and hands-on (laboratory) training in all mechanical acceptance tests specified by Section 120.5. The training has 17 modules that encompass Appendix NA7.5 (subsections 1 through 17) "Installation and Acceptance Requirements for Nonresidential Buildings and Covered Processes" in the *2016 Building Energy Efficiency Standards Nonresidential Appendices*.



## Staff Assessment

Staff evaluated both confidential and non-confidential training material submitted by RSES. It has been determined that the material includes both hands-on and theoretical training and covers all necessary subjects to complete the acceptance tests required in Section 120.5 of the Standards. The instructional material also includes descriptions of the equipment that is likely to be encountered in the field, and special instructions regarding the applicable acceptance tests.

The hands-on and theoretical training program submitted by RSES meet the requirements of Section 10-103.2(c)3A. A summary of the application sections that demonstrate compliance with Section 10-103.2(c)3A is provided in **Table 3**.

**Table 3: Summary of Application Compliance for Section 10-103.2(c)3A**

REQUIREMENT	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Theoretical Training	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Employer Certification (p. 22)	X	
Hands-On Experience	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Certification Exams (p. 22)	X	

Source: California Energy Commission.

# CHAPTER 6: Mechanical Acceptance Test Technician Training Curricula

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## Requirements in Sections 10-103.2(c)3B(i)

ATTCPs shall provide a complete copy of all training and testing procedures, manuals, handbooks, educational materials, and a written explanation of how training and certification procedures include, but are not limited to, the requirements in Sections 10-103.2(c)3B(i).

ATTCP training curricula for mechanical ATTs shall include, but not be limited to, the analysis, theory, and practical application of:

- Constant volume system controls.
- Variable volume system controls.
- Air-side economizers.
- Air distribution system leakage.
- Demand-controlled ventilation with CO<sub>2</sub> sensors.
- Demand-controlled ventilation with occupancy sensors.
- Automatic demand shed controls.
- Hydronic valve leakage.
- Hydronic system variable-flow controls.
- Supply air temperature reset controls.
- Condenser water temperature reset controls.
- Outdoor air ventilation systems.
- Supply fan variable-flow controls.
- Boiler and chiller isolation controls.
- Fault detection and diagnostics for packaged direct-expansion units.
- Automatic fault detection and diagnostics for air-handling units and zone terminal units.
- Distributed energy storage direct-expansion air conditioning systems.
- Thermal energy storage systems.
- Building Energy Efficiency Standards mechanical acceptance testing procedures.
- Building Energy Efficiency Standards acceptance testing compliance documentation for mechanical systems.

## Summary of Compliance Method for Applicant

RSES submitted the necessary mechanical training material to cover the curricula requirements listed in Section 10-103.2(c)3B(i). The technical material is confidential; therefore, staff's evaluation of its compliance is available only in this public document.

### Staff Assessment

The confidential materials were evaluated in accordance with the Standards. All training materials were reviewed and staff determined that adequate documentation was provided to comply with the mechanical acceptance testing requirements of Section 10-103.2(c)3B(i). There are no significant deviations from the *2016 Nonresidential Compliance Manual* and staff has deemed the training material as sufficient instruction. A summary of compliance with Section 10-103.2(c)3B(i) is found in **Table 4**.

**Table 4: Summary of Application Compliance for Section 10-103.2(c)3B(i)**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Constant Volume System Controls	Constant_Air_Volume_AC_HP_Technician_Training.pdf	X	
Variable Volume System Controls	Variable_Air_Volume_Technician_Training.pdf	X	
Air-Side Economizers	AEC_Technician_Training.pdf	X	
Air Distribution System Leakage	Air_Distribution_Duct_Leakage_Tech_Training.pdf	X	
Demand Controlled Ventilation With CO <sub>2</sub> Sensors	DCV_Technician_Training.pdf	X	
Automatic Demand Shed Controls	ADS_Technician_Training.pdf	X	
Hydronic Valve Leakage	Valve_Leakage_Technician_Training.pdf	X	
Hydronic System Variable Flow Controls	Hydronic_VFC_Technician_Training.pdf	X	
Supply Air Temperature Reset Controls	Supply_Air_Reset_Technician_Training.pdf	X	
Condenser Water Temperature Reset Controls	Condenser_Water_Reset_Technician_Training.pdf	X	
Outdoor Air Ventilation Systems	Constant_Air_Volume_Technician_Training.pdf	X	
Supply Fan Variable - Flow Controls	Supply_Fan_VFC_Technician_Training.pdf	X	
Supply Water Temperature Reset Controls	Supply_Water_Reset_Technician_Training.pdf	X	

