



**Rhode Island Commerce Corporation
Renewable Energy Fund**

REQUEST FOR PROPOSALS

Renewable Energy Fund Project Inspector

May 22, 2014

Program Opportunity # REF-Inspector-002

The Rhode Island Commerce Corporation (“Commerce RI”), administrator of the state’s Renewable Energy Fund (“REF”) is requesting inspection and technical assistance through the following Request for Proposals (“RFP”).

This RFP will be offered from May 22, 2014 – June 17, 2014. Final Proposals must be submitted no later than 2:00pm on Tuesday June 17, 2014. Applicants must submit a final proposal both in hard copy and electronic format. If emailing, please submit with all its components attached with the subject heading, “REF-Inspector Proposal” to ref@commerceri.com. If a proposal must be submitted in multiple emails, please indicate this in the email subject line. **All responses, including electronic submissions, must be time stamped no later than June 17, 2014 by 2:00pm to be considered a valid submission to this RFP.**

Hard copy submissions must be mailed or hand delivered to:

The Rhode Island Commerce Corporation
Attn: Renewable Energy Fund Project Inspector RFP
315 Iron Horse Way, Suite 101
Providence, RI 02908

Questions regarding this solicitation must be received by 2:00pm on Friday, June 6, 2014. A Notification of Intention to Bid on this RFP is preferred but not required. Notifications of Intention to Bid should be sent via email to ref@commerceri.com. Questions or clarifications about the RFP should be directed to:

Shauna Beland
Portfolio Manager, Renewable Energy Fund
315 Iron Horse Way, Suite 101
Providence, RI 02908
ref@commerceri.com

Questions from respondents will be accepted by email during the course of this solicitation. Responses to all relevant questions received by Commerce RI will be posted on the Commerce RI’s website by June 10, 2014. The identities of those who submit questions will not be revealed.

Any oral communication concerning this solicitation is not binding and shall in no way alter a specification, term or condition of this program or indicate any selection preference other than that identified herein.

Copies of this RFP and all documentation associated with it are available on the following website:

www.commerceri.com/government/rfp-rfq-rfi.php

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SECTION I – PROJECT BACKGROUND & GOALS

1. BACKGROUND

The Commerce RI Renewable Energy Fund (REF) is dedicated to increasing the role of renewable energy throughout the state. The REF provides grants and loans for renewable energy projects with the potential to create electricity in a cleaner, more sustainable manner, while stimulating job growth in the green technology and energy sectors of Rhode Island's economy. Using funds from the 'system benefit charge' on electric bills and Alternative Compliance Payments, Commerce RI helps offset the cost of renewable projects for businesses and homeowners.

Through quarterly solicitations, the REF accepts proposals for Small Scale solar projects and Commercial Scale projects. The Small Scale program accepts applications for Solar PV and Solar Hot Water projects. The Commercial Scale program accepts applications for technologies other than solar PV however, the selected vendor will only be expected to provide inspection services for the solar PV projects.

2. GOALS

A core goal of each program the REF offers is ensuring that installations for our grantees are safe, high quality, performing as expected, and in conformance with the specifications provided in project application and completion documentation. To accomplish this goal, the REF engages independent consultants to perform inspections of the installed systems. The REF reserves the right to inspect any system to which we provide financial assistance.

We define an inspection as an on-site assessment of the project by a licensed electrician (for PV projects) or a licensed plumber (for solar hot water projects) of an installed system to determine compliance with appropriate codes, including provision of required labeling and operating instructions, and to verify that the system components have been installed with the program requirements and the specifications provided on the project application and completion documentation. Inspections may also include, at the direction of the REF, a detailed review of a project at the design stage of an installation. The inspection concludes with a final report which is submitted to the REF detailing the inspection findings.

3. REQUIREMENTS

Please note that the individuals actually performing the inspections must hold professional licenses or certifications in the appropriate fields, as applicable. The REF will give preference to applicants who are not actively installing systems in Rhode Island. Inspectors with the following backgrounds should have desired experience, if accompanied by appropriate formal training in the relevant technologies:

- ❖ Professional Engineers
- ❖ Retired or inactive master tradesman
 - Electricians
 - Plumbers
- ❖ Home Inspectors
- ❖ Vocational School/community college instructors

Another core requirement the applicant must demonstrate is the ability to provide technical assistance on an as needed basis on subjects such as shading, Rhode Island State electrical code, fire safety, and other relevant topics to the REF programs.

