CSD Weatherization Installation Standards

A CSD Weatherization Programs Document

Effective 10/1/2017

This Manual contains the specifications for proper installation of weatherization measures and criteria to judge if safety considerations are met.

CSD standards are divided into the following sections:

- Procedures for proper site preparation and clean-up requirements;
- Specific installation and repair requirements for single-family, multi-family, and manufactured housing; and
- Quality control metrics to judge acceptable installation.

Use of these installation standards ensures that quality measure installation practices are uniform across the state and in compliance with applicable local, state, and national codes.

This manual shall be applied to CSD's
DOE, LIHEAP, and ECIP EHCS Programs *only*.
Other CSD Programs shall be guided by separate manuals.

California Department of Community Services and Development
Energy Services Division
2389 Gateway Oaks Drive, Suite 100, Sacramento, CA 95833

WEATHERIZATION INSTALLATION STANDARDS

Prepared for:
California Department of
Community Services and Development (CSD)

For use by**:**
Installation Crews
Inspectors
and the Weatherization Community

Prepared by:
RHA, Inc.

INTRODUCTION

This manual provides written standards for the installation and post-inspection of weatherization measures installed under those energy conservation programs administered by the California Department of Community Services and Development (CSD). They apply to the Low-Income Home Energy Assistance Program (LIHEAP), the Energy Crisis Intervention Program (ECIP) Emergency Heating and Cooling Services (EHCS), and the DOE Weatherization Assistance Program (WAP).

This guide to the installation and inspection of weatherization measures provides uniform, objective, clearly written, and illustrated standards. The standards serve as a benchmark for defining quality workmanship and a tool for measuring quality performance. As such, this user-friendly guide can serve as a valuable resource when defining performance elements, when training workers, and when inspecting completed dwelling units.

In preparation of the guide, numerous regulations, codes, standards, training manuals, and manufacturers' specifications were reviewed. The standards are intended to meet or exceed existing codes and regulations, and conform to accepted building practices. When a conflict exists between this issue of the standards and local codes, the more stringent requirement shall take precedence.

This manual addresses weatherization of both conventional (site-built) dwellings and manufactured housing.

The research and preparation of this document has been provided by Richard Heath and Associates under contract to CSD. In order to keep the manual current, CSD welcomes your comments on an ongoing basis.

Please address comments to:

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HEALTH & SAFETY REQUIREMENTS

1.0 INTRODUCTION

These Health and Safety Requirements provide policies and practices applicable to the Weatherization Program administered by the California Department of Community Services and Development (CSD).

It is CSD's goal that their energy efficiency programs enhance clients' quality of life without creating an adverse condition in the home, and that Agencies conduct all weatherization-related activities in a manner that ensures the health and safety of both workers and occupants. CSD's Health and Safety Plan provides policies and guidelines for meeting that goal. It is therefore critically important that all Agency personnel understand and follow this plan.

2.0 HEALTH AND SAFETY REQUIREMENTS OVERVIEW

2.1 PURPOSE

Health and safety is of utmost concern to the California Department of Community Services and Development (CSD). This CSD Health and Safety (H&S) Requirements document puts in place policies to ensure the health and safety of weatherization workers and weatherization clients. Agencies are reminded that the primary goal of the CSD Weatherization Programs is energy efficiency; however, and as such, measures and their costs must be reasonable and must not seriously impair the primary energy conservation purpose of the program.

The CSD H&S Requirements do not replace federal, state, or local health and safety regulations. Rather, it supplements them—as well as the hazard mitigation provisions of the CSD Weatherization Service Provider Contracts. The CSD H&S Requirements document references established regulations, primarily the California Occupation Safety and Health (Cal/OSHA) Construction Safety Orders, and outlines complementary health and safety practices specific to weatherization activities.

2.2 GENERAL POLICIES

CSD weatherization agencies and their subcontractors must follow all applicable laws and regulations pertaining to worker safety. In addition, workers shall take all reasonable precautions against performing work on homes that will subject workers or clients to health and/or safety risks. Agency staff and their subcontractors that perform weatherization work must be aware and knowledgeable of the interaction between weatherization activities and how home systems function interactively.

The health and safety of clients and the integrity of building structures must not be compromised by the installation of weatherization measures. During weatherization, all activities shall be conducted in conformance with Cal/OSHA and all other applicable regulations—in a manner that is safe for workers, occupants, and any others potentially at risk (e.g., visitors, neighbors, pets, etc.).

Each network agency and subcontractor, not CSD, is responsible for the health and safety of its workers. Worker safety is regulated by Cal/OSHA under Title 8 of the California Code of Regulations, the Health & Safety Code by the State Department of Health Services, Division of Occupational Safety and Health, and the Department of Industrial Relations under state law.

All agencies shall develop their own individualized Health and Safety Plans, which contain—at a minimum—all components included in this CSD Health and Safety Requirements document, and including an Injury and Illness Prevention Plan in conformance with Cal/OSHA requirements. Each agency is required to provide a current copy of its plan to be kept on file with CSD.

2.3 Mitigation of Health and Safety Concerns

It is CSD's policy that weatherization agencies aid clients, to the extent possible under the constraints of weatherization funding sources and program guidelines, to maintain a safe and healthy home in which to live. In addition, CSD requires agencies to "do no harm" to residents and their property while conducting weatherization activities at the client's home and includes possible health effects of materials installed in the home.

As part of the weatherization process, assessment workers and installation crews must determine whether there exist potential hazards to workers and/or clients. However, workers shall not conduct an assessment of any structure when such activity will expose the worker or client to conditions regarded as unsafe or unhealthy as outlined in the:

- CSD Weatherization Installation Standards (WIS).
- CSD Field Guide.
- Cal/OSHA Title 8 Construction Safety Orders.

3.0 AGENCY AND SUBCONTRACTOR SAFETY REQUIREMENTS

The responsibility for Health and Safety practices and enforcement rests with each network agency and their subcontractors providing weatherization services under the CSD Weatherization Programs. All employees of agencies and subcontractors are expected to work under conditions that do not jeopardize worker health and safety and protects the health and safety of clients. This includes all program work that occurs in the offices, shops, warehouses, and individual job sites where weatherization activities take place.

All agencies and subcontractors shall ensure a safe working environment for all employees. Workplace safety practices shall include, at a minimum, those listed in this section and its subsections as noted. All activities must meet the safety provisions of state codes and regulations, including:

- California Labor Code (Department of Occupational Safety and Health)
- State Health and Safety Code
- The Safe Drinking Water and Toxic Enforcement Act of 1986 (California Proposition 65)
- Business and Professions Code (licensing requirements)
- Building codes (buildings, electrical, and plumbing)

3.1 CAL/OSHA Requirements

In California, every employer is required by law (Labor Code Section) to provide a safe and healthful workplace for his/her employees. The Department of Energy contracts require that all agency employees and subcontractors performing services under the CSD Weatherization Program shall follow the requirements of the Construction Industry Occupational Safety and Health Act (Cal/OSHA Title 8 Construction Safety Orders). However, in California, federal OSHA requirements are classified under the state's Department of Industrial Relations, Division of Occupational Safety and Health (DOSH or Cal/OSHA) under Title 8 of the California Code of Regulations. Cal/OSHA

statutes are required to be used in California as many of the federal OSHA regulations have been modified to meet California's work environment. Complying with Cal/OSHA requirements ensures automatic compliance with the federal OSHA standards.

The following are the major Cal/OSHA programs (all Cal/OSHA standards require a written component for compliance that must be on file in the agency's records) that must be written documents that each agency must have on file:

- Injury and Illness Prevention Program (IIPP)
- Hazard Communication (HazCom) Program
- Respirator Protection Program (RPP)

3.1.1 Injury and Illness Prevention Program (IIPP)

Title 8 (T8), of the California Code of Regulations (CCR), requires every California employer to have an "effective" Injury and Illness Prevention Program (IIPP) in writing that must be in accord with T8 CCR Section 3203 of the General Industry Safety Orders and for those in the construction field, with the Construction Safety Orders, Sec. 1509.

An Injury and Illness Prevention Program must be a written plan that includes procedures and is put into practice. These elements are required:

- Management commitment/assignment of responsibilities;
- Safety communications system with employees;
- System for assuring employee compliance with safe work practices;
- Scheduled inspections/evaluation system;
- Accident investigation;
- Procedures for correcting unsafe/unhealthy conditions;
- Safety and health training and instruction; and
- Recordkeeping and documentation.

Agencies shall ensure that any subcontractors hired to perform any portion of the Work within this program shall have an effective Injury and Illness Prevention Program in place prior to the initiation of the work (For development guidelines, see the Cal/OSHA eTool at: http://www.dir.ca.gov/dosh/etools/09-031/). The person with the authority and responsibility for implementing and administering such Injury and Illness and Prevention Program shall execute a Compliance Certificate.

At a minimum, Agencies (all employers) shall do the following to safeguard workers:

- Comply with the applicable provisions of Cal/OSHA regulations, including but not limited to Section 6401.7 of the California Labor Code.
- Have in place an Injury and Illness Prevention Program (IIPP), per Cal/OSHA Construction Safety Orders, Article 3, §1509, which requires employers to:
  - Establish, implement and maintain an effective Injury and Illness Prevention Program.
  - Adopt a written Code of Safe Practices, which relates to the employer's operations.
  - Post the Code of Safe Practices at a conspicuous location at each job site office or provide it to each supervisory employee, who shall have it readily available.

  - Hold periodic meetings of supervisory employees under the direction of management for the discussion of safety problems and accidents that have occurred.
  - Conduct “toolbox” or “tailgate” safety meetings, or equivalent, with crews at least every 10 working days to emphasize safety. These meetings are to be conducted by supervisory personnel, and meeting rosters will be provided to CSD containing attendee names and the meeting topic.

- Perform an inspection/assessment of each weatherization job site to identify existing and potential health and safety concerns affecting worker safety.
- Follow the Weatherization Deferral Protocol specified in Section 7.0 of this document when worker health and safety is an issue due to the presence of one or more unsafe or hazardous conditions that cannot be remedied under the Weatherization Program.

3.1.2 Hazardous Communication Program

The hazard communication regulation requires employers (agencies and subcontractors) to inform their employees of the hazardous substances to which they are exposed at the job site. Requirements for developing, implementing, and maintaining a hazard communication program are found in Title 8 of the California Code of Regulations (T8 CCR), Section 5194. Subsection 5194(b)(6) contains the Safe Drinking Water and Toxic Enforcement Act (Proposition 65), which was added to the original hazard communication regulation in 1991. All agencies and subcontractors are required to comply with the HazCom standard and must have a written hazardous communication program in place. According to Cal/OSHA, a HazCom Program must be written and include:

a) A list of the hazardous substances that are used or stored in the workplace. Hazardous substances that require a HazCom program are:
   - Any substance that is a physical or a health hazard.
   - Any listed hazardous substance.
   - Labels and other forms of warning on containers of hazardous substances.
   - Readily accessible Safety Data Sheets (SDS).
   - Procedures for safe handling, use, storage, disposal, and clean-up to protect employees.

b) Training on the hazardous substances that employees are or could be exposed to in the workplace.

c) A plan for managing multi-employer worksite issues.

d) A plan for periodically (e.g., annually) evaluating the effectiveness of the program and for updating the program.

Employers shall provide employees with effective information and training on hazardous chemicals in their work area at the time of their initial assignment and whenever a new chemical hazard is introduced into their work area.

Materials used in the workplace are required to have Safety Data Sheets (SDS) that provide information such as health hazards; special chemical and physical characteristics; protective measures; and precautions for safe handling, use, and storage of each chemical. Information contained in SDS changes over time; therefore, SDSs should be updated annually to ensure that employees are provided with the most current version.

Safety Data Sheets (SDS) for all materials used in the program shall be kept on file at the central office and in every vehicle used by personnel performing weatherization work for the contractor.

The file shall remain at the job site for the duration of all work to ensure that all employees have immediate access to the safety information.

Storage containers of hazardous materials shall be clearly labeled to identify the contents and to show appropriate hazard warnings for employee protection.

3.1.3 Respirator Protection Program

Given the nature of weatherization work, the use of a respirator by weatherization workers is occasionally a necessity for worker health and safety and to improve job performance. However, improper and inappropriate use of respirators can result in worker injury and death.

Particulates like lead-based paint dust, asbestos, fiberglass fibers, cellulose, and other dusts are present on a weatherization job and require the use of a particulate filtered respirator. Once regarded as simple, unregulated breathing protection device, the “dust mask” is now considered a “filtered facepiece respirator,” and agencies that provide them to their workers must now comply with Cal/OSHA T8 Sec. 5144 and have a written respirator protection program in place.

The use of respirators should be “last resort” safety device and everything that can be done to reduce or eliminate the need for a respirator must be done first before they are issued or required to be worn by workers. This means that work practices, engineering controls, and administrative practices must be used, when feasible, before the need for a respirator is determined.

The employer (agency or subcontractor) is required to assess the workplace for respiratory hazards and then make a determination as to what type of respiratory protection is required to meet the health needs of workers. If materials being used have an SDS, this document will describe the respirator type and filtration needed to safely work with the material. If the determination is made that no respiratory hazards exist and the use of respirators is not required, a worker can voluntarily use a respirator that the agency provides or they provide themselves.

Typically on a weatherization project the following may be present:

Material/Chemical	Required Filtration	Type of Respirator
• Lead-based paint dust • Asbestos	-100 series particulate filters (P, N, R)	Half-face air-purifying respirator
• Fiberglass • Cellulose • Dusts	-97 or -95 particulate filters (P, N, R)	Half-face air-purifying respirator Filtered face piece
• Hydrocarbons (solvents, cleaners, etc.) • Odors	Charcoal filtered*	Half-face air-purifying respirator
• Unidentified particulates	-100 series particulate filters (P, N, R)	Half-face air-purifying respirator
• Unidentified odors and gasses	Defer—possible IDLH** situation.	Full face, pressure demand, self-contained breathing apparatus (SCBA)

Material/Chemical	Required Filtration	Type of Respirator
• Low pressure, 2-component, spray polyurethane foam (SPF)*	Organic vapor cartridge and P-100 particulate filter	Half-face air-purifying respirator
• High-pressure SPF insulation*		Supply Air Respirator (SAR)
*Check SDS for filtration requirements first. **"Immediately dangerous to life and health."		

Before issuing respirators, workers must be medically assessed to make sure they can wear a respirator without causing breathing problems, fit tested for the respirator type, and trained in the proper care and usage of respirators.

The written respirator program must include the following:

- Respirator selection
- Medical evaluations
- Fit testing
- Use of respirators
- Maintenance and care of respirators
- Breathing air quality and use
- Training and information
- Program evaluation

3.1.4 Safety Training

Employee training is vitally important in maintaining a safe and healthy workplace. Cal/OSHA requires general workplace safety training for all employees and specific training based on the listed training component of each Cal/OSHA regulation required to be followed on the worksite. Each contractor has the obligation and requirement to provide safety training to their employees on an ongoing basis. For example, before issuing a worker a respirator of any type, a respirator training session is required. Before using any material that has an SDS (Safety Data Sheet), workers must undergo hazardous communication training on the specific SDS.

According to Cal/OSHA, "the Injury and Illness Prevention Program shall identify training needs and establish clear goals and objectives. Safety training shall be presented in a format that closely simulates the actual job and allows employees to clearly demonstrate that they have acquired desired practices and knowledge."

All agency supervisory personnel, weatherization crews, and subcontractors shall be knowledgeable regarding the laws pertaining to construction activities with regard to safety and hazardous materials. Weatherization agencies and their subcontractors are responsible for providing health and safety training for field personnel. All field personnel (assessors, installers, and inspectors) shall participate in health and safety training and follow established safety practices. A health and safety training program shall be designed and implemented to provide:

- All new employees with training before they enter the field for the first time, and
- All employees with regular periodic training.

When an unfamiliar working condition is encountered for the first time, a safety meeting shall be held on the first day of work to cover all new conditions/hazards and applicable safety procedures.

Because of the wide range of activities involved in weatherizing a house, tailgate meetings shall cover a broad range of appropriate Cal/OSHA topics and requirements. Some of these requirements include, but are not limited to:

- Personal protective equipment (PPE),
- Techniques for safely lifting heavy objects,
- Hand and power tool safety,
- Slips, trips, and falls safety training,
- Electrical equipment safety,
- Ladder safety, and
- General worker protection.

Cal/OSHA standards should be consulted for further topic ideas. Other useful information includes Safety Data Sheets that identify potential health risks and describe the proper use, handling, and storage of many common weatherization materials. They also may address first aid measures.

A meeting agenda and/or minutes shall be kept to document (1) the date and location of training, (2) synopsis of subject matter covered, and (3) the names of participants. Signatures of persons in attendance shall be included. These agendas and sign-in sheets shall be kept on file at the agency and with CSD, and all safety records are subject to review by CSD staff upon request.