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Fault Detection and Diagnostics for Packaged Direct-Expansion Units	FDD_Technician_Training.pdf	X	
Automatic Fault Detection and Diagnostics for Air Handling Units and Zone Terminal Units	AFDD_Technician_Training.pdf	X	
Distributed Energy Storage Direct - Expansion Air Conditioning Systems	DES_Technician_Training.pdf	X	
Thermal Energy Storage Systems	TES_Technician_Training.pdf	X	
Energy Management Control System Acceptance	EMCS_Technician_Training.pdf	X	
Energy Code Mechanical Acceptance Testing Procedures	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Technician Certification (pp. 20-22)	X	
Energy Code Acceptance Testing Compliance Documentation for Mechanical Systems	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider	X	

Source: California Energy Commission.

# CHAPTER 7:

## Hands-On Training

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### Requirement in Section 10-103.2(c)3B(ii)

The ATTCP shall describe in its application the design and technical specifications of the laboratory boards, equipment, and other elements that trainers will use to meet the hands-on requirements of the training and certification.

### Summary of Compliance Method for Applicant

RSES will offer hands-on training and certification to technicians at two locations:

Brownson Technical School  
1110 Technology Circle  
Anaheim, CA 92805

North American Training Center  
2025 W. Park Avenue  
Redlands, CA 92373

Because RSES does not control any facilities capable of providing hands-on training in California, these two accredited training centers have agreed to host the required training. RSES developed the curriculum, training, procedures, and certification tests that will be used at the centers. The laboratories provide the necessary equipment, qualified instructors, and, if required, examiners that meet or exceed the requirements set forth by RSES and approved by the Energy Commission.

RSES expects to expand its training program and will inform the Energy Commission of additional locations as they become operational. The mechanical equipment used for hands-on training is portable, enabling the performance exams to be administered at any authorized RSES location. All 17 of the mechanical acceptance tests can be accommodated with this equipment. No computer simulations are used. The equipment has been custom built and is not available commercially.

The portable mechanical equipment is mounted on two platforms. The first platform is centered on a 3-ton heat pump. This unit has a variable frequency drive that controls the blower motor, a factory economizer, a variable air volume system, demand control ventilation capability, capacity control, and an integrated (with both platforms when needed) energy management system. The second platform has a 3-ton chiller, water sourced heat pump, boiler, cooling tower, air handler, and a separate thermal energy storage container. The controls for both systems allow simple switching between operation modes and a visual representation of the cooling or heating circuits in use (through the energy management system).

## Staff Assessment

The hands-on (laboratory) education and experience allows ATTs to apply the knowledge gained to evaluate situations and to troubleshoot procedures during HVAC system installation or during fieldwork maintenance.

Staff visited both proposed RSES facilities (in Los Angeles) and determined that the available training equipment and instructors can provide the required training. Both locations may use the mobile training equipment when needed.

As a condition of approval (see Appendix A), RSES shall notify the Energy Commission within 10 days of loss of access to any laboratory for which a signed memorandum of understanding is in existence. RSES will be given 90 to remedy the issue.

Staff has determined that the hands-on laboratory facilities and equipment meet the requirements in Section 10-103.2(c)3b(ii). A summary of the application sections that demonstrate compliance with Section 10-103.2(c)3B(ii) is provided in **Table 5**.

**Table 5: Summary of Application Compliance for Section 10-103.2(c)3B(ii)**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Hands-On Experience	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Certification Exams (p. 22)	X	

Source: California Energy Commission.

# CHAPTER 8:

## Prequalification

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### Requirement in Section 10-103.2(c)3B(iii)

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.