In addition, the REF will consider applicants who can provide trainings to the solar industry, municipal inspectors and/or state inspectors. These trainings may include electrical, building code, or other technical topics as needed. Applicants who have experience to conduct such trainings should be able to provide experience with RI codes and past course curriculum as part of the application.

The selected vendor will need to demonstrate:

- a) Experience and technical knowledge necessary to perform residential and commercial scale solar photovoltaic project inspections
- b) Experience and technical knowledge necessary to perform residential scale solar domestic hot water project inspections
- c) Ability to provide technical assistance
- d) Ability to use equipment and software necessary to perform independent shading analyses
- e) Experience with writing reports
- f) Demonstrated understanding of the Small Scale Solar and Commercial Scale program and their respective program requirements.
- g) Demonstrated understanding and/or experience with the Rhode Island Building and Electrical Codes.
- h) Ability to climb ladders to inspect roof-mounted systems
- i) Sufficient flexibility in their schedule to respond to requests for site inspections within one week's time

Solar PV Inspectors

Inspectors of PV systems must be Licensed Electricians and should have the following experience and credentials:

- Significant experience with PV system installations
- Good working knowledge of the National Electric Code
- Ability to use and understand a Solar Pathfinder and respective software to generate detailed reports
- Minimum of forty (40) hours of formal training in PV system design and installation

Solar Hot Water Inspectors

Inspectors of Solar Hot Water system must be licensed Plumbers and should have the following experience and credentials:

- Significant experience with solar thermal hot water system installations, including pressurized closed-loop and drainback systems
- Good working knowledge of Rhode Island plumbing codes
- Ability to use and understand a Solar Pathfinder and respective software to generate detailed reports
- Minimum of 40 hours of formal training in solar thermal system design and installation

The following table summarizes the number of PV and hot water inspections that have occurred since the beginning of 2013. We estimate a higher number of inspections for all three types of projects for the 2015 fiscal year which begins on July 1, 2014.

System Type	2013-14
Small Scale PV	43
Solar Solar Hot Water	0
Commercial PV	2

4. COMPENSATION AND SELECTION

Inspectors will be paid by the hour for time actually spent on each project. Travel time will be paid at half the hourly consulting rate. If the REF selects multiple vendors, the amount of work assigned to any one vendor will be at the sole discretion of the REF. While we recognize that the Inspectors will have other demands on their time, factors affecting the frequency of assignments will include:

- Ability to respond promptly to requests for inspection
- Completeness and clarity of inspection reports
- Ability to uphold the rules of the program and applicable Rhode Island codes
- Hourly rate

The selected vendor(s) will enter into a contract with the Rhode Island Commerce Corporation for an amount not to exceed \$40,000 for the 2015 fiscal year. In addition, selection of the vendor(s) will need to be approved by the Rhode Island Commerce Corporation Board of Directors.

SECTION II – SCOPE OF WORK

The Commerce RI Renewable Energy Fund seeks to secure the services of a technical consultant in order to assist in inspecting installed solar photovoltaic and solar domestic hot water projects as needed. The REF may engage separate or potentially multiple vendors for services for the different technology groups. Applicants do not need to offer inspection services for both technologies. If the Applicant is applying to this Solicitation with a focus on only one of the required technologies, please indicate this in the application materials.

The REF team is seeking qualified candidates to provide the following services and deliverables:

- ❖ TASK 1 – Inspections of Small Scale Solar projects
- ❖ TASK 2 - Inspections of Small Scale Solar Hot Water projects
- ❖ TASK 2 – Inspections of Commercial Scale Solar projects
- ❖ TASK 3 – Miscellaneous Special Projects
- ❖ TASK 4 - Trainings

1. TASK 1 – Inspections of Small Scale Solar PV Projects

At the request of the REF, the selected applicant will perform site inspections for PV projects after the installation has occurred. The evaluation items include, but are not limited to onsite panel shading, National Electrical Code compliance, system design and layout and customer satisfaction. In the case of pre-installation activities such as design reviews or site condition assessments, such work will be included under Task 3, Special Projects. All

inspections must be scheduled within five (5) business days from notice of the REF. All reasonable efforts must be made to conduct inspections in a timely manner.