The safety program shall include periodic evaluations by agencies to determine its effectiveness, with the evaluations being used to improve the program.

3.1.5 10- and 30-hour OSHA Training

To make it easier for workers to be trained with all the basic safety information, a number of training providers have developed, in conjunction with OSHA and the Department of Labor, standardized training programs. These programs—either the entry-level 10-Hour OSHA Safety Training for Construction, or the 30-Hour Training for supervisors/competent persons— provide a general safety background for workers in the construction industry. While the 10-hour or 30-hour training programs are not required by Cal/OSHA, they are required within the Department of Energy weatherization program.

Typically, the 10-Hour Training for all field workers includes:

- Introduction to Cal/OSHA
- Material Handling
- Tools—Hand and Power
- Scaffolds
- Stairways and Ladders
- Excavations
- Electrical
- PPE
- Fall Protection
- Cranes

There is also a 30-Hour Training program available for supervisory personnel in the field that includes many of the items listed below:

- Introduction to Cal/OSHA and the OSH Act
- Recordkeeping
- Basic Safety Orientation
- General Safety and Health Provisions
- Health Hazards: Hazard Communication
- Health Hazards: Hazardous Materials
- Process Safety Management (PSM)
- Personal Protective Equipment (PPE)
- Fire Protection
- Materials Handling and Storage
- Hand and Power Tools
- Welding and Cutting
- Electrical Safety
- Fall Protection
- Cranes and Rigging
- Motor Vehicles
- Excavations
- Concrete and Masonry Construction
- Stairways and Ladders
- Confined Spaces
- Lead Safety in the Workplace
- Scaffolds

3.2 CONFINED SPACE COMPLIANCE

On or after January 1, 2016, Cal/OSHA implemented the standard CCR, T8, 1950-1962 related to confined spaces. This standard is in effect as of this date and will be enforced for agencies and subcontractors in conformance with this standard. A copy of the standard components is provided at: http://www.dir.ca.gov/Title8/sb4a37.html. CSD strongly recommends that regular checks to this site be made by agencies and contractors, since new training materials continue to be made available.

The standard is intended to protect employees from hazards related to confined spaces exposure in the construction industry (Section 5158). Employers are required to: 1) determine if there is a confined space, and if so, 2) evaluate the associated hazards and implement specific procedures to protect workers. The level of action is dependent upon whether the space is a “permit-required confined space” or “confined space” only.

A “Confined Space,” in CAL/OSHA is defined as the concurrent existence of the following conditions:

1. The space is big enough to enter but not intended for regular occupancy,
2. Existing ventilation is insufficient to remove dangerous air contamination, oxygen enrichment and/or oxygen deficiency, which may exist or develop.

3. Ready access or egress for the removal of a suddenly disabled employee is difficult due to the location and/or size of the opening(s).

As defined, a “Permit-Required Confined Space” meets one or more of the following conditions: a) hazardous or potentially hazardous atmosphere, b) engulfment hazard, c) physical hazard, and/or d) other serious safety or health hazard. These definitions may apply to attics, chases, and crawlspaces; therefore, confined space safety practices must be observed:

- Confined spaces (attics, crawlspace) shall be inspected for safety hazards prior to work activities.
- Adequate ventilation shall be supplied to confined areas, such as attics and crawlspaces.
- Access and egress points will be located before beginning work.
- Use of toxic materials in confined spaces will be reduced or eliminated.

When an attic or crawlspace is determined to be a Permit-Required Confined Space, Cal/OSHA requirements must be met. These requirements include:

- On-site evaluation of the worksite by a “competent person” (an OSHA-defined descriptor)
- OSHA-compliant documentation,
- Hazards evaluation and corrective procedures,
- Training of personnel,
- Personal protective equipment,
- Defined rescue/emergency procedures,
- Posting of OSHA permit,
- Annual permits review, and
- One qualified attendant to stand by the entrance of the work zone (with entry gear) who is trained in first aid and cardiopulmonary resuscitation, plus one additional employee (who may have other duties) within sight or call of the standby employee(s).

These requirements may impact many CSD weatherization measures and also may require planning and reallocation of personnel.

Agencies and subcontractors will be responsible for complying with all Confined Space requirements at each worksite. Additional information can be found on the Cal/OSHA website at http://www.dir.ca.gov/dosh/Confined_Space_Emphasis_Program.html.

3.3 PROPOSITION 65

Proposition 65 (Prop 65), the Safe Drinking Water and Toxic Enforcement Act of 1986, was voted into law by California voters to address concerns about toxic chemicals. It requires the state to publish a list of chemicals known to cause cancer or birth defects or other reproductive harm. This list, which must be updated at least once a year, has grown to include approximately 800 chemicals since it was first published in 1987. Proposition 65 does not restrict the usage of any of these chemicals, only providing awareness of their presence in residences and/or workplaces.

3.3.1 Prop 65 Requirements

The “Right to Know” warning requirement in Prop 65 mandates that a “clear and reasonable warning” be given to all individuals prior to exposure to any listed chemical that can cause cancer, birth defects, or other reproductive harm. Businesses (agencies and their subcontractors) that

have one or more of the listed chemicals in the workplace as an ingredient in a material they use, a product they manufacture, and/or an emission into the environment must provide a clear and reasonable warning to workers and the public, unless they can prove that the exposure causes no significant risk.

The language in the warning must clearly state that the chemical in question is known to cause cancer, birth defects, or other reproductive harm. The warning must be given so that it effectively reaches the person before he/she is exposed. Under Prop 65, warnings are required for:

1. Consumer product exposures.
2. Occupational exposures.
3. Environmental exposures.

Warnings for exposure in the workplace shall be posted by one, or a combination, of the following methods:

1. A warning on a product label.
2. A warning or sign posted conspicuously in the workplace.
3. A warning that complies with the federal OSHA “Hazard Communication Regulation” (29 CFR, Section 1910.1200), the California “Hazard Communication Regulation” (T8 CCR, Section 5194), the “Pesticides and Worker Safety Requirements” (T3 CCR, Ch. 6, Subchapter 3, Group 3, Section 6700).

3.3.2 Prop 65 Exemptions

Businesses with less than 10 employees and government agencies are exempt from Prop 65 requirements. Businesses are also exempt from the warning requirement and discharge prohibition if the exposures they cause are so low as to create no significant risk of cancer or birth defects or other reproductive harm.

3.3.3 Weatherization and Prop 65

It is <u>not</u> the intent of Prop 65 to inform homeowners of the Prop 65 listed chemicals that may be discovered while an agency (business) is working in, or on, a residence, such as lead-based paint or asbestos. *The agency is responsible for informing the homeowner of only those listed chemicals they knowingly bring into the residence, such as fiberglass insulation or solvents*.

The following list of Prop 65 chemicals may be found in the weatherization process and there may be others. Contractors should check the list of ingredients on the product or in the SDS (Safety Data Sheet) and compare them to the Prop 65 list. If any materials are to be installed that contain chemicals that are Prop 65 listed, then the contractor must provide a “warning” to the occupants before starting the job and review the SDS with workers.

The following chemicals/products may be found on a weatherization worksite:

- Benzene (solvent)
- Butadiene (ABS)
- Carbon monoxide
- Ethyl chloride (binding agent in paints and other similar materials)
- Formaldehyde (binding agent in fiberglass insulation and particle board)
- Glass wool fibers (fiberglass)
- Methyl chloride (blowing agent in polystyrene foam, refrigerant)

- Methyl isobutyl ketone (solvent)
- Naphthalene (drywall)
- Toluene (solvent)
- Trichloroethylene (solvent, refrigerant)
- Urethane (insulation)
- Lead-containing paint chips or dust
- Wood dust

Compliance information is available from Cal/EPA's California Office of Environmental Health Hazard Assessment (OEHHA) at http://www.oehha.org/prop65.html

Other information sources include the following:

- Read “Proposition 65 Made Simple” at http://www.prop65news.com/pubs/brochure/madesimple.html
- Read the actual wording of Proposition 65 at: http://www.arb.ca.gov/bluebook/bb07/HEAd/HEA_d_20_ch_6_6.htm
- Search for “Proposition 65” on the CA Air Resources Board homepage at: http://www.arb.ca.gov/homepage.htm

3.4 RECORDKEEPING

Records pertaining to Health and Safety issues and required Cal/OSHA documentation (exposure assessment and medical testing) shall be filed at an Agency’s main office. They include those records required by:

- Cal/OSHA Construction Safety Orders, as prescribed in CCR Title 8, Chapter 4.
- CSD weatherization field forms, to be placed in the client’s permanent file, include:
  - Combustion Appliance Safety Inspection Form (CASIF) series
  - Duct Leakage Data Sheet
  - Blower Door Data Sheet
  - Weatherization Deferral Form
  - Post-Weatherization Inspection Form

Under CAL/OSHA recordkeeping requirements, information on accidents is gathered and stored. Upon review, causes can be identified and control procedures instituted to prevent the illness or injury from recurring. Keep in mind that any inspection of your workplace by CAL/OSHA or CSD may require that agencies or subcontractors demonstrate the effectiveness of their programs.

3.4.1 Injury & Illness Records

Injury and illness recordkeeping provide a way to evaluate an Agency’s health and safety program.

CAL/OSHA requires the following five steps be incorporated into every IIPP recordkeeping system:

1. Each employer (unless exempt by size or industry) must record each fatality, injury, or illness that is work-related, is a new case, or meets one or more of the general recording criteria specified in Title 8, Section 14300.
2. Record each injury or illness on the Cal/OSHA Log of Occupational Work Related Injuries and Illnesses (Form 300) according to its instructions.
3. Prepare an Injury and Illness Incident Report (Form 301), or equivalent.
4. Annually review and certify the Cal/OSHA Form 300 and post the Summary of Work-Related Injuries and Illnesses (Form 300A) no later than February 1 and keep it posted where employees can see it until April 30.
5. Maintain the last five years of these records in your files.

NOTE: Additional information on recordkeeping can be found on the Internet at: http://www.dir.ca.gov/dosh/etools/recordkeeping/index.html

3.4.2 Exposure Records

Injury and illness records may not be the only records you need to maintain. CAL/OSHA standards concerning toxic substances and hazardous exposures require records of employee exposure to these substances and sources, physical examination reports, employment records, and other information.

3.5 ALLOWABLE EXPENSES

It is not the purpose of CSD's Weatherization Program to bring residences "up to code" or to fix all health and safety items identified in the residence. However, hazards and unsafe conditions affecting the health and safety of workers and/or occupants shall be resolved when repairs are feasible and within the scope of the program.

The cost of correcting H&S problems and hazards that fall within the scope of the CSD Weatherization Program will be reimbursed as provided in the current CSD Weatherization Service Provider contracts. Corrective work, which exceeds the scope of the Weatherization Program, shall not be attempted, nor shall application for reimbursement be made.

CSD contracts mandate that all health and safety hazards must be resolved completely (by the client or the agency) before any other weatherization measures are installed.

4.0 CREW HEALTH AND SAFETY

CSD and CAL/OSHA require that all agencies ensure a safe working environment for employees and subcontractors. Workplace safety practices shall include, at a minimum, those listed in this section and subsections as noted. All activities must meet the safety provisions of state codes and regulations, including:

- California Labor Code (Occupational Safety and Health)
- State Health and Safety Code
- Safe Drinking Water and Toxic Enforcement Act of 1986 (California Proposition 65)
- Business and Professions Code (licensing requirements).
- Building codes (building, electrical, and plumbing)

While all agencies are required to promote safe working conditions in the shop and in the field, it is the duty of all employees to work in a safe and healthy manner and follow CSD's and their employer's (agency or subcontractor) health and safety policies and plans. Field personnel are required to participate in regular safety trainings and meetings. In the field, CAL/OSHA requirements this H&S Requirements document, and the CSD WIS and Field Guide specific safety precautions shall be followed as they apply to weatherization activities.

4.1 General Health & Safety for Workers

4.1.1 Personal Protective Equipment

When a hazard cannot be eliminated or controlled by work practices, engineering, and/or administrative controls, workers must be protected through the use of respirators and personal protective equipment (PPE). CAL/OSHA requires that employers perform hazard assessments for all jobs and select the proper PPE for those hazards. The amount and type of PPE is determined by the level of assessed or presumed hazard and through the guidance provided by each material's SDS (safety data sheet).

Workers are required to wear PPE if instructed to by their employer, it is not an option. Employees can choose to wear PPEs even if the hazard assessment shows that no exposure to a hazard will occur.

According to CAL/OSHA, workers must be protected by PPE as follows:

a) Eye and face protection is required when there is an inherent risk of eye injury from flying particles, injurious chemicals, or harmful light rays.

b) Foot protection is required for workers who are exposed to foot injury from hot, corrosive, or injurious substances, from falling objects, or from crushing or penetrating actions.

c) Hand protection is required for workers who are exposed to cuts, burns, electrical current, or harmful physical or chemical agents. Hand protection shall include durable and wrist-protecting gloves when needed to provide protection from injury.

d) Body protection is required for workers who are exposed to injurious materials. These workers must wear appropriate body protection and clothing appropriate for their work.

e) Hearing protection is required because the noise levels of many construction operations frequently exceed 90 decibels.

f) Head protection is required for employees who are exposed to flying or falling objects, or to electric shocks and burns.

4.1.2 Heat Stress and Stroke Prevention

Field workers must assess workplace conditions (especially attics) for temperature levels and ventilation before starting their job. In addition, the suggestions below should be followed in the field:

- Make sure that adequate shade, water, and breaks are available on hot days.
- Crew members should watch coworkers for signs of heat stress and help them to cool down.
- Workers must heed all safety warnings from co-workers and supervisors.
- If necessary, call 911 and request emergency assistance.
- Prevent heat stress and stroke by not allowing work to be conducted in attics if temperatures exceed 115ºF inside the attic space where temperatures can exceed 150 ºF on hot, sunny days. Lung stress from hot air starts over 115ºF.

4.1.3 Slips, Trips, and Falls

- Use caution around power cords, hoses, tarps, and plastic sheeting.
- Take precautions when ladders are used, when working at heights, or when balancing on joists.
- Use walk boards when practical.
- Wear appropriate footwear and clothing at all times.

4.1.4 Tools and Equipment

Agencies must provide crews with tools and equipment that are in good, safe working condition and ergonomically appropriate for the specific work task. When utilizing this equipment, field workers are responsible to:

- Check tools and equipment before each use to ensure that they are in good condition.
- Use hand tools only for their intended purpose.
- Avoid the use of materials and tools that are dull, bent, damaged, broken, have frayed or unsafe electrical cords (including the ground lug cut off a 3-prong plug), etc.
- Use three-wire extension cords with all portable electrical tools, even if the tool has only two prongs and is internally insulated.

4.1.5 Power Tools

- Inspect and use power tools in accordance with manufacturer specifications to eliminate hazards associated with missing ground prongs, ungrounded circuits, misuse of power tools, noise, and improper or defective cords or extension cords.
- Verify that all electrical devices used are GFCI protected or double insulated.
- Prevent exhaust gases from compressors and generators from entering living space.

4.1.6 Material Safety

Agencies must ensure that materials handled by employees and installed in residences are safe and can be handled safely.

- The least toxic suitable material shall be chosen.
- Handle hazardous materials in accordance with manufacturer specifications or SDS standards to eliminate hazards associated with volatile organic compounds (VOCs), sealants, insulation, contaminated drywall, dust, foams, asbestos, lead, mercury, and fibers.
- Per the HazCom rule, a complete set of SDS must be on-hand at the work site for every material used by installation crews. Similarly, warehouses and shops must also have a complete set of SDS on site for the materials used or stored.

4.1.7 Fire/Flammable Materials

- Workers shall identify and eliminate ignition sources (e.g., turn off pilot lights and fuel supply).
- Eliminate or reduce use of flammable material.
- Use appropriate fire-rated materials around heat producing devices or open flames.
- Workers shall never be allowed to smoke at the jobsite.

4.1.8 Dangerous Work Areas

Workers shall use care when working in unsafe or potentially dangerous areas, including areas that may be contaminated by raw sewage or other unsanitary conditions and areas equipped with unsafe electrical wiring. Standard precautions include the following:

- Supply adequate ventilation in work areas where gas-powered equipment is used.
- Take precautions (e.g., use of helmets) to prevent head injury from sharp objects, such as nails protruding through flooring in crawl spaces and through roof sheathing in attics.
- Avoid unsafe electrical wiring (e.g., frayed or missing insulation, bare wires, improperly secured splices, lack of junction boxes, etc.).
- Avoid the use of metal ladders while conducting electrical work.
- Use walk/crawl boards when working in attics and crawlspaces to prevent falls or other contact injuries.
- Inform client of sources contaminants (e.g., sewage, dead animals, needles, hazardous material, etc.) in work areas. The CSD Deferral Policy shall be followed until the appropriate local service agency (i.e., Health Department, animal control service, licensed clean-up or abatement contractor, etc.) corrects, repairs, or removes the contaminant source before weatherization personnel perform any work that requires access to the affected areas. When appropriate, contaminants shall be neutralized and/or a protective barrier shall be installed around the area.
  (Note: Clients must be informed that the client's clean-up of an area shall not be considered acceptable for the removal of hazardous materials (such as asbestos or radon). Such removals must be performed and documented by a licensed abatement contractor for weatherization work to become feasible).