### Summary of Compliance Method for Applicant

Technician participation in the RSES certification program will be limited to individuals who have a least three years of verifiable professional experience and expertise in mechanical controls and systems for the specific acceptance test for which they are applying.

The applicant must pass a written entrance exam to show competency to perform acceptance tests. Individual prequalification exams will verify the applicant's knowledge as it pertains to each acceptance test. RSES will score the exam and notify the applicant of the results. RSES will allow an exception to the training for completing the acceptance test required of NRCA-MCH-02-A Outdoor Air Acceptance. The NRCA-MCH-02-A compliance document includes Constant Air Volume (CAV) and Variable Air Volume (VAV) system tests. RSES asserts that most small contractors and their employed technicians work on light commercial and residential systems and likely have not designed, installed, or serviced VAV systems. To include those contractors within the certification program, RSES will require:

- Technicians who have passed the RSES prequalification CAV systems exam (Exam 1) will only be certified in CAV Outdoor Air Acceptance Testing and, therefore, will not be certified in compliance document NRCA-MCH-07-A Supply Fan Variable Frequency Drive (VFD) Acceptance which concerns VAV systems.
- Technicians who have passed the RSES prequalification VAV systems exam (Exam 2) will only be certified in VAV Outdoor Air Acceptance Testing and, therefore, will not be certified in compliance document NRCA-MCH-03-A Constant Volume, Single Zone, Unitary Air Conditioner and Heat Pump Systems which concerns CAV systems.
- Technicians who wish to be certified in both VAV and CAV may take Exams 1 and 2.

## Staff Assessment

The procedures and requirements for the entrance exams address the candidate pool that RSES is likely to encounter. Allowing the separation of the CAV, VAV, or the option of taking both exams allows the candidate to specialize as their experience dictates.

Staff has determined that the procedures outlined in the RSES application sufficiently evaluate candidate pre-qualifications prior to acceptance into the ATT certification program in accordance with Section 10-103.2(c)3B(iii). Based on the minimum years of experience, technician application, and entrance exam, RSES provides ample evidence to ensure a high level of competency for certified technicians in mechanical controls and systems. A summary of compliance with Section 10-103.2(c)3B(iii) of the Energy Standards is found in **Table 6**.

**Table 6: Summary of Application Compliance for Section 10-103.2(c)3B(iii)**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Three Years of Experience and Expertise in Mechanical Controls and Systems	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Prequalification Criteria (p. 21)	X	
Description of the Criteria and Review Process	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Prequalification Criteria (p. 21)	X	

Source: California Energy Commission.



# CHAPTER 9: Instructor-to-Trainee Ratio

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## Requirement in Section 10-103.2(c)3B(iv)

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.

## Summary of Compliance Method for Applicant

RSES states that its instructor to student ratio is 1:12 for classroom instruction. For hands-on training in the laboratory or on the shop floor, the ratio is 1:2. Online webinar training is a 1:1 ratio.

RSES bases these ratios on substantial experience in training and laboratory procedures on the understanding of concepts, work completion, and safe operation of laboratory facilities. The instructors have found that more than 12 students are difficult to manage, as the laboratory environment requires a great deal of interaction.

## Staff Assessment

Based on RSES' significant experience in conducting industry training programs, staff has determined that the proposed ratios of instructors to participants ensure the integrity and efficacy of the curriculum and program. A summary of compliance with Section 10-103.2(c)3B(iv) is shown in **Table 7**.

**Table 7: Summary of Application Compliance for Section 10-103.2(c)3B(iv)**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Documentation of Instructor to Trainee Ratio	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Instructor to Trainee Ratio (p. 21)	X	

Source: California Energy Commission.

# CHAPTER 10:

## Testing

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### Requirement in Section 10-103.2(c)3B(v)

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.

### Summary of Compliance Method for Applicant

Each candidate must pass a prerequisite exam, attend and pass a class or webinar, perform laboratory training, and pass a written exit exam and practical (hands-on) exam. The written exam determines if the applicant possesses the knowledge relevant to the specific discipline and protocols contained within the acceptance test. RSES appointed examiners will proctor and administer the written exam, which is closed book in a secure online format, in a secure location. The intent is for the candidate to demonstrate the ability to understand the subject matter and proficiently perform the related mechanical acceptance test. RSES appointed examiners will also proctor the practical exam, which replicates field acceptance testing conditions.