Deliverables for inspections will be one (1) PV Site Inspection Report (see Attachment B) per project. Inspection reports are due to the REF within ten (10) business days after the inspection has been performed. All inspection reports are public documents and should be written in a professional manner.

2. TASK 2 – Inspections of Small Scale Solar Hot Water Projects

At the request of the REF, the selected applicant will perform site inspections for solar hot water projects after installation to evaluation items including but not limited to onsite panel shading, State Plumbing Code compliance, system design and layout, and customer satisfaction. Each inspection will result in one, final inspection report. A sample template for the deliverable report is included below as Attachment C. All inspections must be scheduled within five (5) business days from notice of the REF. All reasonable efforts must be made to conduct inspections in a timely manner.

The REF will work with the selected vendor to finalize an inspection template report. Once finalized, the REF will require the agreed upon template be used for all solar hot water inspections. Inspection reports are due to the REF within ten (10) business days after the inspection has been performed. All inspection reports are public documents and should be written in a professional manner.

3. TASK 3 – Inspection of Commercial Scale Solar PV Projects

At the request of the REF, the selected applicant will perform site inspections for PV projects, in most cases, after the installation has occurred. The evaluation items include, but are not limited to onsite panel shading, National Electrical Code compliance, system design and layout and customer satisfaction. In the case of pre-installation activities such as design reviews or site condition assessments, such work will be included under Task 3, Special Projects. All inspections must be scheduled within five (5) business days from notice of the REF. All reasonable efforts must be made to schedule inspections in a timely manner.

Deliverables for inspections will be one PV Site Inspection Report (see Attachment B) per project. Inspection reports are due to the REF within ten (10) business days after the inspection has been performed. All inspection reports are public documents and should be written in a professional manner.

4. TASK 4 – Special Projects

The REF may request work from selected vendor to assist with special projects. These could include devising post-installation protocols, pre-installation screening of technical designs (one or three line electrical diagrams, structural analysis, etc.) or providing guidance on shading analyses. All special projects will be requested in writing. Deliverables associated with special projects will be determined at the time of request. All special projects will be billed according to the agreed upon hourly rate.

5. TASK 5 – Trainings

The REF may request the vendor to conduct trainings on electrical, building or fire code to the solar industry, municipal inspectors and/or state inspectors. If the selected vendor has demonstrated the ability to perform these trainings and the REF is conducting such an event, the vendor will be notified in writing and arrangements made regarding topics, curriculum, and other planning process will be

determined at the time of the request. All trainings will be billed according to the agreed upon hourly rate.

SECTION III - PROPOSAL SUBMISSION & APPLICATION REQUIREMENTS

The Proposal must be submitted in the format described below, clearly labeling the sections as described. Please keep fonts to 11 point at a minimum, include page numbers, and limit the length of proposals to 20 pages as a maximum including all sections listed below:

- ❖ TITLE PAGE (1 page)
- ❖ AUTHORIZED APPLICANTS'S SIGNATURE AND ACCEPTANCE FORM (1 page)
- ❖ EXECUTIVE SUMMARY (1-2 pages)
- ❖ TECHNICAL PROPOSAL (4 pages minimum; 10 pages maximum including figures)
- ❖ QUALIFICATIONS & EXPERIENCE (5 pages or fewer)
- ❖ COST PROPOSAL (1 page)

1. TITLE PAGE

Rhode Island Commerce Corporation Renewable Energy Fund, "Renewable Energy Fund Project Inspector" Proposal, your company name, address, web site address, telephone number, fax number, e-mail address and primary contact person.

2. AUTHORIZED APPLICANT'S SIGNATURE AND ACCEPTANCE FORM

The Authorized Applicant's Signature and Acceptance Form will be signed by an owner, officer, or authorized agent of the firm or organization, acknowledging and accepting the terms and conditions of this Request, and tendering an offer to the Rhode Island Commerce Corporation. The signature of the official with authority to sign a contractual agreement should be included. Please see Attachment A for this template form.