4.1.9 Clothing

Loose or frayed clothing, dangling ties, chains and necklaces, bracelets, rings, etc. shall not be worn around moving machinery or other sources of entanglement. Appropriately safe footwear shall be worn, such as closed-toed work shoes or work boots appropriate to the task.

4.1.10 Shop and Work Areas

The shop and all work areas shall be free of obstacles and other hazards. The following precautions apply:

- Aisles and passageways shall be kept clear to allow for the safe movement of employees and material handling equipment.
- Stored materials shall not block exits or fire doors.
- Combustible materials shall not be stored near combustion appliances, electrical outlets or circuit control panels.
- Lumber shall be stacked on level and solidly supported sills so that it is stable and self-supporting. Lumber piles that are handled manually shall be stacked no more than 6 feet high.
- All scrap lumber, waste material and rubbish shall be removed from the immediate work area as the work progresses.
- Covers shall be provided for all containers used to store or transport oily or flammable chemicals and hazardous waste.

4.1.11 Ladders

Ladders are a standard construction tool and also one of the most hazardous. Every year thousands of men, women and children are seriously injured or killed falling from ladders. According to the U.S. Bureau of Labor and Statistics, falls from ladders accounted for 20% of all fatal falls alone in 2009. Many, if not all, of these injuries or deaths could have been avoided if proper ladder safety procedures were followed.

The ladder is one of the simplest tools that a person can use, and it can be used safely given proper instruction. The U.S. Department of Labor, Occupational Safety & Health Administration (OSHA) mandates in their "Safety and Health Regulations" that all personnel who are going to use a ladder be properly trained. "The employer shall provide a training program for each employee using ladders and stairways, as necessary. The program shall enable each employee to recognize hazards related to ladders and stairways, and shall train each employee in the procedures to be followed to minimize these hazards" is written specifically into the regulations.

The following steps will ensure a worker knows how to properly use a ladder:

a) **CHECK FIRST.** Is it safe to get on the ladder where it is located? If the work is outdoors, is it windy? Is the ground solid under the ladder? Are there any power lines? Will my ladder be a hazard to anyone else? Are there any other hazards near the work area?

b) **THE RIGHT LADDER FOR THE JOB.** Ladders are rated for specific uses. The American National Standards Institute (ANSI) rating sticker should be on every ladder stating the ladder use and weight restrictions. Ensure that the ladder will hold the weight of the user and the equipment too.

c) **INSPECTION.** Is the ladder in good condition? Are there any missing screws or bolts? Are there any loose pieces? Never use a damaged ladder!

d) **LADDER SET UP.** The base of the ladder should be 1 foot from the building (or top support, such as an eave) for every 4 feet of ladder length up to the resting position. If a ladder square is on the side of the ladder, make sure it is parallel to both the ground and the vertical surface. If a stepladder is used, ensure the braces are locked.

e) **CLIMBING A LADDER.** Do not climb a ladder carrying tools or equipment. Hands (and feet) should be free of impediments. Keep "three points of contact" on the ladder while climbing.

f) **REACHING.** Many people fall off of ladders because they are reaching for something and get off balance.

There are many good resources available online regarding ladder use and safety. These are just a few of the numerous sites available:

- OSHA Safety and Health Regulations for Construction: Ladders
- American Ladder Institute http://www.laddersafety.org/ls/Content.aspx?pageid=81
- Electronic Library of Construction Occupational Safety and Health http://www.elcosh.org/en/sitemap.html
- Occupational Safety and Health Administration - eTool http://www.osha.gov/SLTC/etools/construction/falls/4ladders.html
- The Center for Construction - Research and Training Http://www.cpwr.com/search.php
- U.S. Consumer Product Safety Commission http://www.cpsc.gov/library/neiss.html

4.1.12 Electrical Safety

An electrical safety assessment will be performed at each work site and in the agency's and subcontractor's warehouses and shops.

4.1.12.1 General Electrical Safety

- Frayed wires, uncovered electrical boxes, inadequate wiring will be identified prior to workers entering work areas.
- Water sources (e.g., condensate pans) and electrical sources will be kept separate.
- Aluminum products (such as foils, etc.) will be kept away from live wires.
- Aluminum ladders will not be used for electrical work.
- For arc flash hazards, NFPA 70E will be consulted.

4.1.12.2 Electrical Cords

- Workers shall not use electrical cords that are damaged, such as frayed or worn insulation or loose connectors.
- In the workshop, a ground fault circuit interrupter (GFCI) device shall protect all 15A or 20A circuits. If the electrical service doesn't have this protection, the workers must supply it. If a two-wire ungrounded system is in place, proper grounding shall be installed.
- In all on-site work areas, particularly under a floor where the worker is in contact with the earth, all electrical cords shall be GFCI-protected.

4.1.12.3 Knob & Tube Wiring

Workers will stay away from knob and tube wiring unless:

- Certified to be safe by an electrical contractor (see CSD WIS Appendix F).
- Special precautions are taken.

4.1.12.4 Dwelling Current Electrical Hazards

Although properly maintained aluminum wiring is general considered acceptable, aluminum may become degraded faster than copper. Damaged or degraded connections in outlets, switches, and light fixtures containing aluminum wiring may become increasingly dangerous over time. Poor connections could cause wiring to overheat, and create a fire hazard.

- **All Dwelling Types.** When installing measures that increase load to any circuit, the installer is responsible for adhering to program policies, this section, the applicable WIS section for the measure, and all requirements of the local jurisdiction (including acquisition of a permit, when required).
  - If aluminum wiring is found to be present, work on the home must be stopped until the suspect wiring is inspected and determined to be safe by a licensed C-10 contractor (electrician).
  - After energy retrofit is completed, wiring will be re-inspected by a licensed electrician.
- **Mobile Home Additional Policies.** When installing measures that increases load to any circuit, the mobile home metal skin and frame will be grounded through the panel box.
  - The grounding system will be connected to the copper grounding rod that is driven into the ground a minimum of 8' when possible, and when required by code or the authority having jurisdiction.

4.1.12.5 Equipment Grounding as a Work Practice to Avoid Static Shock

- Rigid insulation fill tubes shall be made of a material that will not hold an electric charge, such as Schedule 40 PVC Electrical Conduit, and be grounded.
  - For an additional level of protection, the metal coupler on the hose (when present) will be connected to the grounding wire.
  - Grounding wire will be connected to the grounding rod or the electrical system grounding conductor.
  - When required by the local jurisdiction, the grounding rod will be driven into the ground a minimum of 8’ when possible.

4.1.13 Carbon Monoxide Poisoning

Carbon monoxide (CO) is a poisonous gas that can cause permanent brain damage or even death. It is colorless, odorless and tasteless; therefore, workers must be aware of its sources and the signs of CO poisoning.

In a shop or warehouse, CO may be created by gasoline-powered equipment, such as compressors and generators. Thus, such equipment shall be used only with adequate ventilation.

In any setting where propane or natural gas appliance are in operation (office, shop, warehouse or weatherization client's home), there is the possibility of excessive CO in the air due to an appliance malfunction. Common signs of carbon monoxide poisoning include the following:

- Headache
- Nausea
- Sleepiness
- Dizziness or fainting
- Drunk feeling or foggy thinking

If CO poisoning is suspected, the affected person must be immediately provided with plenty of fresh air. If fainting occurs, cardiopulmonary resuscitation (CPR) may be required and qualified medical assistance should be obtained.

4.1.14 First Aid Kit and Emergency Aid Information

Each agency and its subcontractor(s) shall supply a CAL/OSHA-approved first aid kit for each vehicle so it is readily available. A list of telephone numbers of physicians, hospitals, and ambulances shall also be available in case of emergency.

When possible, each crew should have available at least one person who is trained to render first aid, including CPR.

4.1.15 Vehicles

Agency crews and subcontractors are responsible for maintaining its vehicles in proper running order. All equipment, parts, and accessories that affect safe operation shall be checked regularly to assure that they are in proper working order and free from defects. Any vehicle that is unsafe shall be repaired before it is allowed in service.

All seats in a vehicle shall be equipped with safety belts. Each operator and passenger riding in a vehicle shall occupy a standard seat (not a portable chair or other makeshift seat) and shall wear their safety belt.

When performing service or repairs, employees shall not work under vehicles supported by jacks or chain hoists without protective blocking that will prevent injury should the jack or hoist fail.

4.1.16 Drinking Water

A supply of potable water (safe to drink) shall be provided in all places of employment. Portable drinking water containers shall be equipped with a tap and tightly closing lid. Common drinking cups are not allowed.

4.1.17 Clean-Up

Crews must maintain all work sites and related structures, equipment, and facilities in a clean and orderly condition during all work conducted under the CSD Weatherization Program. Any unused or leftover materials, garbage and debris must be promptly removed from the client's premises, and disposed of at the agency's or subcontractor's expense. The client's premises must be left in a clean and orderly condition at the end of each day and at the completion of work.

4.2 TASK-ORIENTED WORKER SAFETY

This Health & Safety document does not specifically address worker safety by type of task as most workers perform a variety of tasks on each residence and are not trade-specific. However, to comply with DOE's SWS the following task-oriented safety procedures are included in this document. All workers are required to incorporate safe work practices in every aspect of their workday.

4.2.1 Air Sealing Worker Safety

Workers performing air sealing will follow all worker safety rules, policies, and regulations at all times on the job. Workers performing air sealing of a structure shall have access to all parts of the structure, and may be use materials that require special respirators. Workers and supervisors shall ensure that the following are included as safety practices with air sealing jobs:

- Confirm that structurally sound ceiling, roofing, placement of walk boards, and safe electrical wiring and boxes are in place.
- Identify existing insulation types to ensure that hazardous insulation materials like asbestos and vermiculite are not present.
- Ensure adequate ventilation and accessibility in attics and crawl spaces. Crews shall practice safety drills in case of accidents in a tight attic or crawlspaces.
- Use respirators with HEPA/N-100 filters to prevent the inhalation of particulates—attic/crawl space dust, mold spores, animal feces, insulation fibers, etc.
- Use hard hats to prevent punctures from roofing nails
- Thoroughly review and follow Safety Data Sheets for all air sealing materials used.
- Postpone crawlspace (e.g., sealing and insulation) until after any feasible appliance and HVAC system work has been completed and inspected.

4.2.2 Insulation Worker Safety

Insulation workers shall follow all worker safety rules, policies, and regulations at all times on the job. Insulation workers shall focus on safety issues related to the installation of insulation and need to make sure that the following are included as safety practices before starting a job:

- Confirm that structurally sound ceiling, roofing, placement of walk boards, and safe electrical wiring and boxes are in place.

- Identify existing insulation types to ensure that hazardous insulation materials like asbestos and vermiculite are not present.
- Ensure adequate ventilation and accessibility in attics and crawlspaces as well as ventilation. Crews shall practice safety drills in case of accidents in a tight attic or crawlspaces.
- Use respirators with HEPA/N-100 filters to prevent the inhalation of particulates—attic/crawl space dust, mold spores, animal feces, insulation fibers, etc.
- Use hard hats to prevent punctures from roofing nails.
- Confirm insulation blower equipment safety.
- Thoroughly review and follow Safety Data Sheets on insulation materials used.
- Restrict work in hot attics or wet crawl spaces.
- Rigid insulation fill tubes will be made of a material that will not hold an electric charge, such as Schedule 40 PVC, or be grounded.

4.2.3 Combustion Worker Safety

Combustion safety workers will:

- Follow all worker safety rules, policies, and regulations at all times on the job.
- Monitor ambient CO during combustion testing and testing will be discontinued if ambient CO level inside the home or work space exceeds 9 parts per million (ppm).
- Identify fuel leaks around and in the building before starting combustion appliance testing. If fuel leaks are present, testing will be discontinued and the condition will be reported immediately to the occupant(s).
- Beware of flame roll outs.

4.2.4 Heating and Cooling System Worker Safety

Heating and cooling workers will follow all worker safety rules, policies, and regulations at all times on the job. Workers shall be aware of tasks that may expose workers to a variety of safety hazards. Workers should pay attention to:

- Structural issues, if roofs are accessed.
- PPE appropriate for heating and cooling tasks.
- Long sleeves and long pants should be worn as additional protection from liquid nitrogen and other hazards.
- Asbestos-containing materials in or on duct systems.
- Thermostats with mercury bulbs shall be disposed of in accordance with EPA guidance.
- Proper refrigerant recovery procedures and safety equipment.
- Assessors shall check for the presence of combustible gas leaks before work begins.
- Leaks will be repaired before work is performed.
- Assessors and crews will check for presence of ambient CO before and during work.
- CO issues will be addressed before weatherization work is performed or continued.
- Pipes will be sealed by a certified professional with an approved fastening process and sealant in accordance with manufacturer specifications (International Fuel Gas Code).

- Gas lines shall be leak-free when tested with an electronic combustible gas leak detector and verified with bubble solution, or gas lines will be leak free when tested by a standing pressure test that meets the approval of the local code.
- Shut-off valves will be installed by a certified professional at each gas appliance (ANSI Z21.15).

4.2.5 Ventilation Worker Safety

Ventilation workers will follow all worker safety rules, policies, and regulations at all times on the job, and be aware of electrical hazards when installing ventilation systems or controls in addition to general safety practices.

4.2.6 Electric Baseload Worker Safety

Electric baseload worker shall follow all worker safety rules, policies, and regulations at all times on the job, and be aware of safety practices for the following:

- Electrical hazards
- Lifting hazards

4.2.7 Basement and Crawlspace Worker Safety

Workers entering basements and crawlspaces shall follow all worker safety rules, policies, and regulations at all times on the job, and pay attention to the following safety hazards:

- Accessibility in tight places
- Pooled water
- Insect and animal hazards in basements and crawlspaces
- Environmental hazards including Hantavirus and Valley Fever.
- Proper use of respirators and safety equipment when working in basements and crawlspaces.

5.0 CLIENT HEALTH AND SAFETY

The client's health and safety are critical to the state's Weatherization Program both during and after work is conducted. Agency workers and subcontractors shall take all reasonable steps to "do no harm" to clients and their property. Before, during, and after all weatherization work, all field staff and subcontractors are required to identify and remedy (when within the program scope) potentially hazardous, unsafe, and unhealthy conditions that might affect clients during the weatherization process and use the least toxic materials feasible.

When the health and safety of the workers or residents may be jeopardized by the installation of a weatherization measure due to the presence of a hazardous condition, such measures shall not be installed until appropriate corrections have been made. When appropriate and feasible, minor repairs to correct hazardous conditions should be accomplished to eliminate hazardous materials or the threat to health and safety caused by their presence. While the program can remedy many unsafe and unhealthy conditions associated with the installation of measures, it does not have the resources to fix work outside of the program scope.

Assessors and crew members shall:

- Thoroughly assess the condition of the dwelling, noting all potential safety hazards.

- Conduct a weatherization assessment of each jobsite to identify existing and potential health and safety concerns.
- Identify if a person's health condition is such that work activities would create a health or safety hazard for them. Occupants that may have health issues with the work being performed will be required to leave the home during these work activities.
- Perform weatherization activities in a manner which:
  1) Ensures that client/occupants' and workers' health and safety is protected during all phases of the weatherization process; and
  2) Avoids subjecting the client/occupants to undue discomfort (e.g., blowing cold/damp air on frail or ill persons by pressurizing the home during winter).
- Pay particular attention to elderly and disabled persons and to young children who may be playing in areas where work is being done.

Note: If an H&S hazard exists prior to weatherization, installation of weatherization measures shall not proceed until such problems are remedied.

6.0 DWELLING HAZARD CONSIDERATIONS

Prior to installation of any measures, an assessment of the structure shall be conducted to identify conditions potentially hazardous to workers and/or clients. Inspection shall be performed by a competent person (CAL/OSHA 1504(a)).

Assessors and crews must be conscious of the presence of hazardous materials and attempt to minimize the risk of exposure to themselves and the client. Common hazards crews are likely to encounter are discussed in this section.

6.1 PRELIMINARY SAFETY INSPECTION OF THE WORKSITE

In assessing the worksite, conditions outside the structure that may be hazardous shall be checked routinely, including but not limited to the following:

- Dogs and other pets
- Broken glass in work areas
- Low electrical lines and other electrical hazards
- Trash and debris
- Toys, tools, furniture, etc. in the work area
- Holes in the yard
- Insect activity (spiders, wasps, bees, etc.)