All program participants will be required to use the data registry managed by ESCO Group. RSES will use the registry to maintain the results of both written and hands-on exams for a minimum of seven years. RSES provided sample tests that demonstrate relevancy to the subject material.

### Staff Assessment

The confidential exam questions submitted by RSES were determined to comprehensively meet the acceptance testing requirements, the Standards, and the requirements of the applicant's proposed ATTCP program. The exam ensures an ATT that receives a passing score has learned the subject material and has demonstrated sufficient competency to successfully perform mechanical acceptance tests, complete the acceptance test compliance documents, and appropriately submit those compliance documents to the regulating agencies.

RSES' ATT testing results retention policy complies with the requirements Section 10-103.2(c)3B(v). A summary of compliance with Section 10-103.2(c)3B(v) is provided in **Table 8**.

**Table 8: Summary of Application Compliance for Section 10-103.2(c)3B(v)**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Retention of ATT Testing Results	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: RSES and the Registry (p. 27)	X	

Source: California Energy Commission.

# CHAPTER 11:

## Recertification

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### Requirement in Section 10-103.2(c)3B(vi)

The ATTCP shall recertify all ATTs and ATEs prior to the implementation of each adopted update to the 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 the Standards.

### Summary of Compliance Method for Applicant

When the Standards are updated by the Energy Commission, RSES requires that all ATT and ATE certification holders recertify and meet all qualifications and requirements as amended by the updated Standards. ATTs and ATEs must take and pass the relevant training and testing to renew their certifications. Training and testing will be limited to changes that affect acceptance testing in the updated Standards.

To ensure ATTs remain current on their certifications, RSES will require recertification of ATTs who have not performed a specific acceptance test in 24 months. This recertification, which is not required by regulation, may be limited to a laboratory (hands-on) test.

RSES may also require ATEs to recertify on changes in the California Building Code that modify the ATE's administrative responsibilities outside of an update to the Standards. This recertification, which is not required by regulation, may require one or all of the following:

- A signed statement that the new or modified changes have been read and are understood
- Employer attendance at a class or webinar
- A passing score on a written exam

### Staff Assessment

Staff has determined that these procedures comply with and surpass the requirements specified in Section 10-103.2(c)3B(vi). A summary of compliance with Section 10-103.2(c)3B(vi) is provided in **Table 9**.

**Table 9: Summary of Application Compliance for Section 10-103.2(c)3B(vi)**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Discussion of Recertification Procedures	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Recertification (p. 23)	X	

Source: California Energy Commission.

# CHAPTER 12: Mechanical Acceptance Test Employer Training

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## Requirement in Section 10-103.2(c)3C

Training for mechanical acceptance test employers shall consist of a single class or webinar consisting of at least four hours of instruction covering the scope and process of the acceptance tests in Section 120.5.

## Summary of Compliance Method for Applicant

The training proposed by RSES for nonresidential Mechanical ATEs requires completion of at least four hours of instruction covering the scope and process of the acceptance tests described in Section 120.5. All ATEs must pass the Employer Exam to earn credit for completing the instruction course.

## Staff Assessment

Staff has reviewed the proposed four-hour (confidential) training for prospective employers and has determined that it provides a foundational understanding of the tasks and scope of work performed by ATTs. Staff also determined that RSES' proposed employer training complies with the requirements in Section 10-103.2(c)3C. A summary of compliance with Section 10-103.2(c)3C is provided in **Table 10**.

**Table 10: Summary of Application Compliance for Section 10-103.2(c)3C**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Minimum Employer Training	Presentation - California Energy Commission Title 24, Part 6 Acceptance Testing Employer Training.pdf	X	

Source: California Energy Commission.

# CHAPTER 13:

## Complaint Procedures

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### Requirement in Section 10-103.2(c)3D

An ATTCP shall submit written procedures for notifying building departments and the public that it will accept complaints regarding the performance of any certified ATT or ATE, and procedures for how the ATTCP will address these complaints.