3. EXECUTIVE SUMMARY

The Executive Summary will highlight the contents of the Technical Proposal and provide the review team with a broad understanding of the Applicant's technical approach and ability.

4. TECHNICAL PROPOSAL

Discuss your approach to the proposed scope of work. If you are applying to this Solicitation with a focus on one of the two technologies, please indicate this. Provide information on your experience and ability to perform inspections with one or both relevant technologies. Indicate your ability to complete the scope of work within the established timeframe.

5. QUALIFICATIONS & EXPERIENCE

Please provide the following:

- ❖ **Company Profile:** Provide information on history, length of time in business, organizational capacity & staff, core competencies. Include staff capacity and any other resources and capacity uniquely suited to the Applicant to complete the scope of work outlined in the RFP.
- ❖ **Reference Information:** Provide names, addresses, telephone numbers and permission to contact two former or current clients for which your organization has performed similar work outlined in the Scope of Work in the last two years.
- ❖ **Past Experience:** Describe your experience with similar work for governmental agencies and/or businesses in the New England region. Also, include details of any trainings your company has offered in the past to the solar industry, municipal inspectors, and/or building inspectors, including curriculum.
- ❖ **Examples of Prior Work:** If possible, reference two or three examples of previous projects that best display your work and outline the role your firm played in each project.
- ❖ **Staffing & Administration:** Please identify all staff and/or subcontractors proposed as members of the project team and the tasks they will perform on the account. Describe their duties, responsibilities, and concentration of effort applying to each (as well as resumes, curricula vitae or statements of prior experience and qualification). Please also include the estimated availability of staff and subcontractors to carry out the required Scope of Work in a timely manner. The REF reserves the right to investigate and review the background¹ of any or all personnel assigned to work under agreement for services and based on such investigations, to reject the use of any persons within the REF's discretion. Bids will be accepted from teams, but management of subcontractors will be the responsibility of the primary applicant, not the REF. Any changes to personnel require formal written approval by the REF and as such the REF reserves the right to terminate the contract if changes are not approved.

6. COST PROPOSAL

Please provide detailed information on rates of all team members associated with work referenced in tasks one through five outlined in the Section II. Travel time will be paid at half the hourly consulting rate. No indirect costs will be allowed (printing, film developing, phone charges, etc.). The hourly rates for staff that will or could potentially be associated with work on this effort must be included in the response to this Solicitation.

¹ Including the requirement of a National Background Search by the Attorney General's BCI Division.

SECTION IV – EVALUATION & SELECTION PROCESS

1. SCORING AND EVALULATION

The REF will evaluate and score all proposals. Responses from qualified candidates will be reviewed and evaluated according to the criteria outlined below.

Scoring Criteria	Description	Possible Points
Technical Proposal	<ul style="list-style-type: none"> - The quality of the Proposal demonstrates the candidate’s ability to provide quality inspections and provide technical support for the Rhode Island Renewable Energy Fund funded PV and Solar Hot Water projects - Applicant demonstrates an understanding of the concepts and motivators of the REF programs. - The applicant demonstrates an ability to write clearly and can communicate effectively. - The Applicant understand the REF programs 	4
Qualifications and Experience	<ul style="list-style-type: none"> - The candidate has completed similar projects and is qualified to undertake the scope of work outlined in the RFP. - References and prior work demonstrate the candidate’s ability to provide superior modeling analyses, technical support, and trainings. - Proposal shows clarity of team management structure, the availability of senior staff to supervise and contribute to the work, and ability to schedule and complete inspections in a timely fashion - The firm has personnel capacity and organizational resources well suited to the scope of the RFP 	4
Cost Proposal	<ul style="list-style-type: none"> - The applicant submits a reasonable and competitive pricing structure commensurate with the value offered 	2
<i>Total</i>		<i>10</i>

Proposals must attain a minimum score of 7 points to be considered. Proposals found to be technically or substantially non-responsive at any point in the evaluation process will be rejected and not considered further. Proposals that do not include all of the requirements will not be considered.

Only candidates submitting a Proposal in accordance with the criteria set forth above shall be eligible for evaluation. Each submitted Proposal meeting the administrative requirements will be evaluated by the REF and ranked from highest to lowest. Upon completion of the initial evaluation, candidates may be invited to participate

in an interview phase of the selection process. However, the REF Project Team reserves the right to make a selection and award the contract based on evaluation of the proposals without conducting formal interviews.