6.2 STRUCTURAL/CONSTRUCTION HAZARDS

6.2.1 Common Structural Issues

Dwellings shall be examined for any structural conditions that may jeopardize the safety of crews and clients during or after weatherization. A thorough structural inspection shall include a check of:

- Unsafe structural conditions (roofs, ceilings, walls, windows, floors, etc.)
- Attic and crawlspace accessibility problems
- Pets, insect activity, spiders, etc.
- Electrical hazards
- Raw sewage and other unsanitary conditions
- Moisture problems (inadequate roofing, flashing, or weatherproofing; plumbing problems; inadequate venting, etc.)
- Unsafe construction conditions, such as protruding nails; potential for slips, trips, and falls; broken glass, etc.

6.2.2 Attic and Crawlspace Accessibility

Accessibility is a key factor in determining feasibility of any measure that requires crawling in the attic or crawlspace. An attic or crawl space may be deemed inaccessible (unfeasible for access) if clearances do not meet the minimum clearances and accessibility requirements described in CSD WIS Appendix E.

6.2.3 Crawlspace Safety

Any portion of the crawl area affected by any of the following conditions is not feasible to crawl:

- Hazardous insect infestation.
- Excessive ground moisture (standing water or mud).
- Hazardous electrical condition.
- Sewage waste on the ground, or any other unsanitary condition.

6.2.4 Plumbing Assessment

Review of plumbing and feasible repairs of plumbing problems shall be made prior to weatherization.

Moisture from leaks in household plumbing fixtures and pipes can cause mildew and fungus growth and result in structure degradation and other problems.

Sewer leaks, “gray water” leaks, or standing water can cause illness to workers and residents. The dwelling shall be deferred until these can be corrected in accordance with the CSD Deferral Policy.

6.2.5 Electrical Wiring

Exposed electrical wiring in boxes in the attic shall be covered in accordance with the National Electrical Code before insulating. If there are too many conductors in the box for it to be covered, an electrician will have to be used to make the situation code-compliant.

Common electrical wiring problems that weatherization subcontractors may encounter are usually related to one of the following:

- Broken light fixtures, loose electrical fixture boxes,
- Frayed wiring,
- Improperly connected electrical appliances,
- Improper use of extension cords,

- Damaged outlets and switches,
- Missing cover plates, etc.,
- Electric shock while working around wiring in all areas of the home,
- Fire resulting from arcing of loose wiring connections, and
- Fire resulting from heat build-up due to encapsulation of heat-producing sources by insulation.

6.3 INDOOR AIR QUALITY

Indoor air quality can be a major source of health issues for many households. We spend more time in our homes than anywhere else where the air quality is the poorest. Many weatherization measures have the ability to improve air quality: sealing ducts properly eliminates the infusion of attic or crawlspace air into the condition space; sealing attic bypasses reduces hot or foul attic air from being drawn into a house; improving combustion efficiency of gas appliances and fixing cracked and broken heat exchangers reduces carbon monoxide; and lastly, reducing infiltration is known to improve air quality.

At the same time, many weatherization measures can also worsen the quality of the indoor environment if considerations are not taken into account when the measures are installed. Caution should be taken when selecting air tightness limits for dwellings with these problems.

Dwellings shall not be sealed when sources of air pollution are present and cannot be removed or vented out: unvented moisture sources, significant pet waste and odors, methane gas, radon, fumes from stored chemicals and volatile organic compounds, asbestos-containing materials, combustion byproducts, etc. Each dwelling must be evaluated to determine if the installation of a controlled air source (mechanical ventilation) would improve the air quality, or if its installation would potentially worsen the health condition of occupants.

Removal of biologicals and remediation of unsanitary conditions (mold, odors, viruses, bacteria [including raw sewage], dead animals, etc.) is not a CSD Weatherization Program responsibility; however, weatherization workers frequently encounter these conditions. If one or more of these conditions is identified, and if the problem is not corrected by the homeowner (or a licensed abatement contractor for certain hazardous substances such as lead, radon, asbestos, etc.), weatherization services shall be deferred (using the CSD 542 Form). If available, agencies shall refer the client to another agency for assistance and remedial action (rehabilitation).

Additional information about possible indoor air pollutants is provided in the items that follow.

6.3.1 Combustion Appliances and Combustion Gases

Combustion appliance safety is the most common and a critical area where hazards occur may be present or may be created. In order to ensure the correct diagnostic testing of all combustion appliances, combustion appliance safety technicians must follow the protocols outlined in the following documents:

- CSD Field Guide, Appendix A (CAS Protocol).
- Health or Safety Hazard Repair or Replacement policies for Appliances are listed in the CSD Field Guide by measure type.

Weatherization crews must perform tests or assessments of combustion appliances. Experienced combustion appliance safety technicians must conduct this testing of natural gas

appliances and follow established guidelines in reporting their findings. The combustion appliance testing shall dictate the feasibility of installing infiltration measures.

Workers should be mindful of hazards or signs of significant problems, such as the following:

- Gas odors or leaks
- Evidence of improper combustion (e.g., scorching of paint, presence of a large amount of soot near the draft hood, or acrid odors associated with formation of aldehydes)
- Deteriorated (rusted through or other holes) or disconnected flue pipe
- Improperly installed or multiple draft hoods
- Vent termination clearances or conditions

When a hazardous condition appears to be present, the resident and owner/agent (if a rental) shall be notified and examination by a qualified professional is required. If extremely strong odors are present in the unit, the call to notify the utility company should be made from outside of the unit.

Note: Unvented combustion appliances produce moisture as well as other indoor air contaminants. Primary source unvented space heaters should be removed (with client permission) and replaced by a properly vented heat source. Client refusal to allow a primary unvented space heater to be removed shall result in the home qualifying for non-infiltration reduction measures only (home is NIM). When unvented space heaters are a secondary heat source, assessors should explain the potential dangers of use to the client and seek permission to remove the appliance if it is not ANSI Z21.11.1–listed. Client refusal to allow removal of a secondary source unvented space heater shall be documented, but does not NIM the home. Other types of unvented combustion appliances (i.e., cooktops, ovens, etc.) are not covered by this mandate or by California's Title 24 codes.

6.3.2 Moisture Issues

Dwellings shall be inspected for previous or existing moisture problems. Moisture sources in the house that can generate excessive moisture will be identified and removed or reduced when feasible within the CSD Weatherization Program. The following are common sources of moisture problems in homes:

- Leaking roofs, windows, doors, and structural penetrations
- Condensation on attic structures
- Leaking plumbing
- Inadequate ventilation
- High humidity levels
- Dryer venting
- Moisture sources—breathing, showers, washing, cooking, aquariums, etc.
- Crawlspaces and attic bypasses
- Cold surfaces (windows, walls, metal frames, etc.)

During the assessment process, the assessor shall report on noticeable signs of moisture/water problems in the CSD 540A form. Waterstained ceilings and walls are a good sign of past or present water leaks. The assessor should then check the roof and attic structure for the source of the water problem. A leaky, deteriorated roof would need to be fixed before attic-related work is conducted.

The odor of mold is also an indicator of moisture problems; however, finding the source(s) may be problematic, as odors tend to travel throughout a house.

There are more sources and evidence of moisture problems in the winter, when the house is shut up and cold surfaces exist, than in the warmer seasons. So be aware that things in the house could drastically change when it gets colder.

Clients who shut down rooms in their homes by closing off registers and doors will develop moisture issues in these rooms during the winter and will likely have mold problems. Inform clients that they need to circulate air through these rooms to reduce the incidence of mold and moisture problems in their home.

If moisture problems are found which present a hazardous condition in relation to weatherization measures, those measures shall not be installed until the problems are resolved. For example, if signs of inadequate ventilation are present, shell sealing measures (e.g., caulking, weatherstripping, etc.) shall not be installed when tightening the shell would cause or worsen indoor air quality. Furthermore, shell sealing should not be attempted without testing the home with a blower door to determine the house's tightness when required by program policy.

- When repairs are feasible and possible within the scope of the Weatherization Program and Limited Home Repair measure, moisture problems shall be eliminated at the source. If a major leak is present, work is not feasible and correction is the responsibility of the client.
- The roof sheathing shall be checked from the attic to determine if the roof is leaking or if there are signs of mildew growth.
- Doors, windows, and the adjacent walls shall be checked for evidence of damage from condensation or water leakage, indicated by water stains or mildew.
- In the crawlspace or basement, a check shall be made for moist floors, standing water, or watermarks on the walls.

If workers encounter additional moisture issues not identified during the dwelling assessment while they are installing measures, they should stop and contact their supervisor about how best to handle the issue.

6.3.3 Radon

Radon is a naturally occurring radioactive gas that is odorless, invisible, and without taste. It is released during the natural decay of uranium, which is present in most rock, soil and water. Its occurrence in the state is influenced primarily by geology. Radon is the second leading cause of lung cancer in the United States, after cigarette smoking.

By CSD policy, all clients, irrespective of county location, shall receive and acknowledge receipt (CSD Form 321) of the EPA pamphlet "A Citizen's Guide to Radon" (current edition from: http://www.epa.gov/radon/pdfs/citizensguide.pdf). In conformance with regulation by the California Department of Public Health, in no circumstance is radon testing or remediation allowed under the weatherization program scope.

6.3.4 Methane Gas

The presence of methane (or sewer gas) is usually obvious and normally requires repairs or adjustments to a waste line and/or vent system or it could be a ruptured or broken natural gas line. If naturally occurring ground methane is detected, the agency shall advise the resident and owner/agent (if a rental) to consult the local Health Department or the Department of Agriculture Extension Service for further information and assistance. If you believe the methane gas smell is natural gas or propane, immediately contact the gas service company for that residence.

6.3.5 Formaldehyde and Volatile Organic Compounds (VOCs)

Formaldehyde vapors may be slowly released by some new carpets, particle board, waferboard, plywood, etc. VOCs are also emitted by some household cleaning agents and paints. Caution should be taken when measuring and setting tightness limits in dwellings with VOCs present. The client shall be notified and asked to remove stored containers of chemicals, when feasible. If the client is physically unable to remove the chemicals, assistance shall be provided to move the containers to a safe outdoor storage location.

6.4 BIOLOGICAL HAZARDS

Biological health hazards are those that are caused by molds, viruses, bacteria, insects, rodents, and other animals. The remediation of these hazards or potential hazards is not a weatherization agency responsibility; however, program workers may encounter these conditions and must use appropriate safety equipment to protect themselves to the extent possible.

6.4.1 Mold/Fungus

The growth of mold/fungus in a residence is directly attributable to the amount of water available for the mold. Without water, molds/fungi will not grow. Water can come from a number of different sources including moisture intrusion through the building structure, leaky plumbing, and condensation. Moisture, in the form of water vapor, needed to condensate is available from high indoor humidity levels, attic and crawlspace bypasses, breathing, cooking, aquariums, washing, and showering. Often, inadequate ventilation is the primary cause of high moisture levels in a residence.

The intrusion of bulk water through leaky roofs, walls, windows, and doors can be remedied through weatherization projects and is often the easiest to find and fix. However, moisture intrusion from damp or wet crawlspaces into the conditioned areas, or even through bypasses in wall all the way to the attic, is harder to detect. Condensation of moisture on cold, uninsulated walls and single-paned windows can cause significant mold growth that is remedied by mechanical ventilation.

Moisture moving from a warm, humid living space through attic bypasses into a warm, uninsulated attic usually doesn't condense into water and can escape through roof vents. Insulating an uninsulated or poorly insulated attic in a cold climate without properly sealing all attic bypasses will result in moisture migrating into a now cold attic and condensing on the attic structure, causing water damage and often mold growth.

Another weatherization-derived source of moisture for mold/fungus is by tightening the house and not providing for mechanical ventilation to remove the excessive moisture that can build up once a house is tightened. The moisture has to go somewhere and it will end up condensing on cold surfaces like walls and windows.

Not all molds/fungi are health problems. Without sending in lab tests, the type of mold present is almost impossible to identify. Uninformed statements like “You have black mold in your bathroom!” are likely to panic clients when it may not be the black mold that they think is a health hazard.

6.4.2 Viruses/Bacteria

There are a couple viruses that crews need to be aware of that may affect workers and clients during and after weatherization activities as listed below:

Hantavirus—Hantavirus comes from rodent feces, saliva, and urine. Working in attics or crawlspaces without respiratory equipment and not washing hands after touching infected rodent feces can transmit the disease to workers. While Hantavirus is found in California, it is not

everywhere. It has been found in the eastern and western sides of the Sierras and desert areas. While the presence of rodent feces or urine does not mean that Hantavirus is present, it is recommended that agencies check with their local public health departments to find out if Hantavirus has been detected in their territories in order to educate and protect workers.

Valley Fever—Valley Fever is another virus of concern in many areas of California. It is commonly found in the dry soils of the Central Valley of California and southward and eastward into Arizona. While the Central Valley appears to be a hotbed of Valley Fever cases, outbreaks are noticed in Southern California after major earthquakes when the soil is stirred up and the virus is blown around. This virus is associated with dry soils, so working in crawl spaces should be done with adequate respirators. Checking with the local public health official will help determine if Valley Fever is in your service area.

Tuberculosis—Tuberculosis (TB) is becoming a major disease again. Screening sick clients before sending crews into homes with TB patients may prevent crew members from catching this transmittable disease.

Rabies—Rabies is a preventable viral disease of mammals most often transmitted through the bite of a rabid animal. The vast majority of rabies cases reported to the Centers for Disease Control and Prevention (CDC) each year occur in wild animals like raccoons, skunks, bats, and foxes. A bite from any animal must be taken seriously and treated immediately. Some pets are required to have rabies shots, and owners must show proof that their pet had their shot if their pet bites someone. A bite by an unvaccinated pet or wild animal will likely require rabies treatment.

6.4.3 Poisonous Bites and Stings

There are many animals that can and will bite or sting, causing an allergic reaction or direct poisoning. Bees, wasps, hornets, ants, spiders, scorpions, ticks, bedbugs, and a host of others can be found on a weatherization job site. Before conducting any work in attics, crawl spaces, or around a house, a bug inventory should be undertaken to identify bugs that are known to sting or bite. Awareness is the key, and if a wasp nest or spiders impede work, they should be removed safely before beginning. Don't spray a chemical if you don’t know what it is; often. pesticides can cause more severe health hazards than the bugs they kill.

Workers who know they are allergic or react to stings should make everyone working with them aware of this and, if they have a sting kit, they should review its use with other crewmembers.

If something bites or stings a person, try to collect the bug that did it in case positive identification is required by a doctor.

6.5 HOUSEHOLD HAZARDOUS MATERIALS

Assessors and weatherization crews should be mindful of hazardous materials that may be found in clients’ homes.

6.5.1 Pesticides

If pesticides are present, workers shall wear properly-rated respirators and protective clothing when working in treated areas (PPE & RPP).

6.5.2 Flammable Materials

Flammable materials stored near water heaters and furnaces shall be removed and stored in a safe place on the property. Occupants shall be made aware that it is extremely important to keep combustibles away from appliances.

CVA vents that are obstructed by household items shall be cleared, and occupants shall be made aware that it is extremely important to keep all vents clear.

6.5.3 Lead-Based Paint

Lead-based paint was common in homes built before 1950, when lead-free latex and acrylic paints replaced the leaded, oil-based paints. While lead-based paint was not very commonly used in houses built after 1950, it wasn't legislatively eliminated from residential paint until 1977; therefore all homes built before 1978 are considered to be lead painted unless they are tested and found to not to be lead painted.

The presence or assumption of lead-based paint does not defer the house from weatherization work. CSD developed a Lead Safe Weatherization (LSW) program in the late 1990s to address the lead paint issue, and CSD WIS Section 2 (Lead-Safe Weatherization Requirements) is a summary of CSD's lead-based paint policies.

When lead-safe weatherization practices are applicable (e.g., on pre-1978 homes), containment, cleanup, and disposal shall be in accordance with state regulations and CSD requirements. See CSD WIS Section 2 (Lead-safe Weatherization Requirements) for more information on lead and other environmental hazards such as asbestos and radon.

6.5.4 Asbestos

Asbestos is a fibrous mineral with fireproofing and insulation qualities which led to its use in a variety of building materials until the late 1970s when it was discovered that asbestos fibers can cause asbestosis and lung cancer if inhaled. The inhalation risk is greatest when asbestos-containing construction materials become "friable" (air borne) and are disturbed during remodeling activities.