### Summary of Compliance Method for Applicant

RSES's application provides detailed procedures for accepting and resolving complaints. On behalf of RSES, the ESCO Group will provide a web portal for the intake and processing of complaints from any local enforcement agency, other permitting agency, and/or the public, concerning the performance of certified RSES ATTs or ATEs. After preliminary screening to validate its relevancy to the project, the ESCO Group will notify RSES (RSES Committee Liaison, Committee Chairman, and the RSES International Office) of the complaint to allow RSES to process the complaint appropriately. Customer complaints, which are brought to RSES's attention, will result in investigation and potentially on-site audits. Acknowledgment of the receipt of a complaint will be sent to the complainant within fourteen days and whether it can be addressed by the RSES Title 24 Oversight and Accountability Committee. RSES will not take any actions if the complaint is filed later than three months from the date of acceptance test completion.

The RSES Complaint procedure includes several components.

**Filing of a Complaint:** A project's owner, his representative, general contractor, mechanical contractor, engineer, or a representative of the Permit Issuing Authority (PIA) may initiate a complaint to RSES.

**Examination of the Complaint:** RSES appoints an Examiner to investigate the complaint and mediate a solution if possible, culminating in a report to the RSES Title 24 Oversight Committee.

**Assessment of the Complaint:** Through its Title 24 Oversight Committee, RSES determines what corrective action, if any, is appropriate.

**Request for reconsideration:** In the event that RSES decertifies or suspends an ATT or ATE, the ATT/E may request reconsideration of the decision, and may present information and evidence not previously considered by RSES.

**Notice of Determination:** RSES will report to the complainant and the Energy Commission, with copies to the Certificate holders, the resolution of the complaint.

If there is any change in the status of an ATE or ATT, the data registry will be updated promptly and accordingly.

## Staff Assessment

Staff reviewed RSES’s application regarding the proposed complaint process. RSES’s proposed process for addressing complaints is reasonably transparent and fair to both the complainant and the ATT/ATE. The process provides many opportunities for a balanced resolution. Staff determined that the proposed process is sufficient to comply with the requirements of Section 10-103.2(c)3D. A summary of compliance with Section 10-103.2(c)3D is provided in **Table 11**.

**Table 11: Summary of Application Compliance for Section 10-103.2(c)3D**

REQUIREMENT	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Notification to Building Departments	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Complaints (p. 23)	X	
Procedures for Accepting Complaints	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Complaints (p. 23)	X	
Procedures for Addressing Complaints	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Complaints (pp. 24-27)	X	

Source: California Energy Commission.



# CHAPTER 14:

## Certification Revocation Procedures

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### Requirement in Section 10-103.2(c)3E

ATTCPs must describe procedures in writing for revoking the certification of ATTs and ATEs based on 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.

### Summary of Compliance Method for Applicant

RSES is Title 24 Oversight and Accountability Committee reserves the right, based on the examiner's report, to require corrective actions when appropriate. The examiner will determine if the ATE and/or the ATT adequately performed the required acceptance test(s), and completed the compliance documentation as required under the Standards. Corrective actions may include, but are not limited to, additional training and/or recertification. In the case of intentional noncompliance, RSES will suspend the ATE, the ATT, or both, and require re-training with possible probation. If the ATE fails to comply with the corrective action, then RSES shall decertify the ATE and suspend the certificates of all the ATTs in its employ. Additionally, the ATE will pay all the costs for re-review and re-verification of the performed acceptance test. If the ATE refuses to pay, then RSES will decertify the ATE and suspend the certifications of all ATTs in its employ. If there is any change in the status of an ATE or ATT, the data registry will be updated promptly and accordingly. A copy of the determination shall be sent to all parties including the ATT and ATE, the Energy Commission, and RSES.

### Staff Assessment

Staff reviewed RSES' proposed procedures for revocation of certification. The procedures results are adequately available to all permitting authorities. The procedures are reasonably fair to the ATT and ATE providing both a path towards re-certification or de-certification, if necessary. The proposed process is in compliance with the requirements set forth in Section 10-103.2(c)3E. A summary of compliance with Section 10-103.2(c)3E is provided in **Table 12**.