2. FUNDING AVAILABILITY

The anticipated budget range for this solicitation will be capped at \$40,000. Under no circumstances can the contract for fiscal year 2015 exceed \$40,000 without the written authorization by the REF.

3. ANTICIPATED TERM OF CONTRACT

A final contract is subject to successful negotiation of a final budget and scope of services. It is anticipated that the contract will commence on or about June 30, 2014 for a period of 12 month, until June 30, 2015. The contract will be reviewed during its course and may be extended at the sole discretion of the REF.

4. APPLICATION DEADLINE:

Applications to this Solicitation need to be submitted electronically and in hard copy. Responses to this Solicitation must be received by the REF no later than Tuesday, June 17, 2014 at 2pm. Hard copies must be received by June 17, 2014 to CommerceRI, 315 Iron Horse Way, Suite 101, Providence, RI 02908 Attn: Renewable Energy Fund Project Inspector. No electronic proposals time stamped by Commerce RI after this deadline will be accepted. The REF recommends that Applicants consider sending electronic submissions in advance of the 2pm deadline in case technical issues arise. Only complete responses will be considered. Applicants must submit their their responses electronically in accordance with the instructions described on page 2 of this Solicitation.

5. NOTICE OF PUBLIC DISCLOSURE

As a public entity, the Rhode Island Commerce Corporation is subject to Rhode Island's Access to Public Records Act (the Act). Any responses to this Solicitation are subject to Act (R.I.G.L. § 38-2-1 et seq). The public shall have the right to examine any pertinent documents, papers, records and books of the REF, including documents submitted in connection to this Solicitation.

6. CONTRACTUAL REQUIREMENTS

Upon REF authorization from the Rhode Island Commerce Corporation Board of Directors, the REF and the selected Applicant will execute a contract which will set forth the respective roles and responsibilities of parties.

7. WAIVER AUTHORITY

The REF reserves the right, at its sole discretion, to waive minor irregularities in submittal requirements, to request modifications of the application, to accept or reject any or all applications received, and/or cancel all or part of this Solicitation at any time prior to awards.

8. DISCLAIMER

This Solicitation does not commit the REF to award any funds, pay any costs incurred in preparing an application, or procure or contract for services or supplies. The REF reserves the right to accept or reject any or all

applications received, negotiate with all qualified applicants, cancel or modify the solicitation in part or in its entirety, or change the application guidelines when it is in its best interests.

SECTION V – TIMELINE

The following schedule describes the timeline for RFP release, proposal submission and review, evaluation and selection of vendor(s), and Proposal award. The REF reserves the right and latitude to modify this schedule as needed. Any revisions to this schedule would be posted the REF website.

Posted	Thursday , May 22, 2014
Deadline for Written Questions	Friday June 6, 2014 by 2:00pm
Final Question and Answer Posted	Tuesday, June 10, 2014 by 5:00pm
Applications due at Commerce RI	Tuesday June 17, 2014 by 2:00pm
Commerce RI Board Approval of Selected Vendor	Monday, June 23, 2014
Award Announced	Tuesday, June 24, 2014

ATTACHMENT A – AUTHORIZED APPLICANT’S SIGNATURE AND ACCEPTANCE FORM

Authorized Applicant’s Signature and Acceptance Form

The undersigned is a duly authorized representative of the applicant listed below. The Applicant has read and understands the Solicitation requirements. The undersigned acknowledges that all of the terms and conditions of the Solicitation are mandatory.

The Applicant understands that all materials submitted as part of the application are subject to disclosure under the Rhode Island’s Access to Public Records Act, as explained in Section IV.5 of the Solicitation, and acknowledges and agrees that the REF has no obligation, and retains the sole discretion to fund or choose not to fund the application set forth herein, and that REF’s receipt of the application does not imply any promise of funding at any time.

The Applicant understands that, if selected by the REF and approved by the Rhode Island Commerce Corporation Board of Directors, the Applicant and the REF will detail and execute a contract that outlines the respective roles and responsibilities of the parties.

I certify that the statements made in this application, including all attachments and exhibits, are true and correct to the best of my knowledge.