Materials that contain asbestos fibers are called "asbestos-containing materials" or "ACMs." Construction materials that contain asbestos are also known as ACCMs or "asbestos-containing construction materials." There are different types of asbestos compounds that were used in construction, such as:

- Pipe and boiler insulation
- Asbestos insulation (powdered or in vermiculite)
- Plaster, cement, drywall, joint and taping compounds
- Acoustical ceilings (tiles and sprayed-on)
- Asbestos-cement piping, shingles, and panels
- Roofing felt and sealing compounds
- Floor tiles
- Siding shingles

Common ACM Locations/Materials:

Asbestos-containing materials in older homes may be in the following locations:

Duct systems

- Duct insulation
- Duct sealing materials
- Ducts made of ACM

Walls and ceilings

- Ceiling and wall insulation (e.g. vermiculite)
- Textured ceiling (popcorn or coarse, bumpy texture)
- Drywall and drywall compound
- Caulking compound

Siding

Flues

The only way to determine if a material contains asbestos is to have it tested by a qualified asbestos laboratory.

The Environmental Protection Agency (EPA) banned use of asbestos in building materials (e.g., spray-on insulation in 1973, patching and taping compound in 1977, and corrugated asbestos paper pipe insulation in 1996). However, ACMs may be encountered in homes built even after the bans went into effect. ***The California Contractors State License Board (CSLB) advises that it can be assumed that asbestos is present in any structure built before 1980***, unless there is proof that the materials are asbestos-free (such as by laboratory testing).

Weatherization crews are likely to encounter asbestos-containing materials sometime during the course of their fieldwork. The possibility is greatest when sealing and insulating duct systems in older homes. Precautions shall be taken to minimize exposure to asbestos fibers. The best practice is to avoid the disturbance of asbestos. Assessors and crews are encouraged to learn to recognize suspected asbestos containing materials (ACM).

Weatherization personnel or appointed representatives shall not take any action that will disturb, expose, release, or discharge any ACM. This includes (attempted) removal or disposal of asbestos. Due diligence shall be taken when working on building components that may contain ACM. All applicable CAL/OSHA regulations pertaining to asbestos and asbestos-containing materials shall be followed.

All protocol relating to asbestos contained in the CSD Asbestos Policy is located in Section 8.0.

6.5.5 Fiberglass/Insulation

Fiberglass and cellulose insulation materials may be lung, eye, and/or skin irritants to workers and occupants. At a minimum, the following precautions shall be followed to avoid posing a hazard:

- Sensitive individuals shall be provided with protection as needed.
- Workers shall wear properly rated respirators and protective clothing when working with or around fiberglass or insulation materials. (Personal Protection Equipment, PPE & Respirator Protection Plan, RPP). Additionally, workers shall follow the recommendations of the Health & Safety Partnership Program (HSPP) as endorsed by the North American Insulation Manufacturers Association (NAIMA).
- Dusts and particulate matter should not be inhaled. Therefore, all workers must wear properly-fitting respirators with HEPA filters when working with or cleaning up insulation materials.
- Fiberglass shall not be left exposed in occupied areas of homes (e.g., exposed edge of a water heater blanket).
- Cutting of fiberglass materials shall occur outdoors or in the attic or crawlspace, never in the home.
- Clean-up of all insulation materials shall be conducted with a HEPA vacuum to prevent the spread of fine particles.

6.6 EXISTING OCCUPANT HEALTH PROBLEMS

Crews must perform weatherization activities in a manner which: 1) ensures that clients'/occupants' and workers' health and safety is protected during all phases of the weatherization process; and 2) avoids subjecting the client/occupants to undue discomfort (e.g., blowing cold/damp air on frail or ill persons by pressurizing the home during winter).

Field personnel shall plan and carry out their work in a manner that will protect the health and safety of all occupants.

Particular attention shall be paid to elderly and disabled persons and to young children who may be playing in areas where work is being done.

6.7 Refrigerant Issues

The replacement of air conditioners and refrigerators requires that agencies reclaim refrigerant per the Clean Air Act 1990, section 608, as amended by 40 CFR 82, 5/14/93. The appliance vendor, de-manufacturing center, or other entity recovering the refrigerant utilized by the agency must possess EPA-approved section 608 Type I or universal certification. Agencies shall ensure that they have appropriate protocols in place that comply with all standards relating to the disposal of the existing appliances.

A written record/description of hazardous materials encountered which required special handling and/or disposal shall be kept in client's permanent file.

6.8 Other Code Compliance Issues

Local and state codes are in full force and effect under the CSD Weatherization Program. Agencies shall ensure that weatherization-related work conforms with applicable codes in jurisdictions where the work is being performed.

6.9 Correction of Conditions

It is not the purpose of CSD's Weatherization Program to bring residences up to code. However, hazards and unsafe conditions affecting the health and safety of workers and/or occupants shall be resolved when repairs are feasible and within the scope of the program.

When an Agency or its Subcontractor notes an existing hazard and work is conducted in that area (i.e., installation of a measure or repair/replacement of an affected appliance), the CSD installer must:

- Document the hazard in the home assessment in the client's file,
- Inform the homeowner in writing, and
- Complete all work according to CSD standards and policies.

When an Agency or its Subcontractor notes an existing hazard, or one created by the resident or under a separate weatherization program, but the CSD Agency will not be doing any work in that area (by installing a measure or repair/replacement of an appliance), the CSD installer must:

- Document the hazard in the home assessment in the client's file, and
- Provide the hazard information to the homeowner.

Examples include the following:

- Mitigate Combustion Appliance Safety hazards and perform corrections of CAS Fails on gas appliances, as prescribed in the CSD Field Guide Appendix A (CAS Protocol) and CSD 700.
- Mitigate potential fire hazards, electrical problems, and other unsafe conditions, such as those described in Section 2.1.2, "Hazardous Conditions."

6.10 Resident & Owner/Agent Notification

When correction of a safety-related problem or hazard cannot be accomplished because it exceeds the scope of the weatherization program, the resident and owner/agent shall be notified as described in Section 7.0 below. When the problem/hazard prevents installation of any weatherization measure, notification shall be in writing.

6.11 Allowable Expenses

Health and safety-related expenditures are allowed when the elimination of hazards is necessary for the safe installation of weatherization measures. The cost of correcting H&S problems and hazards that fall within the scope of the CSD weatherization programs will be reimbursed as provided in the current CSD Weatherization Service Provider contracts. Corrective work that exceeds the scope shall not be attempted, nor shall application for reimbursement be made.

6.12 Limited Home Repairs

Repairs necessary for the effective performance or preservation of weatherization materials are allowed under the category of “Limited Home Repairs.” Examples of these limited repairs include sealing minor roof leaks to preserve new attic insulation, repairing a door jamb so the door closes properly and can be weatherstripped, and repairing water-damaged platforms or flooring as part of replacing a water heater, heating, or cooling appliance.

6.13 Housekeeping

Agencies shall maintain clean and safe working conditions on the job (as required by Cal/OSHA Construction Safety Orders). Each weatherization crew shall have and use a HEPA vacuum to clean up dust and debris and have appropriate means for disposing of waste materials and debris. Workers shall leave the dwelling and premises in a condition that is as good as or better than it was prior to commencement of work.

7.0 CSD DEFERRAL POLICY

Conditions may exist that cannot be mitigated because corrections exceed the scope of the CSD Weatherization Program or cannot be achieved in a cost-effective manner. In these instances, Agencies shall install feasible measures and, as applicable, refer the client to other agencies/programs for additional assistance.

7.1 DEFER AND REFER (WEATHERIZATION DEFERRAL PROTOCOL)

Presence of any of the following conditions will require deferral of weatherization activities:

Home's condition is described as below, and is not correctable within the weatherization program scope:

- ❑ Mechanical, electrical, or plumbing system is in such disrepair that failure is imminent.
- ❑ An environmental condition exists that endangers the client or weatherization workers. (Example: standing water/sewage, mold, friable asbestos, lead paint that would create a hazard if disturbed, etc.).
- ❑ Evidence of significant infestation of rodents, insects, and/or other vermin is present.
- ❑ Moisture conditions within the home are severe, and cannot be corrected under Limited Home Repair.
- ❑ Home is condemned, is under remodeling or rehabilitation, or has structural issues beyond the program scope.
- ❑ Maintenance or housekeeping practices limit access of workers to the dwelling for diagnostics or services.
- ❑ Home has unsafe air quality. (Examples: sewage, significant animal feces or moisture issues in the home, improperly stored chemicals, combustible materials, or other fire hazards present a danger to the occupants or workers, etc.)
- ❑ Home is pre-1978 construction and paint is seriously degraded and/or damaged, creating a hazardous condition with paint chips or dust that is beyond the scope of the weatherization program to remedy.
- ❑ Home receives HUD funding, and at the time of completion, will not meet HUD Lead-Based Paint standards.
- ❑ Un-vented space heater(s) is/are present that have a harmful effect on the air quality of the home.
- ❑ Combustion appliance safety or heating fail exists that cannot be reasonably corrected.
- ❑ Manufactured housing registration is not current or in good standing, and HCD permit will not be granted.

Safety condition is present, as described below:

- ❑ Occupant has a known health condition that would be made worse by weatherization activities.
- ❑ Unsecured pets prevent workers from safely completing their work.
- ❑ Client refusal of combustion appliance safety testing, duct leakage testing, or shell leakage testing (circle one or more)
- ❑ (DOE Program) Mechanical ventilation refused by client or is structurally unfeasible.
- ❑ (LIHEAP) Mechanical ventilation refused by client or is structurally unfeasible (NIM).
- ❑ Client is uncooperative, abusive, or threatening to weatherization team members.
- ❑ Illegal activities are taking place in the home.

❑ **Other condition (as described):** _____

An Agency may need to defer some or all weatherization services when the presence of hazards and other unsafe conditions requires repairs that exceed the scope or funding parameters of the weatherization program. When this occurs, the Agency shall follow the Weatherization Deferral Protocol described below and in CSD Field Guide Section 3.12 and shall make a good faith effort to refer the client to another agency or program that can provide assistance.

7.2 CLIENT NOTIFICATION

Clients shall be informed about identified problems and safety concerns and the reasons why weatherization services must be deferred. Notification shall also indicate the type of assistance the Agency will provide and what the property owner can do to facilitate installation of deferred weatherization measures. Notification shall be provided to the homeowner (when the dwelling is occupied), or to the occupant and owner/agent when the dwelling is a rental.

- Written Notification: Agencies shall utilize the CSD 542 Weatherization Deferral Form.
- Verbal Notification: Prior to obtaining client signature(s) on the Deferral Form, weatherization personnel shall:
  - Review contents of the form with the client(s) and explain each applicable section of it, and
  - Ensure that the client understands why the deferral is needed before signing the "Client Acknowledgement" section.

7.3 RECORD KEEPING FOR WEATHERIZATION DEFERRAL FORMS

- A copy of the completed CSD Weatherization Deferral Form shall be placed in the client's permanent file.
- All other records pertaining to Health and Safety issues shall be placed in the client's permanent file, including:
  - Combustion Appliance Safety Inspection Form (CSD 700) series
  - Shell Leakage Data Sheet (CSD 704)
  - Duct Leakage Data Sheet (CSD 706)

7.4 CLIENT REFERRALS

When correction of deferral conditions is beyond the scope of the Weatherization Program, the Agency shall actively pursue alternative options on behalf of the client, including referrals to other programs and agencies, such as:

- Local Housing and Community Development Department (HCD)
- U.S. Farmers Home Administration (FHA)
- U.S. Department of Housing and Urban Development (HUD)
- Local Department of Aging
- Local utility company programs
- Other similar organizations and programs

8.0 CSD ASBESTOS POLICY

See the following policy.

California Department of Community Services and Development

CSD Asbestos Requirements

CALIFORNIA DEPARTMENT OF

COMMUNITY SERVICES AND DEVELOPMENT

2389 Gateway Oaks, Suite 100

Sacramento, CA 95833

916-576-7109

1. ASBESTOS AND REGULATIONS

Asbestos is a fibrous mineral, with fireproofing and insulation qualities, which may be included in a variety of building materials. Small, sharp asbestos fibers may cause damage to lungs if they are friable and inhaled. In accordance with the Cal/OSHA definition in Title 8, Section 5208, Appendix G:
'"Friable" means that the material can be crumbled with hand pressure and is therefore likely to emit fibers. The fibrous fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable, and they readily release airborne fibers if disturbed. Materials such as vinyl-asbestos floor tile or roofing felt are considered non-friable if intact and generally do not emit airborne fibers unless subjected to sanding, sawing and other aggressive operations. Asbestos-cement pipe or sheet can emit airborne fibers if the materials are cut or sawed, or if they are broken.'
A material that contains asbestos fibers is called an "asbestos-containing material," abbreviated "ACM."

The Environmental Protection Agency (EPA) has banned use of asbestos in building materials (e.g., spray-on insulation in 1973, patching and taping compound in 1977, and corrugated asbestos paper pipe insulation in 1996). However, ACM may be encountered in homes built even after the bans went into effect. The California Contractor's State License Board (CSLB) advises that it can be assumed that asbestos is present in any structure built before 1980, unless there is proof the materials are asbestos-free (such as by laboratory testing).

2. HEALTH AND SAFETY POLICIES FOR WORK WITH TOXIC SUBSTANCES

AGENCY/SUBCONTRACTOR RESPONSIBILITIES

Weatherization agencies and subcontractors are advised to proceed cautiously when preparing to weatherize a dwelling unit where lead, mold, asbestos or other toxic substances may be present. Work must be performed in accordance with guidelines set forth by the Contractors State License Board (CSLB), Cal/OSHA, and the Environmental Protection Agency (EPA). When toxic or potentially toxic materials and/or conditions are known to be present, agencies are advised to inform the building owner and to create a work scope that ensures weatherization will not cause harm to occupants or installers. Where work cannot be performed safely, it must be deferred until hazardous conditions are resolved. Furthermore:

1. All agencies and their subcontractors providing work under the CSD weatherization program shall be knowledgeable regarding the laws pertaining to construction activities involving ACM.
2. Weatherization agencies and subcontractors are responsible for providing health and safety training (including asbestos recognition training) for their field personnel.
3. Agencies and their subcontractors may not use abatement contractors to remove or dispose of asbestos-containing materials (ACM) without prior authorization from CSD.
4. Asbestos remediation costs shall not be allowed under CSD weatherization assistance programs; however, testing may be allowed, as described in Item 5.
5. No action may be taken that will disturb, expose, release, or discharge any ACM and in no case shall the agency authorize the removal or disposal of asbestos by individuals who are not certified to do such work. *Note:* Only properly trained personnel may remove samples of material for laboratory testing to determine if the sample is, in fact, an ACM.
6. Where the presence of asbestos or other potentially hazardous material is known or suspected, appropriate safety practices shall be followed to minimize exposure to airborne environmental hazards. Installers shall be required to use asbestos-safe work practices when ACM are known or suspected to be present.
7. Weatherization work around ACM shall be performed by personnel in conformance with state regulations, which may include required trainings, use of properly-rated respirators and protective clothing, wetting the suspected material, containment when needed, proper laundering of clothing, and other specified practices.
8. Respirators with appropriate filter cartridges must be worn when working in areas where exposure to airborne environmental hazards is a risk. Before issuing respirators, workers must be

medicated assessed to make sure they can wear a respirator without causing breathing problems, fit tested for the respirator type, and trained in the proper care and usage of respirators.

9. When ACM is known to be present, the agency and/or subcontractor shall inform the property owner that ACM is present, and describe the precautions that will be taken to eliminate exposure in writing. Additionally, agencies and their subcontractors shall:
   a. Instruct occupant(s) to not disturb confirmed ACM locations, and recommend avoidance of suspected ACM locations.
   b. Formally notify occupant(s) if test results are positive for asbestos, and obtain a client signature confirming their notification.
   c. Provide safety information to the client, from resources such as those listed at the end of this policy.
   d. Provide the client with contact information for the regional EPA asbestos coordinator.

EPA Region (California)	NESHAP Regional Coordinator	Asbestos Abatement/Management Ombudsman (Public Representative)
EPA Region 9 75 Hawthorne Street San Francisco, CA 94105	Regional Air Office Mail Code: A-3-3 Phone: 415-947-8704 FAX: 415-744-3579	Phone: 800-368-5888 Fax: 202-566-1505

   e. Occupants will be asked to contract with an EPA-certified asbestos contractor to conduct abatement before weatherization is performed in the affected area (occupant is responsible for abatement or remediation work and costs).
10. When major energy saving measures might be sacrificed as a result of suspected asbestos-containing materials, the agency or subcontractor shall have the suspected material tested by laboratory for asbestos content. (e.g., for all vermiculite or un-encapsulated textured “popcorn” ceilings.) This does not apply to metal air ducts/components insulated and/or sealed with gray paper-like material, which is presumed to contain ACM. Testing is an allowable line item to be billed under the lead-safe weatherization line item in the current program.
11. For Large-Multifamily Projects: Where grantees work on large heating and distribution systems, including related piping, the cost of asbestos removal (or less costly approaches such as encapsulation) is allowable, with prior approval of CSD, to the extent that documented energy savings resulting from the measure will demonstrate a cost-effective SIR (1.0 or greater). In all cases, compliance with all codes and EPA regulations is required.
12. Encapsulation of non-friable asbestos in limited amounts may be allowed with prior approval by CSD, on a case-by-case basis. Encapsulation is the process of covering (encapsulating) ACM in order to contain the fibers permanently. Possible locations include duct register boots containing intact asbestos tape, or rough edges of transite pipe. An approved encapsulation material may be applied; however, such work shall be performed only by qualified personnel, in accordance with state and federal regulations.