**Table 12: Summary of Application Compliance for Section 10-103.2(c)3E**

REQUIREMENT TYPE	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Procedures for Revocation of Certification	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Complaints (pp. 23-27)  RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Annual Audit (p. 27)	X	

Source: California Energy Commission.

# **CHAPTER 15:**

## **Quality Assurance, Independent Oversight, and Accountability**

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### **Requirement in Section 10-103.2(c)3F**

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 one percent of each technician's completed compliance forms, and shall perform randomly selected on-site audits of no less than one percent of each technician's completed acceptance tests. Independent oversight may be demonstrated by accreditation under the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC) 17024 Standard.

### **Summary of Compliance Method for Applicant**

As described in Chapter 3, RSES will create a Title 24 Oversight and Accountability Program to provide independent oversight and accountability measures, computer generated reports for each certified employer and technician, auditor visits to sites where certified technicians are completing acceptance tests when required, certification process evaluations, building department surveys to determine acceptance testing effectiveness, and expert review of the training curricula that covers Section 120.5.

In an agreement with ESCO Group, RSES will implement quality assurance measures for the percentage of desk (paper) audits and on-site audits to satisfy the random sampling requirement for each technician's completed acceptance tests: no less than one percent of each ATT's completed compliance documents and no less than one percent of each ATT's completed acceptance tests.

### **Desk Audits**

ATTs will be subject to a random desk audit rate of five percent of completed mechanical acceptance tests or five compliance documents whichever is greater. RSES requires all certified ATEs to enter and submit all completed acceptance compliance documents into the ESCO nonresidential mechanical data registry. The registry uses algorithms within each compliance document to check 100 percent of submitted compliance documents for inaccuracies and anomalies. Any anomalous findings or

exact replication of results will be examined and, in most cases, initiate field verification and more frequent audits of the personnel involved. Notifications will be sent to RSES if any compliance documents are identified as atypical. If an audit reveals suspicious activity that requires more than a desk audit; auditors reserve the right to follow up with a site visit to investigate deficiencies.

## **On-Site Audits**

RSES' application included an on-site audit component to augment the desk audit and to comply with the 2016 Standards. ATTs will be selected randomly for an on-site audit after performing approximately 50 acceptance tests (of any kind). The ATT and ATE will be contacted by an auditor and an on-site audit will be scheduled for the next registered job. Successful completion of the audit will stand for 100 acceptance tests, at which point the process will begin again. If an onsite audit reveals that an ATT did not perform a test properly or complete an acceptance compliance document accurately, the auditor shall notify RSES. The RSES Title 24 Oversight and Accountability Committee shall determine whether remedial action is required, which may include additional training, decertification, or suspension.

## **Auditors**

The auditors will be employed by ESCO as independent contractors, will have a minimum of five years of field experience in mechanical systems and controls, and will have passed a performance exam for each of the forms for which they are authorized to audit. Standardized on-site audit compliance documents will be used for each specific acceptance test. Audit compliance documents will include information to help rate the ATT's accuracy in conducting all phases of the acceptance test and the proper completion of the acceptance test compliance document. Audit forms will contain space for additional comments. Completed forms will reside in the ESCO data registry for no less than seven years. Access to the forms shall be granted to RSES and the Energy Commission.

Auditors will only discuss, converse, or ask questions of the ATT during the audit that requires completing the compliance documents. For safety reasons, the auditor will wait for the ATT to finish tasks that involve operating equipment or the use of tools. The auditor will not assist with or advise the ATT on any task being performed.

To provide quality assurance of the on-site audit process and the auditors, the ESCO Group will provide several "master auditors" that will audit no less than one percent of each auditor's on-site audits. The audit results will be sent to RSES and the Energy Commission for review.

## **Staff Assessment**

The proposed quality assurance program includes 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 the Standards. RSES will review 100 percent of each ATT's completed compliance forms electronically and will perform randomly selected desk and on-site audits of no less than one percent of each ATT's completed acceptance tests. Staff has determined that the proposed quality assurance program complies with the requirements in Section 10-103.2(c)3F. A summary of compliance to Section 10-103.2(c)3F is provided in **Table 13**.