Applicant: (Printed Name of Applicant)

By: (Signature of Authorized Representative)

Name:

Title:

Date:

ATTACHMENT B – REF SOLAR PV INSPECTION REPORT TEMPLATE

REF SOLAR PV SYSTEM POST INSTALLATION INSPECTION REPORT

Owner of PV System:
Developer/Installer:
Lead Reviewer:
Report Reviewed By:
Submission to REF Date:

Scope and Purpose

The purpose of this report is to present the findings of a post installation inspection conducted on the PV system described in the REF Small Scale or Commercial application, and supporting documentation. This review will, to the extent possible, attempt to ascertain the system’s compliance with the REF program Rules and Regulations as well as:

- Compliance with appropriate edition of Rhode Island Electric Code requirements
- Accuracy of shading/energy production analysis
- Use of UL listed new equipment

Table 1: Overview of Application Compliance		
Requirement	Satisfactory (Y/N)	Comments
Energy Output Estimate Accurate		
Compliant with electrical requirements (as installed)		
Compliant with electrical code requirements (as modified)		
Installation Meets REF Program Requirements		
Application accurately reflects equipment installed		

Overall Findings and Recommendations:

System Description:

Design Review Findings:

Inspection Findings:

Output/Shading Analysis Review:

Table 2: System Output/Shading Analysis Review		
Requirement	Satisfactory (Y/N)	Comments
Shading Analysis Complete		
Energy Production Estimate Accurate		
Calculation Method Reasonable		
Information in application matches what was installed		

Electrical Design Review²

Table 3: Electrical Design Review Findings		
Component/Criteria	Value	Comments
PV Modules		
Manufacturer		
Model		
Quantity		
UL listed		
Series Fuses Present/Sufficient		
DC Wiring		
Wire Used		
Ampacity Sufficient		
Color Code Correctly Followed		
Rated for Application		
DC Disconnect		
Sufficient Rating for Application		
Wired Correctly?		
Labeling Requirement Met		
Inverter		
Manufacturer		
Model		
Quantity		
Sufficient for Application		
Labeling Requirement Met		
AC Disconnect		
Labeling Requirement Noted		
Sufficient Rating for Application		
Backfeed Breaker		
Labeling Requirement Noted		
Within Limits of Main Bus Bar		
Sufficient for Application		
Grounding		
DC System Ground Correct		
Equipment Ground Correct		

² This table may be amended should Rhode Island adopt the 2014 National Electrical Code standard.

Disclaimer

This design review/inspection is completed in good faith based on submitted documentation, onsite observations/measurements, and other information received from the REF, the system installer, and/or other sources. The results of this review are intended to verify that the system, as designed, will meet the requirements of the REF program Rules and Regulations. The reviewer makes no warranty for the design and installation of the system under review and assumes no liability for the reviewed system's operation and/or performance.

Questions or comments regarding this review may be directed to:

Contact Information:

**ATTACHMENT C – PROPOSED TEMPLATE FOR SOLAR HOT WATER INSPECTION
REPORT**

Proposed Template: REF Solar Hot Water System Inspection

Installation owner:	Address:	Date:
	Back-Up Fuel Source (Gas or Electric):	Inspector:

Proposed Template: REF Solar Hot Water System Inspection

Inspection Item	Explanation	Inspection Findings: Pass or Fail (Explanation required for failure)
Operating Limits	<p>Means shall be provided to protect the Solar Hot Water (“SWH”) system within the design limits of temperature and pressure. Limit tank temperatures to a value not to exceed the tank supplier's specified high temperature limit (<i>unless using emergency stagnation prevention cycling.</i>) The pressure/temperature relief valve shall not be used for this purpose under normal operating circumstances. <i>Emergency stagnation prevention cycling is when the controller cycles the solar loop pump on and off during the day to allow the tank temperature to rise above the high temperature limit in order to prevent stagnation in the collector.</i></p> <p>The system shall be able to withstand prolonged periods of stagnation (high solar flux, no hot water demand) without significant system deterioration and with no maintenance. This includes conditions during loss of electrical power to the system. <i>Acceptable overheat control mechanisms are:</i></p> <p><i>Controller with "Vacation Mode" or with stagnation prevention cycling mode,</i></p> <p><i>Steam Back Heat dump radiator or convector,</i></p> <p><i>Pressure Stagnation Protection,</i></p> <p><i>Integral Stagnation Temperature Control,</i></p> <p><i>Hartgard Thermosiphon Protection</i></p>	
Freeze Protection Measure	<p>Protection from freeze damage under the most severe environmental conditions that can be expected in actual use shall be provided for all system components containing heat transfer fluids. The supplier of each system shall specify the limit ("Freeze Tolerance Limit") to the system's tolerance of freezing weather conditions. At least one freeze protection mechanism, in addition to manual intervention, shall be designed to protect components from freeze damage, even in the event of power failure. At the time of installation, a conspicuously placed label explaining how the system is protected from freezing and what actions the homeowner should take to protect the system is required.</p>	