CREW RESPONSIBILITIES

1. Asbestos-safe weatherization practices shall be taken when working on building components which are known or suspected to be ACM. Examples include pre-1980 homes with a duct system sealed/insulated with light paper-like material, vermiculite insulation, or “popcorn” textured ceilings.
2. Field personnel (assessors, installers, and inspectors) are responsible for participating in health and safety training and following established safety practices.
3. Field personnel shall ensure that the condition of the material (i.e., degraded and potentially friable versus intact and non-friable), material type, and precise location of potential ACM are documented clearly in the CSD 540.

4. No action may be taken that will disturb, expose, release, or discharge any ACM and in no case shall the agency authorize the removal or disposal of asbestos by individuals who are not certified to do such work.
5. Installers are required to use asbestos-safe work practices including site preparation, clean up, and use of personal protective equipment. Installers shall perform safe weatherization installation activities around ACM using techniques and practices that prevent a hazard from being created in the living space. The use of properly rated respirators and protective clothing is advised in situations involving low level, limited-time exposure. Wetting down the suspected material is also recommended.
6. All dust and debris generated as a result of weatherization activities in areas where ACM is present shall be thoroughly cleaned up, using a HEPA vacuum, wetting, bagging, and all other state-mandated safety practices. (See CSLB publications references listed at the end of this document.)

3. ACM CLASSIFIED BY TYPE AND CONDITION OF MATERIAL

Homes built before 1980 are presumed to have asbestos-containing building materials, unless determined otherwise (e.g., by laboratory testing or previous certification). Table 1 below lists examples of some common types and conditions of ACM that may be encountered during weatherization work; however, this is not an exhaustive list of the asbestos-type materials that may be encountered. “Condition Level” (1, 2 or 3) determines procedures to be followed by field personnel, which are further described in Tables 2–5.

These are examples only; agencies, their subcontractors, and field personnel are responsible for recognizing actual and possible ACM, and for conducting all weatherization activities affected by its presence in a manner prescribed by state law (see CSLB publications listed at the end of this document).

Table 1: Condition Levels

Asbestos-Containing Building Material/Component (Examples Only)	*Condition Level 1* *Non-friable, intact, encapsulated ACM (i.e., non-degraded, undamaged)*	*Condition Level 2* *Non-encapsulated, potentially-friable, or partially damaged or degraded ACM*
• Supply system metal ductwork with ACM insulation on ducts, register boots, and other components, and/or ACM tape used to seal metal duct joints	• Intact, with no disconnections	• With evidence of damage, degradation, or duct disconnection(s)
• Return system metal ductwork with ACM insulation on ducts, register boots, and other components, and/or ACM tape used to seal metal duct joints	• Intact, with no disconnections	• N/A: See Condition Level 3
• "Transite" vent pipe (asbestos cement pipe)	• Intact	• Damaged or degraded
• Fireproof composite ACM, and asbestos insulation board (e.g., hearth and wall protectors for heating appliances, such as wood-burning stoves)	• Intact	• Damaged/degraded
• Textured ceiling (popcorn or coarse, bumpy texture)	• Intact, may be covered with paint	• N/A: See Condition Level 3
• Caulking compound	• Intact	• Damaged/degraded
• Drywall and drywall compound	• Intact	• Damaged/degraded
• ACM siding ("asbestos shingles")	• Intact	• Damaged/degraded
• Vermiculite ceiling insulation	• Lab-verified to not contain ACM	• Lab-verified to contain asbestos or presumed ACM.
Asbestos-Containing Building Material/Component (Examples Only)	***Condition Level 3*** ***Friable ACM—damaged, degraded, crumbling, flaking— and is/may be discharging asbestos fibers into the air***	
• Rigid nonmetallic ductwork made of ACM is present	• Regardless of condition, this is an unacceptable duct material	
• Return system ductwork with partial/full disconnection(s) and/or unsound/friable ACM at leaking joints	• May allow asbestos fibers to enter the return system. Unacceptable.	
• Textured ceiling (popcorn or coarse, bumpy texture) • Caulking compound • Drywall and drywall compound	• Characterized by crumbling or flaking. Unacceptable.	
• Transite pipe	• Damaged, degraded, or requiring replacement to facilitate appliance replacement	
If an ACM is encountered that is not on this list, consult with the Technical Assistance Hotline for guidance at: (877) 831-7596 or Wx.Hotline@csd.cas.gov.		

4. DIAGNOSTICS AND ACM POLICIES

No pressure diagnostics and no duct or shell tightening of any kind is allowed—including catastrophic leakage repair—while an uncorrectable CAS fail or any hazardous (Level 3) ACM is present. *Exception:* When ACM is present but there is no CAS fail, weatherstripping and door bottom may be installed to isolate open combustion appliances from the living space (e.g., on a door between an attached garage and the home, or a door of an interior enclosure with CVA vents to outdoors).

Table 2: Duct and Shell Testing and Sealing

Level	Condition/Approach	Duct Testing & Sealing	Shell Testing & Sealing
1	• ACM insulation/sealing on *supply or return* metal ducts is not degraded or friable and there are no disconnections	• Duct testing is allowed, and duct sealing is allowed in locations where ACM will not be disturbed	• Pressurized blower door test with registers and grilles blocked—and shell sealing—are allowed
	• Transite pipe (intact in the living space, or with minor damage in the attic)	• Duct testing and sealing activities that will not disturb ACM are allowed	• Pressurized blower door test with registers and grilles blocked—and shell sealing—are allowed
	• ACM (in one or more of the following locations) is verified to be *intact* or *encapsulated*, and is in good condition and non-friable: - Fireproof composite ACM - Asbestos insulation board - Textured ceiling - Vermiculite confirmed to not contain asbestos - Caulking compound - Drywall and drywall compound - ACM siding	• Feasible	• Feasible
2	For each of the Level 2 materials listed below, It is required to: • Visually assess the level of friability of material in multiple locations and note in the Assessment Form • Lab test if ACM is suspected but not confirmed[1] • Visually check for metal duct disconnections[2]		
	• ACM insulation/sealing on metal supply ducts, and a disconnection exists or is presumed to exist *(Note: ACM on return ducts with evidence of damage, degradation, or duct disconnection(s)is a Level 3 condition)*	• Duct test is not feasible, but prescriptive duct *sealing* that will not disturb ACM is feasible	• Pressurized blower door test with registers and grilles blocked—and shell sealing—are allowed
	• ACM (in one or more of the following locations within the living space) is verified to be *damaged or degraded*: - Fireproof composite ACM - Asbestos insulation board - ACM drywall and drywall compound - ACM caulking compound *(Note: An un-tested textured ceiling with evidence of damage or degradation is a Level 3 condition)*	• Duct testing and sealing activities that will not disturb ACM are allowed	• Not feasible; home is NIM, although special weatherstripping* shall be allowed • *Weatherstripping and door bottom may be installed to isolate open combustion appliances from the living space (on door between attached garage and the home, and door on interior enclosure with CVA vents to outdoors)

[1] "Transite" pipe and gray paper insulation and sealing tape on metal ducts/components are presumed to be ACM; testing is not required.
[2] Disconnection presumed to exist, if all ductwork sealed or insulated with ACM cannot be accessed and visually checked.

	• ACM siding is verified to be *damaged or degraded*	• Duct test is allowed, and duct sealing is allowed in locations where ACM will not be disturbed	• Feasible
	• Vermiculite insulation verified to contain asbestos	• Duct test and sealing activities that will not disturb ACM are allowed	• Pressurized blower door test with registers and grilles blocked—and shell sealing—are allowed
3	• Any non-metallic ductwork made of ACM	• Not feasible; home is NIM, defer home	• Not feasible; home is NIM, defer home
	• Return system ductwork with partial/full disconnection(s) and/or friable ACM at leaking joints • Textured ceiling (popcorn or coarse, bumpy) • Caulking compound • Drywall and drywall compound • Transite pipe (damaged and crumbling, in the living space or enclosure vented to it)	• Not feasible, home is NIM	• Not feasible; home is NIM, although special weather-stripping may be allowed • Weatherstripping and door bottom may be installed to isolate open combustion appliances from the living space (on door between attached garage and the home, and door on interior enclosure with CVA vents to outdoors)
	• Vermiculite insulation is verified to contain asbestos, and metal supply ducts with ACM are in the attic, but there is no duct disconnection	• Duct sealing that will not disturb ACM is allowed	• Pressurized blower door testing with registers and grilles blocked—and shell sealing—are allowed
	• Vermiculite insulation is verified to contain asbestos, and metal supply ducts with ACM are in the attic, and there is a duct disconnection	• Duct *testing* is not feasible, but prescriptive duct *sealing* that will not disturb ACM is feasible (e.g., platform return)	• Pressurized blower door testing with registers and grilles blocked—and shell sealing—are allowed

Table 3: CAS Testing and Appliance Repair/Replacement

Level	Condition/Approach	CAS Testing/Appliance Repair or Replacement
1	• CAS fail exists, and intact transite vent pipe is present	• CAS testing is feasible • Appliance repair/replacement feasible, if ACM not disturbed
	• Other Condition Level 1 ACM situations exist	• Feasible, if ACM will not be disturbed
2	• CAS fail exists, and correction would require adjustment/repair/replacement of transite vent pipe, and the correction will cause ACM to be released or discharged	• Appliance replacement/repair is not feasible; *however,* if the *owner* hires an asbestos remediation contractor to remove the ACM, then appliance repair/replacement by the CSD contractor is allowed
3	• Any nonmetallic ductwork made of ACM	• CAS testing not feasible; home is NIM and is deferred
	• Return system ductwork with partial/full disconnection(s) and/or friable ACM at leaking joints	• Do not operate the FAU; the home is NIM and deferred • A *partial* deferral is an option, when required minimum number of non-infiltration measures can be installed
	• Textured ceiling (popcorn or coarse, bumpy) • Caulking compound • Drywall and drywall compound • Vermiculite insulation verified to be ACM	• CAS testing is feasible • Appliance repair/replacement that will disturb ACM is not feasible
	• Transite pipe (damaged or crumbling, in the living space or enclosure vented to it)	• CAS testing not feasible for the affected appliance • If affected appliance is the FAU, the home is NIM • If affected appliance is not the FAU, CAS testing, repair, replacement is feasible for other combustion appliances

5. WEATHERIZATION INSTALLATION ACTIVITIES AND ACM

The following weatherization measures may be affected by the presence of ACM:

Table 4: Weatherization Measure Installation

Weatherization Measure	Location of ACM	Recommended Action
• Ceiling Fans • Hard-Wired Fixtures	• Textured "Popcorn" Ceiling	• Contractors who are certified/trained to handle ACM may disturb limited quantity of material, as long as state requirements are met for containment, clean-up and reporting
• Smoke Alarms	• Textured "Popcorn" Ceiling	• Seek alternative installation location where ACM is not present
• Mechanical Ventilation	• Textured "Popcorn" Ceiling	• Seek alternative installation location where ACM is not present • Contractors who are certified/trained to handle ACM may disturb limited quantity of material, as long as state requirements are met for containment, clean-up and reporting • If contractor is not certified, measure is not feasible
• Wall Insulation	• "Asbestos Shingles" / Siding	• Do not cut, drill, or sand asbestos wall material • House siding containing asbestos shall not be drilled through or removed; however, insulation may be blown from inside the home

Additionally, the installation of ceiling insulation may be affected by the presence of ACM in accordance with the condition levels described in Table 1.

Table 5: Ceiling Insulation

Level	Condition/Approach	Ceiling Insulation
1	• Attic contains metal ducts/components, and ACM is not present on ducts	• Feasible
	• Attic contains vermiculite insulation verified to not contain asbestos (by prior certification or lab test)	• Feasible
	• Other Condition Level 1 ACM situations exist	• Feasible
2	• Attic contains metal ducts/components, and ACM is present on ducts	• Feasible only when there is no large leak or disconnection, and ACM will not be disturbed during installation (by the installer or insulation hose)
	• "Transite" vent pipe	• Feasible only when ACM will not be disturbed
	• Textured ceiling (popcorn or coarse, bumpy)	• Not feasible
	• Caulking compound	• Feasible
	• Drywall and drywall compound	• Feasible
	• ACM siding ("asbestos shingles")	• Feasible
3	• Attic contains rigid nonmetallic ductwork made of ACM	• The home is NIM, and ceiling insulation is not feasible
	• Attic contains return system ductwork with partial/full disconnection(s) and/or friable ACM at leaking joints	• Not feasible
	• Attic contains vermiculite insulation verified to contain asbestos	• Not feasible

Level	Condition/Approach	Ceiling Insulation
	• Attic contains transite pipe that is damaged and crumbling	• Not feasible
	• Textured ceiling (popcorn or coarse, bumpy)	• Ceiling insulation and sealing of thermal bypasses in the ceiling are not feasible
	• CAS testing is not feasible for an FAU, due to ACM "transite" vent pipe	• Home is NIM, but ceiling insulation may be installed if ACM will not be disturbed.
	• Duct and shell testing and sealing, and CAS testing, are not feasible	• Defer the home.

6. ADDITIONAL ASBESTOS INFORMATION RESOURCES

Air Resources Board of California (ARB): http://www.arb.ca.gov/toxics/asbestos/1health.pdf

California Department of Public Health (CDPH): http://www.cdph.ca.gov/programs/IAQ/Documents/IAQ_Asbestos_2000-03.pdf

Environmental Information Association (EIA): http://www.eia-usa.org/fact-sheets/asbestos/

Environmental Protection Agency (EPA): http://www.epa.gov/asbestos/ and http://www.epa.gov/iaq/pubs/insidestory.html#Look8

Occupational Safety and Health Administration (OSHA): http://www.osha.gov/OshDoc/data_AsbestosFacts/asbestos-factsheet.pdf

Contractor's State License Board (CSLB): "A Consumer Guide to Asbestos" available at:
http://www.cslb.ca.gov/Resources/GuidesAndPamphlets/AsbestosGuideForConsumers.pdf
For the booklet "Asbestos: A Contractor's Guide and Open Book Examination" and other contractor-related asbestos information, go to:
http://www.dir.ca.gov/dosh/ACRU/ACRUinfo.htm

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NOTES

LEAD-SAFE WEATHERIZATION REQUIREMENTS

Lead Paint Risk Factor
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LEAD-SAFE WEATHERIZATION REQUIREMENTS

1.0 INTRODUCTION

It is CSD's goal that their energy efficiency programs enhance clients' quality of life without creating a hazardous condition in the home, and that Agencies and their subcontractors conduct all work activities in a manner that protects the health and safety of both workers and occupants. CSD's Lead-Safe Weatherization (LSW) Requirements provide practices and guidelines for meeting that goal. These Lead-Safe Weatherization (LSW) Requirements provide policies and practices applicable to all Weatherization Programs administered by the California Department of Community Services and Development (CSD).

CSD weatherization program agencies and their subcontractors shall follow all applicable local, state, and federal laws and regulations pertaining to lead-based paint and lead hazards. They shall be aware of the potential hazards and conduct all activities in a "lead-safe" manner, avoid contaminating homes with lead-based paint dust and debris, and avoid exposing the clients, themselves, and their families to those hazards. It is therefore important that all Agency personnel understand and follow this section and all related trainings.

2.0 LEAD AS A HEALTH HAZARD

Symptoms of lead poisoning may develop quickly but are often not recognized until severe damage has been done. Lead enters the bloodstream and is distributed throughout the body. If not detected early enough, both children and adults are at risk. Symptoms of lead poisoning may vary depending on the amount of lead in the blood. However, it is important to remember that many individuals show no outward signs of lead poisoning. An individual may have an elevated blood lead level even if they appear healthy and show no outward signs of lead poisoning.