**Table 13: Summary of Application Compliance for Section 10-103.2(c)3F**

REQUIREMENT	LOCATION IN APPLICATION	DATA ADEQUATE	NEED MORE INFO
Quality Assurance	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Annual Audit (p. 27)	X	
Independent Oversight	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Annual Audit (p. 27)	X	
Accountability Measures	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Annual Audit (p. 27)	X	

Source: California Energy Commission.

# CHAPTER 16: Certification Identification Number and Verification of ATT Certification Status

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## Requirement in Section 10-103.2(c)3G

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, and 10-103(a)4, and Reference Joint Appendix JA7.

## Summary of Compliance Method for Applicant

On behalf of RSES, the ESCO Group will issue a unique certification number to each certified ATT. ATTs must carry the certification card when performing acceptance testing. ATTs must use and be listed in the ESCO Group managed database. The database will include names, addresses, dates of expiration, and examination history, and will be searchable on the ESCO Group data registry.

## Staff Assessment

Staff reviewed RSES's application regarding the process to issue unique certification numbers to each ATT on successful completion of the training and testing requirements. RSES will issue each ATT and ATE a unique certification number and the certification holders' status will be retained in the ESCO data registry. Staff has determined that the proposed process complies with the requirements in Section 10-103.2(c)3G. A summary of compliance with Section 10-103.2(c)3G is provided in **Table 14**.

**Table 14: Summary of Application Compliance for Section 10-103.2(c)3G**

REQUIREMENT TYPE	APPLICATION LOCATION	DATA ADEQUATE	NEED MORE INFO
Issue Certification ID	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Certification Identification Numbers and Cards (p. 22)	X	

REQUIREMENT TYPE	APPLICATION LOCATION	DATA ADEQUATE	NEED MORE INFO
Maintain Records of Certified ATTs	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: RSES and the Registry (p. 27)	X	
Provide Verification of Current ATTs Status	RSES Application for California Title 24 Mechanical Nonresidential Acceptance Test Technician Certification Provider: Certification Identification Numbers and Cards (p. 22)	X	

Source: California Energy Commission.

## **CHAPTER 17:**

# **Staff Recommendations**

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Staff has evaluated RSES's application, which was submitted on December 12, 2016, pursuant to Section 10-103.2(e)1 and has determined that the application meets the requirements of Section 10-103.2(c). Staff recommends that RSES be considered for approval to become a nonresidential mechanical Acceptance Test Technician Certification Provider in accordance with the 2016 Standards.



## APPENDIX A: Proposed Condition of Approval

Refrigeration Service Engineers Society (RSES) does not control any training centers capable of providing hands-on training in California. Therefore, RSES has arranged for two accredited training centers to host the training. RSES has developed curriculum, training, procedures, and certification tests for use at these centers. The laboratories have appropriate training equipment, qualified instructors, and, if required, examiners that meet or exceed the requirements set forth by RSES and approved by the California Energy Commission.

The proposed training centers (in Los Angeles) have the appropriate training equipment, experienced instructors, and capability to provide the required training. Both locations have access to the training equipment, which is mobile.

Staff recommends as a condition of approval that the Refrigeration Service Engineers Society shall notify the Energy Commission within 10 days of any loss of access to any laboratory for which a signed memorandum of understanding was in existence. RSES shall be given a reasonable time frame to remedy the issue within 90 days.

In addition to the applicable program requirements, staff recommends the following condition for RSES approval as a nonresidential mechanical Acceptance Test Technician Certification Provider:

**COA-1:** RSES must notify Energy Commission staff within 10 business days of any loss of access to any laboratory facility. RSES must identify sufficient replacement facilities within 90 days.

**Compliance:** RSES must notify Energy Commission staff within 10 business days of any loss of access to any laboratory facility for which a signed memorandum of understanding allowing RSES to perform mechanical systems acceptance tests required by the Building Energy Efficiency Standards, Section 120.5, in an instructional setting.