Glycol systems: pressure gauge	<i>A pressure gauge showing minimum acceptable collector loop pressure shall be provided.</i>	
Drainback: water level gauge	<i>A water level gauge or a properly installed transparent in-line flowmeter shall be installed.</i>	
Protection from UV Radiation	Components or materials shall not be affected by exposure to sunlight to an extent that will significantly deteriorate their function during their design life. <i>Insulation must be protected from UV by jacketing or at least two coats of the insulation manufacturer's recommended UV coating.</i>	
Back Thermosyphon Prevention	Means shall be provided to prevent undesired escape from storage through thermosyphoning action. <i>Acceptable means are check valves, solenoid valves, and/or 18" heat traps.</i>	
Protection from Leaks	All potable water sections of a solar water heating system shall not leak when tested in accordance with the codes in force at the installation site. All non-potable sections of a solar water heating system shall be tested for leaks in accordance with the supplier's instructions.	
Shade	No more than 90% annual shading is allowed on the solar collectors between the hours of 9am and 3pm.	Shading %:
Collector Flow Rate	In multiple collector arrays the instantaneous flow rate variation between collectors shall not exceed 10% of the array average flow. When an array of collectors is connected by manifolds to form a parallel flow configuration, provision shall be incorporated in the manifold and/or collectors to maintain the proper design flow rate of the heat transfer fluid through each collector.	
Water Damage	Collectors and support shall be installed in such a manner that water flowing off the collector surface <i>or from the pressure relief valve</i> shall not damage the building or cause premature erosion of the roof. Water tanks located in or above the living space shall be installed on a drip pan with a drain line to a waste or outside or have other means to safely remove any excess liquid.	
Solar Tank	Both pressurized and non-pressurized tanks shall meet the requirements set by a nationally accepted standard setting organization. Non-pressurized tanks shall be vented to atmospheric pressure.	Capacity: Manufacturer: Model:
Waterproofing	Underground and above ground unsheltered storage tanks shall be waterproofed to prevent water seepage. <i>Storage tanks used outdoors shall be rated for outdoor use.</i>	
Collector Circulation Control	The collector subsystem control shall be designed to be compatible with control requirements of the system.	
Control Line and Sensors	All wires and connections, sensors, pneumatic lines, hydraulic lines or other means for transmitting sensor outputs to control devices shall be sufficiently protected from degradation or from introducing false signals as a result of environmental influence such as wind, moisture, temperature or other factors which may alter their intended sensing function. Weather-exposed wiring must be rated sunlight and moisture resistant and comply with NEC Articles 340 and 690. <i>Sensor wiring shall be separated from hot</i>	