Lead poisoning symptoms are frequently mistaken for the indications of a cold or flu virus. Sometimes these symptoms can come and go for several months, making it difficult for the afflicted person to recognize them as a serious health threat. A child with lead poisoning may appear healthy because the obvious symptoms often do not develop until the condition is serious and permanent damage has been done. Once the lead poisoning has been discovered, the effects of it may be difficult to identify. The following is a list of common signs of lead poisoning:

- Tiredness
- Wrist or foot drop
- Sleep problems
- Weakness
- Dizziness
- Clumsiness
- Irritability
- Joint and muscle pain
- Nervousness
- Vomiting
- Headaches
- Loss of appetite
- Difficulty concentrating
- Risk of birth defects
- Stomach aches
- Depression
- Constipation
- Forgetfulness
- Metallic taste in mouth
- Hyperactivity
- Numbness

3.0 LEAD-SAFE WEATHERIZATION OVERVIEW

3.1 APPLICATION

Lead-Safe Weatherization Requirements shall apply to ALL residential structures built before January 1, 1978 that are not certified to be "lead-free" by a lead-based paint inspection conducted by a certified Inspector/Assessor. The Lead-Safe Weatherization Requirements listed in this section are not intended to be a complete list of practices for controlling and containing lead hazards; however, by using these suggested practices and common sense, lead poisoning from weatherization activities may be prevented.

3.2 LEAD-RELATED REGULATIONS

CSD weatherization agencies and their subcontractors are required to follow all applicable regulations when weatherizing homes. With lead-based paint, there are a number of regulations that shall be followed:

- Local lead-based paint regulations (check local codes). Note: In California, a few cities have instituted additional lead-regulations which also shall be followed.
- California Department of Public Health (DPH), CCR Title 17, Chapter 8 Accreditation, Certification and Work Practices for Lead-Based Paint and Lead Hazards.
- Environmental Protection Agency (EPA) Renovation, Repair, and Painting (RRP) Rule.
- Department of Housing and Urban Development Lead-Safe Housing Rule, 24 CFR Part 35 for work conducted on federal HUD properties.
- Department of Energy regulations.
- California Department of Occupational Health and Safety (CalOSHA) Title 8, Section 1532.1.

3.2.1 California Department of Public Health (DPH)

The California Department of Public Health (DPH) governs lead-related activities in California. According to DPH, disturbing ANY amount of lead-based paint or presumed lead-based paint may create a lead hazard. A lead-hazard is defined as “disturbing lead-based paint or presumed lead-based paint on a residential structure built before 1978 without containment.” Presumed lead-based paint is defined as: “any paint or coatings attached to a residential structure built before 1978 that has not been tested to determine the lead content.” Therefore, everyone shall presume painted surfaces on homes built before 1978 are leaded, unless tested and determined to be lead free.

California lead regulations require that anyone conducting “lead activities” shall use the following lead-safe work practices:

1. Contain—Use a system, process, or barrier to contain lead hazards inside a work area (lead-safe practices are considered “containment”);
2. Clean—Ensure that the work area has no visible dust or debris following the completion of a project;
3. Comply—Upon request, be able to demonstrate compliance with items (1) and (2) above to the regulatory department or a local enforcement agency (environmental health, environmental agency, housing department, or building department).

Under the California Department of Public Health lead rules, there are no additional training, certification, or paperwork requirements for contractors, other than appropriate application of these three lead-safe activities. However, additional regulations in these areas are part of the EPA RRP, DOE, and HUD regulations that are also in effect for lead-safe practices.

3.2.2 EPA RRP Rule

The EPA RRP Rule applies (in addition to the Lead-Safe Weatherization rules) to **all** pre-1978 dwellings, except:

- Zero (0)-bedroom dwellings, such as studio apartments; or
- For dwellings built after 1977; or
- Housing for the elderly or persons with disabilities (care facilities). This exemption is in effect unless any child who is less than six years of age also resides or is expected to reside in such housing; and/or
- When minor repair and maintenance activities disturb *less than* EPA RRP *de minimis* levels. Window replacement, demolition work, and activities that disturb less than the EPA RRP *de minimis* levels are the exception to this exemption, and they automatically trigger RRP Rule compliance.

The EPA's *de minimis* levels are:

- 6 sq. ft. of paint disturbance in any one interior room; or,
- 20 sq. ft. on exterior surfaces.[1]

EPA-Certified Firm Requirements

The EPA RRP Rule requires that all contractors/firms performing renovation, repair, and painting projects that disturb lead-based paint in pre-1978 homes, childcare facilities, and schools be certified by the EPA.

Renovation is defined as "any activity that disturbs painted surfaces and includes most repair, remodeling, and maintenance activities, including window replacement." Weatherization is included in the activities that trigger this rule. To become certified, a contractor/firm shall submit to the EPA a completed "Application for Firms," signed by an authorized agent of the firm, and pay the correct fees ($300 for the 5-year certification).

EPA-Certified Firms are required to:

- Use certified renovators (Certified Firms are not required to have a Certified Renovator on staff; however, it is considered a best practice for the weatherization program) who are trained by EPA-approved training providers to follow lead-safe work practices.
- Provide owners, tenants, and/or child-care facilities with a copy of the EPA's lead hazard information pamphlet and obtain a signed acknowledgement before beginning work.
- Use lead-safe work practices when disturbing leaded or presumed leaded surfaces.
- Document lead paint identification, safe practices, thorough cleaning, and cleaning verification.
- Retain documents for three years.
- Information and certification applications are available on EPA's website (www.epa.gov/lead).

[1] HUD Lead-Safe Housing Rule, 24 CFR 35, subparts B through R, page 70.

EPA-Certified Renovator Requirements

Certified renovators are responsible for ensuring overall compliance with the Lead-Based Paint Renovation, Repair, and Painting Program's requirements for lead-safe work practices. To become a Certified Renovator, a person shall attend a one-day, EPA-accredited RRP training program.

A Certified Renovator:

- Determines if compliance with the RRP Rule is required.
- Shall use an EPA-recognized test kit to determine whether components affected by the renovation contain lead-based paint or assume lead-based paint is present for housing and buildings covered by this rule, unless testing is done that determines the components affected are lead-free (see "Reminder" below).
- Shall determine the type and extent of lead-safe work practices at each job site and provide on-the-job training to other workers (who have not taken the Certified Renovator training course) on the lead safe work practices to be used in performing their assigned tasks.
- Shall be physically present at the work site when warning signs are posted, while the work-area containment is being established, and while the work-area cleaning is performed.
- Shall regularly direct work being performed by other individuals to ensure that the work practices are being followed, including maintaining the integrity of the containment barriers and ensuring that dust or debris does not spread beyond the work area.
- Shall be available, either on-site or by telephone, at all times renovations are being conducted.
- Shall perform work site cleaning verification.
- Shall have with them at the work site copies of their initial course completion certificate and their most recent refresher course completion certificate.
- Shall prepare required records. (For a sample checklist of required records, see www.epa.gov/lead/pubs/samplechecklist.pdf.)
- Be recertified every five years.

REMINDER: The California Department of Public Health does not allow the use of lead test kits to make a determination for the presence or absence of lead, no matter how much area may be disturbed. Currently, DPH only recognizes the use of a XRF (x-ray fluorescence (XRF) spectrometer) or identification by a certified laboratory test to identify the presence of lead. Since EPA and DPH both hold jurisdiction under the weatherization program, the most stringent applies (which is DPH, regarding the test kits). However, DPH also permits contractors to ***presume*** that lead is present for pre-1978 dwellings, and if they apply lead-safe practices when working on those homes, then no testing of any kind is required.

EPA RRP Prohibited Practices

- Prohibited methods—The following equipment/methods are not allowed by EPA RRP:
  - Open-flame burning or torching of painted surfaces.
  - Heat gun above 1,100ºF.
  - The use of machines designed to remove paint or other surface coatings through high-speed operation such as sanding, grinding, power planing, needle gun, abrasive blasting, or sandblasting unless such machines have shrouds or containment systems and are equipped with a HEPA vacuum attachment to collect dust and debris at the point of generation.

EPA RRP Compliance

Agencies and subcontractors providing weatherization services are required to be EPA-certified Firms. Each firm is required to use a certified renovator to assess the needs of each pre-1978 job and be on-site during work to ensure that crews follow lead-safe practices for containment and clean-up when *de minimis* levels will be exceeded by weatherization activities.

While the EPA's containment and cleaning practices themselves are not different from standard lead-safe weatherization practices, the Rule requires Certified Renovators to certify and document that workers have complied with these practices and conduct a visual inspection and cleaning verification process when the project is completed.

3.2.3 HUD Lead-Safe Housing (LSH) Rule

HUD's Lead-Safe Housing Rule (24 CFR Part 35) applies to residences funded by federal housing programs, such as[2]:

- Housing receiving a federal subsidy that is associated with the property rather than with the occupants (project-based assistance).
- Public housing.
- Housing occupied by a family receiving a tenant-based subsidy (i.e., Section 8 voucher or certificate).
- Housing receiving federal assistance for rehabilitation, reducing homelessness and other special needs.

HUD Lead-Safe Housing Rule

When weatherization work is conducted on pre-1978 federally-funded housing, HUD's Lead-Safe Housing Rule shall be followed when: 1) lead-based paint or lead hazards are present (or presumed to be present); and 2) *more than* the HUD *de minimis* level of paint will be disturbed. Note: If less than the *de minimis* level will be disturbed, the HUD Lead-Safe Housing Rule does not apply.

HUD's *de minimis* levels are:

- 2 square feet of paint disturbance in any one interior room; or,
- 20 square feet on exterior surfaces and/or,[3]
- 10 percent of the surface area of small building components (i.e., trim, baseboard, etc.).

HUD's Lead-Safe Housing Rule requires that the following lead-safe work practices[4] be followed:

- Occupant protection—Occupants may not enter worksite.
- Worksite preparation and containment—It is required to use practices to minimize the spread of lead dust, paint chips, soil and debris, and place warning signs at entries to work areas.
- Prohibited methods—The following practices/methods shall not be used:
    - Open flame burning or torching,
    - Heat guns above 1100ºF or charring the paint,
    - Machine sanding or grinding without a high-efficiency particulate air (HEPA) local exhaust control.
    - Dry scraping or sanding farther than 1 ft. of electrical outlets, and

[2] These regulations do not apply if the structure or building components are found by a certified lead inspector/assessor to be "lead free."

[3] HUD Lead-Safe Housing Rule, 24 CFR 35, subparts B through R, page 70.

[4] HUD Lead-Safe Work Practices, http://portal.hud.gov/

- Paint stripping in a poorly ventilated space using a volatile stripper that is a hazardous substance in accordance with regulations of the Consumer Product Safety Commission at 16 CFR 1500.3, and/or a hazardous chemical in accordance with the Occupational Safety and Health Administration regulations at 29 CFR 1910.1200 or 1926.59, as applicable to the work.

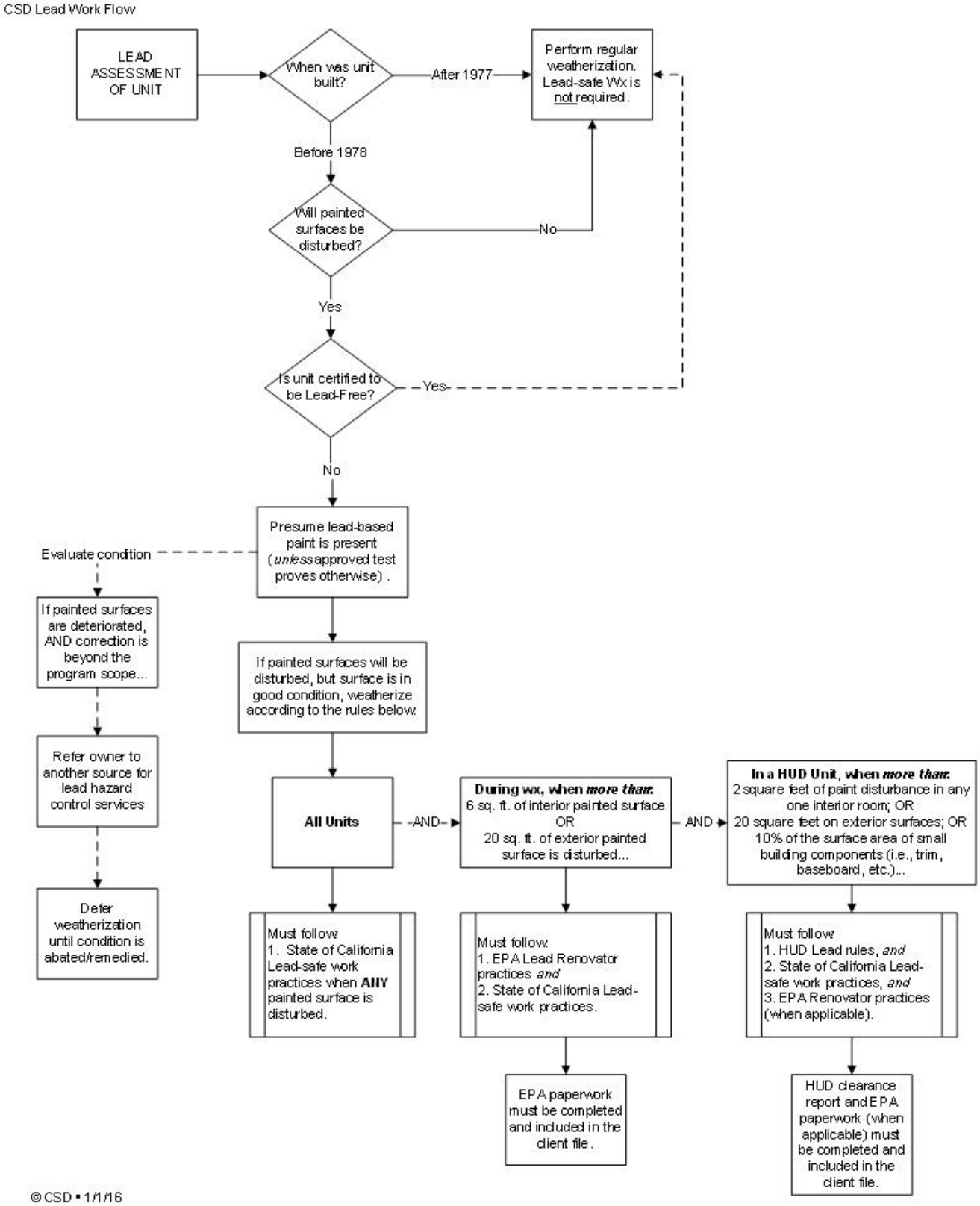
- Worksite cleanup—HEPA vacuuming and detergent/wet-wash cleaning is required.

HUD Compliance

In order to comply with HUD guidelines, a clearance inspection conducted by a certified inspector/assessor or clearance technician is required when the project is completed. A key difference between EPA RRP and HUD is the clearance procedure, because the EPA RRP allows the inspection to be done by a Certified Renovator while the HUD program guidelines require that the clearance inspection is conducted by a certified inspector/assessor or clearance technician.

3.3 LEAD-SAFE WEATHERIZATION DECISION FLOWCHART

To assist agencies in following lead-safe practices, the following decision tree is provided:



3.4 LEAD SAFE WEATHERIZATION RISK FACTORS

A set of "risk factors" has been developed to assist weatherization workers in developing adequate dust control strategies (also known as containment and cleaning) for the measures being installed. The risk factors represent three categories, based on the amount of painted area to be disturbed and how much dust may be generated by these activities. The categories are "High Risk," "Low Risk," and "No Risk" activities. The list of measures/activities on the following pages is not all-inclusive and only represents instances in which there may exist the probability of disturbing lead-based paint in a dwelling built before 1978. **Actual risk shall be assessed, and appropriate containment and cleaning methods shall be prescribed, by the on-site Certified Renovator**. While these risk factors are a useful way of addressing lead-based paint issues, everyone needs to know that lead paint may become hazardous no matter how much is disturbed if it is not contained and cleaned properly.

3.4.1 Risk Factor Icon

Lead Paint Risk Factor
Low-High

Standardized risk factors for each weatherization/efficiency measure/activity are identified in each section of the CSD Weatherization Installation Standards (WIS) by an emblem like the one shown at the right. However, in pre-1978 dwellings, **any painted surface that is disturbed should be considered to contain at least a "low risk," unless testing has proven otherwise**. Additional information on lead safety may be obtained from organizations identified in the graphic below.

CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

Childhood Lead Poisoning Prevention Branch
850 Marina Bay Parkway
Building P, Third Floor
Richmond, CA 94804-6403

Lead Hotline: 1-800-597-LEAD (1-800-597-5323)
CLPPB: (510) 620-5600
Fax: (510) 620-5656
www.cdph.ca.gov/programs/CLPPB

NATIONAL LEAD INFORMATION CENTER
1-800-424-LEAD

EPA United States Environmental Protection Agency

US EPA Region 9
75 Hawthorne St.
San Francisco, CA 94105

Region l9 Contact: (866) EPA-WEST (372-9378)

www.epa.gov/lead/

U.S. Department of Housing and Urban Development
Office of Lead Hazard Control and Healthy Homes (OLHCHH)
451 7th Street S.W., Room B-133
Washington, DC 20410
Ph: (202) 755-1785
Fax: (202) 755-1000

EQUAL HOUSING OPPORTUNITY

https://hud.gov/lead

The risk factors are based on the amount of paint that may be disturbed (based on the EPA and HUD *de minimis* levels) and how paint is disturbed (cutting, drilling, sawing, etc.). These Risk Factors are recommendations ONLY, and actual containment and cleaning practices shall be based on the details of the actual job, which may be different for every home.