Within 90 days, RSES must identify sufficient replacement facilities and provide Energy Commission staff the following information:

- The owners/operators of the facilities
- The addresses of the facilities
- The acceptance tests to be performed at each facility
- A RSES representative must submit a signed and dated affidavit stating the following for each facility identified:
  - A RSES representative(s) has visited the facility in person
  - A RSES representative(s) has reviewed and has knowledge of RSES' acceptance test laboratory procedures relevant to the facility

- A RSES representative(s) will vouch that the facility is currently capable of being used for the educational purposes intended by RSES for acceptance test education and testing

Energy Commission staff may request additional information about the replacement facilities, which may include a memorandum of understanding between RSES and a facility owner/operator of the replacement facility.

Energy Commission staff must be granted physical access to the facility to ensure that it is capable of providing the required laboratory training environment.

Once Energy Commission staff is satisfied with the information submitted by RSES, Energy Commission staff will provide RSES with a written acknowledgement of compliance.

## APPENDIX B: Glossary

ATTCP Acceptance Test Technician Certification Provider	An agency, organization or entity approved by the Energy Commission to train and certify acceptance test technicians and acceptance test employers.
ATT Acceptance Test Technician	A Field Technician certified by an authorized Acceptance Test Technician Certification Provider.
ATE Acceptance Test Employer	A person, or entity, that employs an acceptance test technician and is certified by an authorized Acceptance Test Technician Certification Provider.
CAV Constant Air Volume	A type of heating, ventilating, and air-conditioning (HVAC) system, for which the supply air flow rate is constant, but the supply air temperature varies to meet the thermal loads of a space.
DCV Demand Control Ventilation	HVAC system's ability to reduce outdoor air ventilation flow below design values when the space served is at less than design occupancy.
DxAC Direct Expansion Air Conditioning	A standard HVAC system prevalent in commercial use where the refrigerant is compressed in a compressor and then cooled in an air-cooled condenser and delivered to the building via ducting.
EIN Employer Identification Number	Also known as a Federal Tax Identification Number, which is used to identify a business entity.
FDD Fault Detection and Diagnostics	Automated FDD systems ensure proper HVAC equipment operation by identifying and diagnosing common equipment problems such as temperature sensor faults, low airflow, or faulty economizer operation.
HVAC(R) Heating, Ventilation and Air Conditioning (and Refrigeration)	An acronym used in the heating and cooling industry.

<p>IEC International Electro-Technical Commission</p>	<p>A nonprofit, non-governmental international standards organization that prepares and publishes international standards for all electrical, electronic, and related technologies.</p>
<p>ISO International Organization for Standardization</p>	<p>An independent, non-governmental international organization that develops market relevant standards that support innovation and provide solutions to global challenges.</p>
<p>PDF Portable Document Format</p>	<p>A file format introduced to ease the sharing of documents between computers and across operating system platforms to save files that cannot be modified but still need to be easily shared and printed.</p>
<p>RSES Refrigeration Service Engineers Society</p>	<p>A non-profit trade association with the charter to provide opportunities for enhanced technical competence by offering comprehensive, cutting-edge education and certification to its members and the HVACR industry. RSES has members in chapters in the US and Canada with additional technicians using its training material in 50 other countries.</p>
<p>Standards Building Energy Efficiency Standards</p>	<p>State regulations contained in Title 24, Parts 1 and 6 of the California Code of Regulations. California's Building Energy Efficiency Standards are updated on roughly a three year cycle. The Standards focus on key areas to improve energy efficiency of newly constructed buildings and additions and alterations to existing buildings in a cost effective manner.</p>
<p>TES Thermal Energy Storage</p>	<p>A commercial HVAC system that reduces energy consumption during peak demand periods by shifting energy consumption to nighttime by creating and storing cooled fluid or ice in tanks.</p>
<p>VAV Variable Air Volume</p>	<p>A type of HVAC system that varies the airflow at a constant temperature.</p>
<p>VFD Variable Frequency Drive</p>	<p>A VFD adjusts the speed of an HVAC fan or pump motor, based on demand, to save energy and prolong motor and mechanical component life.</p>