	<i>collector piping and shall be protected from UV.</i>	
Temperature Control/Mixing Valve	The system shall be equipped with a mixing valve to limit scalding temperature water to the end-users. <i>Acceptable means are: Properly installed mixing valves or ASSE anti-scald valves with a set point option appropriate for use. Other ASSE rated anti-scald valves such as point-of-use anti-scald valves</i>	
Insulation	<i>All interconnecting hot water piping and the final 5 feet of metallic cold water supply pipe leading to the system, or the length of piping which is accessible if less than 5 feet, shall be insulated with R-2.6 °F-ft²-hr/Btu or greater insulation. All exterior piping insulation shall be at least 3/4" thick wall, rated for the temperatures expected, and protected from UV or moisture damage. Systems with recirculation loops must insulate all accessible piping with a minimum of R2.6 value insulation. This includes the hot supply line from the auxiliary water heater to the farthest accessible point of use and the return line from the farthest accessible point of use back to the auxiliary water heater.</i>	
Owner's Manual	An owner's manual or manuals shall be provided with each SHW system. The manual shall contain the name, phone number and address of the system supplier, the system model name or number and shall describe the operation of the system and its components and the procedures for installation, operation and maintenance. The manual shall include a comprehensive plan for maintaining the specified performance of the SHW system. The plan shall include a schedule and description of procedures for ordinary and preventive maintenance including cleaning of collector exterior surfaces. The manual shall include minor repairs and give the projections for equipment replacement.	
Glycol Systems	<i>Glycol Systems Owner's Manuals shall, among normal matters, recommend the next date when the glycol should be tested.</i>	
Drain Back Systems	<i>Drain Back Systems Owner's Manuals shall recommend regular checking by the homeowner of the water level.</i>	
Solar Loop Isolation	Isolation/bypass valves must be installed to allow the system owner to bypass the solar storage tank in the case of a 2-tank system, or to shut off the cold water supply to the solar tank in a 1-tank system. All isolation valves shall be labeled with their normal operating position indicated.	
Entrapped Air	Suitable means of air or gas removal from all high points in the piping system and any other location where air is most likely to accumulate shall be provided. The method of removal shall be appropriate for the system type.	

Pressure Relief	Each portion of the system where excessive pressures can develop shall have a pressure relief device to ensure that no section can be valved off or otherwise isolated from a relief device. Automatic pressure relief devices shall be set to open at not more than maximum design pressure, <i>or as limited by code.</i>	
Operating Indicators	The SHW systems shall include means for an observer to determine readily that the system is operating properly and providing solar heated water. <i>As a minimum, a temperature indication is required for the solar storage tank.</i>	
Fluid Safety Labeling	Labels shall mark all drain and fill valves in the SWH system. Each label shall identify the fluid in that loop. The location of fluid handling instructions shall be referenced. The label shall list the heat exchanger type and heat transfer fluid class as defined by the American Water Works Association, Cross Connection Control Manual. (<i>Water is Class I. Propylene Glycol is Class II.</i>) The label shall include a warning that fluid may be discharged at a high temperature and/or pressure. The label shall contain the following warning: "No other fluid shall be used that would change the original classification of this system. Unauthorized alterations to this system could result in a hazardous health condition."	
Rain and Snow on Collector	The location, orientation, and position of the collector surface relative to nearby objects and surfaces shall be such that water run-off from the collector surface is not impeded nor is excessive build-up of snow on lower portions of the collector glazing permitted to occur.	
Expansion Tank	Expansion tanks shall be sized in accordance with <i>manufacturer's instructions or ASHRAE methods.</i>	
Pumps and Control	Pumps and controllers shall be those listed in the Installation Manual.	
Water Shut-Off	The SWH system shall be valved to provide for shut-off from the service water supply without interrupting normal cold water service to the residence.	
Service Connections and Permanent Maintenance Accessories	Suitable connections and permanent maintenance accessories shall be provided at readily accessible locations for filling, draining and flushing liquid systems.	
Buried Components	Solar components and materials that are intended to be buried in soils shall be protected from degradation under in-service conditions to insure that their function shall not be impaired. <i>Use proper jacketing and flashing to prevent rain penetration.</i>	
Pipe and Component Supports	Hangers shall provide adequate support and correct pitch of pipes. Hangers or supports for insulated pipes or components shall be designed to avoid compressing or damaging the insulation material.	
Pitch or Angle of Piping Installation	Piping should be sloped toward drain ports with a drainage slope of no less than 1/4 inch per foot.	
Thermal Expansion	The system design, components and subassemblies shall include adequate provisions for the thermal contraction and expansion of heat transfer fluids and system components that will occur over the design temperature range.	

Building Penetrations	Penetrations of the building through which piping or wiring is passed shall not reduce or impair the function of the enclosure. Penetrations through walls or other surfaces shall not allow intrusion by insects and/or vermin. Required roof penetrations shall be made in accordance with applicable codes and also practices recommended by the National Roofing Contractors Association.	
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