The risk factors developed for Lead-Safe Weatherization are:

- No-Risk Measures
- Low-Risk Measures
- High-Risk Measures

The table below summarizes the regulatory agency, compliance triggers, and the compliance activity required.

Regulatory Agency	Paint Disturbance Compliance Triggers (*de minimis* levels)	Compliance Activity
California DPH	• Pre-1978 • **Any** amount of paint	• "Appropriate" containment and cleaning when ANY paint is disturbed.
HUD LSH Rule	• Pre-1978 • More than 2 sq. ft. per interior room • More than 20 sq. ft. of surface on the exterior • More than 10% of small building components (i.e., trim, baseboard, etc.	• "Appropriate" containment and cleaning when HUD *de minimis* levels are exceeded. • Prohibited Activities shall not be used. • Clearance Inspection and report by a DPH-certified Inspector or Assessor is required.
EPA RRP Rule	• Pre-1978 • More than 6 sq. ft. in any interior room • More than 20 sq. ft. on exterior surfaces	• Certified Renovator shall be on-site during all work • Client Education Pamphlet shall be delivered and signature obtained. • "Appropriate" containment and cleaning when HUD *de minimis* levels are exceeded. • Prohibited Activities shall not be used. • Certified Renovator shall provide 1) a Visual Inspection and 2) Cleaning Verification at the end of the job. • EPA-compliant documentation shall be kept in the client file.
DOE Lead-Safe Wx	• Pre-1978 • Less than EPA *de minimis* level • More than EPA *de minimis* level	• RRP Rule Requirements • Level 1 Containment is required when less than the EPA *de minimis* level is disturbed. • Level 2 Containment is required when more than the EPA *de minimis* level is disturbed. • CSD 708 form and Photographs of work during set-up and cleaning stages.

3.4.2 Risk Factor Evaluation

The LSW "Risk Factor" shall be evaluated for each measure before beginning weatherization work. Based on the types of work to be performed and the year the home was built, **the appropriate Lead-Safe Weatherization Practices listed in this section shall be employed**. The tables below are recommendations for each measure; however, trained workers and Renovators shall evaluate the existing conditions and make the final determination about the amount of material that will be disturbed and prescribe what containment and cleaning practices shall be used.

To use the table below: 1) find measure to be installed and 2) note the "Risk Level" associated with the work to be done and the type of documentation required for the work. Then, use this section to determine if Lead-Safe Weatherization containment and cleaning practices are required for the job.

3.4.3 No Risk Measures

"No Risk" weatherization measures are those that *will not disturb paint* or are that are installed in dwellings built after 1977 (or 1978 in the City of San Diego). Examples of these measures are listed in the table below.

Warning: A No-Risk measure may become a High-Risk measure and require special actions if paint ends up being disturbed during the installation (example: worker falling though a ceiling while installing insulation).

NO RISK MEASURES: Containment and Clean-up activities are NOT required.		
REQUIRED DOCUMENTATION	**LSW Procedure**	CSD 708 Form, page 1 only.
	EPA Procedure	CSD 708 Form, page 1 only.
	HUD Procedure	CSD 708 Form, page 1 only.

POTENTIAL "NO-RISK" MEASURES		
AC Unit Repair or Maintenance	Duct Insulation	Microwave Ovens
AC (Central) Installation*	Duct System Testing, Repair & Sealing	Refrigerator Repair or Replacement
Advanced Power Strips	Evaporative Cooler Installation*	Showerhead Replacement
Air Filter Replacement	Electric Water Heater Timers	Thermostatic Shower Valve or Thermostatic Showerhead
Assessment/Post-Inspection	Faucet Aerator	Vent Covers—Interior
Attic Ventilation (roof vents only)	Floor Insulation	Water Heater Insulation
Ceiling Insulation	Fluorescent Torchiere Lamps	Water Heater Pipe Insulation
CAS Pre/Interim/Post-Inspection	Furnace (Central) Repair or Replacement*	Water Heater Repair or Replacement*
CFLs—Thread-Based	Furnace (Floor or Freestanding) Repair or Replacement*	Window Film
Cooktop/Range Repair or Replacement	LED Bulbs and LED Nightlights	Wood Burning Space Heater, if addition of venting is not required*

**The installation of these measures, or alternation/disturbance to an enclosure, may disturb paint, if so apply the appropriate LSW risk level.*

3.4.4 Low Risk Measures

"Low-Risk" activities are associated with weatherization/efficiency measures that may generate minimal lead dust or debris if performed improperly. This applies when the amount of surface area to be disturbed is less than or equal to the EPA RRP or HUD *de minimis* levels (when applicable), and considered "minor repair or maintenance." When conducting these activities, Containment via lead-safe practices and thorough Cleaning are required. Examples of potential low-risk are provided in the table below. While this type of work is not likely to disturb significant amounts of lead-based paint; it is the responsibility of the Certified Renovator to determine the extent of the lead-safe containment and cleaning practices that shall be performed appropriate to the amount of material disturbed.

Note: These activities do not trigger EPA RRP Rule requirements, but may trigger HUD's LSH Rule if working on HUD-qualified housing.

LOW RISK MEASURES:	**Required Containment and Clean-up Activities shall be determined by the Certified Renovator appropriate to the level of lead risk and amount of paint to be disturbed.**	
REQUIRED DOCUMENTATION	**LSW Procedure**	Full CSD 708 form shall be completed. Photographic documentation of job site set-up, any containment, and clean-up activities is required.
	EPA Procedure	See LSW Procedure
	HUD Procedure	See LSW Procedure

POTENTIAL LOW-RISK MEASURES		
AC (Window/Wall) Installation*	Duct Leakage Test	Minor Envelope Repair
Blower Door Diagnostic (when paint is intact. If not intact, do not perform test.) *	Evaporative Cooler Installation	Occupancy Sensor Switches
Caulking	Furnace (Wall Heater) Repair or Replacement	Shade Screens
Carbon Monoxide Alarm	Glass Replacement (Window is a wood or metal frame with a rubber gasket. No glazing compound.)	Smoke Alarm
Ceiling Fan	Hardwired Fixture Installation	Thermostat
Cover Plate Gaskets	High Efficiency Toilets	Weatherstripping
Door Repair or Replacement of only door blank or hinges	Limited Home Repair*	

**The installation of these measures may disturb paint based upon the individual home condition. The Certified Renovator shall apply the appropriate LSW risk level.*

3.4.5 High Risk Measures

"High Risk" measures are those that disturb more than the EPA's "*de minimis*" levels and generate significant quantities of paint dust and debris. They have the potential to create a "hazardous" condition for occupants and workers if lead-safe steps are not taken. Activities such as those listed in the table below are considered a "renovation" activity, and require advanced levels of containment, lead-safe work methods, and clean-up procedures. It is the responsibility of the Certified Renovator to determine the extent of the lead-safe containment and cleaning practices that shall be performed appropriate to the amount of material disturbed.

High-risk activities are those that may disturb more than **the *de minimis* levels** of painted surface and require special containment and cleaning precautions. Additional documentation is also required by the Certified Renovator or DPH-certified Inspector/Assessor (HUD only) on the CSD 708 form during the Compliance phase of the process.

HIGH RISK MEASURES:		**Required Containment and Clean-up Activities shall be determined by the Certified Renovator appropriate to the level of lead risk and amount of paint to be disturbed.**
REQUIRED DOCUMENTATION	**LSW Procedure**	Full CSD 708 form shall be completed. Photographic documentation of job site set-up, containment, and clean-up is required.
	EPA Procedure	a. Full CSD 708 form shall be completed when *de minimis* is *exceeded*. b. Photo documentation of job site set-up, containment, and clean-up is required. c. Certified Renovator is required to perform: 1) jobsite monitoring, and 2) visual inspection and cleaning verification of all affected work areas. Certification of results shall be recorded in the CSD 708 form.
	HUD Procedure	a. Full CSD 708 form shall be completed when *de minimis* is *exceeded.* b. Photo documentation of job site set-up, containment, and clean-up is required. c. A Clearance Inspection from a certified inspector/assessor is required. (Note: Clearance of only the worksite is permitted when containment was used to ensure that dust and debris generated by the work is kept within the worksite. Otherwise, clearance shall be of the entire dwelling unit, common area, or outbuilding, as applicable.)

POTENTIAL HIGH RISK MEASURES		
AC (Window/Wall) Installation*	Furnace (Floor) Repair/Replacement*	Thermal Shutters*
Attic and Crawlspace Ventilation (i.e., eaves, soffits, foundation exteriors)	Furnace (Wall) Repair/Replacement*	Wall Insulation
Demolition of any painted surface area	Glass Replacement (when glazing compound disturbance is required)	Water Heater Repair or Replacement (when enclosure shall be repaired)
Door Replacement, when replacement of jamb or structural framing is required.	Limited Home Repair*	Window Replacement (even if activity disturbs less than the *de minimis*)
Evaporative Cooler Installation	Minor Envelope Repair*	Use of power tool without HEPA-attached shroud

**The installation of these measures may disturb paint based upon the individual home condition. The Certified Renovator shall apply the appropriate LSW risk level.*

3.4.6 Required Dwelling Deferral

It is the policy of the CSD Weatherization Program to not defer or abandon the weatherization of a home simply because it may contain lead-based paint. Because the risk can be reduced using lead-safe weatherization work practices, activities should not be deferred just because the risk factor may be high. The variation in risk depends on how much paint is disturbed and how it is disturbed.

Weatherization services shall be deferred when any one or more of the following conditions are true in a pre-1978 home and the condition is documented in writing and with photographs:

- The paint on a pre-1978 residential structure is in seriously deteriorated condition;
- Large amount of paint chips is present on the ground or floor;
- Painted surfaces that are to be worked on are in seriously deteriorated condition;
- Reimbursement for a Clearance Inspection by a certified Inspection/Assessor for HUD units will not be provided by the property owner or local housing authority or CSD; or
- Other Health & Safety deferral condition exists as outlined in the CSD Field Guide.

If any of the above conditions exist, deferral of weatherization work would mean postponing the work until another agency or the owner has corrected the problem before weatherization can be safely performed (deferral of the home shall be on a whole-dwelling basis, and would not be allowed on a measure-by-measure basis). Clients shall be referred to the appropriate agency for assistance in remedying the problem that prompted the deferral. Deferral of weatherization services shall be documented and retained in the client's file.

4.0 LSW MINIMUM SAFETY STANDARDS FOR WORK CREWS

This section is a guide for lead-safe weatherization practices that will reduce or eliminate lead hazards addressed herein. It is a supplement to training required by DOE, CAL/OSHA, DPH, the EPA Rule, and HUD. Every pre-1978 job where paint will be disturbed will require the "three C's" in order to be compliant: Containment, Cleaning, and Certification.

4.1 PERSONAL PROTECTIVE EQUIPMENT (PPE)

Workers, Renovators, and Field Supervisors are required to wear adequate protection while working with presumed lead material to prevent the spread of lead dust and debris.

Personal Protective Equipment, or PPE as it is known, is used to keep workers safe, reduce the potential for dust to exit the work area, and to keep work area clean. Depending on the amount of paint to be disturbed and risk factor of work to be performed, the recommended PPE is:

No-Risk and Low-Risk PPE

- No PPE is required.
- Workers can choose to wear PPE while conducting low-risk activities, however:
  - All clothes or PPE shall be cleaned in accordance with the procedures listed in these requirements; AND
  - Work clothes shall not be worn home by workers, but shall be: 1) "contained" before leaving the worksite in accordance with DPH and CAL/OSHA policies, or 2) properly cleaned and laundered (when not disposable items) to remove all traces of presumed leaded dust.

High-Risk PPE

- Workers must wear PPE while conducting these activities.
- Work clothes shall not be worn home by workers, but shall be: 1) "contained" in accordance with DPH and CAL/OSHA policies before leaving the worksite, and 2) properly laundered/cleaned to remove all traces of presumed leaded dust.
- PPE shall include:
  - Half-face, National Institute for Occupational Safety and Health (NIOSH)-approved, air purifying respirators with N-100, R-100, or P-100 type particulate filters.
  - Disposable work clothing that may include a painter's hat or Tyvek hood; Tyvek or polyspun suit or coveralls, and shoe covers or booties. Remove work clothing, including booties before stepping off the poly to leave the work area. This prevents the movement of leaded dust throughout the building and keep it off your shoes so that you do not contaminate your vehicle, and bring it to your shop or home;
  - Alternatively, Cal/OSHA allows the use of washable work clothes (i.e., uniform, coveralls), provided that the clothing is HEPA-vacuumed, removed, and stored properly before leaving the worksite. The bagged clothing must be collected at the end of each installation, and washed at least once a week in accordance with DPH and CAL/OSHA policies (the agency's responsibility).
    Note: Disposable suits (i.e., Tyvek-type) may be the most expensive option to comply; however, they are easiest from a worker standpoint.
  - Optional PPE also includes gloves (cloth, plastic, or rubber as appropriate) and eye protection.

Protective clothing is not allowed to be worn from jobsite to jobsite, nor shall it be allowed to move from one work area to another at the same house unless the entire area is properly contained and the clothing cleaned in a lead-safe manner.

Work clothing (Tyvek or the worker's own clothing) shall not be worn home after the job.

4.1.1 Required Worker Safety Procedures

- Be aware that workers in PPE during hot weather may be prone to heat stress including heat exhaustion and heat stroke. You shall be provided with training on heat stress and exhaustion, be provided adequate breaks, have constant availability of water away from the worksite, and access to other re-hydrating liquids.
- Limit occupant access to the work area. Occupants, children, and pets shall be kept out of the work area at all times until after visual inspection and cleaning verifications prove that the surfaces are clean and free from lead-containing dust.
- Tell clients what you will do and how long it will take you before any work begins so they can plan to stay clear of the area.
- During weatherization work, wash your hands and face frequently, particularly when leaving the work area and especially before leaving the area for the purpose of eating, drinking, or smoking. Absolutely no smoking, drinking, or eating shall be allowed in the work area!
- Clean up and remove work clothing before entering your vehicle to return to your office or home. Don't bring home a hazard to your office or family.
- Carefully follow all interior and exterior site preparation practices, containment work, and clean-up activities as described in this section.
- In accordance with CAL/OSHA regulations, you are required to wear monitors and have annual medical exams to check blood lead levels. Do non-lead related work if your blood lead level gets too high.
- Inform your employer if you develop signs of lead poisoning.

4.2 "THREE C'S" FOR WORKERS (CONTAINMENT, CLEANING, AND CERTIFICATION)

4.2.1 Containment

Containment is the active control of lead dust and debris in the work site. It is required by the State of California whenever lead-based paint or presumed lead-based paint is disturbed. It includes measures taken to ensure that dust and debris created or released during weatherization are not spread, blown, or tracked from inside to outside of the worksite perimeter. The set-up of the worksite (i.e., use of poly sheeting, catch bags, vertical containment, etc.) shall be performed appropriate to the amount of painted surface to be disturbed, with the specific containment methods to be defined by a Certified Renovator.

4.2.2 Cleaning

Precautions shall be taken to ensure that all personnel, tools, and surfaces are free of dust and debris during weatherization work and before workers leave the work area. Proper cleaning requires:

- Periodic cleaning of the work area during job if sufficient dust is created that may be spread.
- The use of a HEPA filtered vacuum and wet detergent cleaning activities.
- Workers to carefully clean and remove personal protective equipment so lead dust is not carried out of the work area.

- Final clean-up of work area and proper removal/disposal of hazardous materials.

Following the renovation, the work area shall also be cleaned until no dust, debris or residue remains and all waste that has been collected from renovation activities shall be collected and disposed of properly.

Photos courtesy of MT Wx Training Center

4.2.3 Certification

Under the EPA RRP Rule a visual inspection and cleaning verification of each work area shall be performed by the Certified Renovator after the cleaning is completed. If the housing also receives HUD (federal) assistance, a clearance inspection conducted by a Certified Lead Inspector/Assessor or Certified Lead Sampling Technician is also required.

After completion of all cleaning, the Certified Renovator shall visually inspect the indoor and/or outdoor work area to confirm that the entire area is free of dust, paint debris, or residue. For exterior projects, when work areas have passed the visual inspection, the project is complete and the area may be turned over to the occupants. When interior project work areas have passed the visual inspection, the Certified Renovator shall perform the cleaning verification procedure.

The cleaning verification is performed by wiping each horizontal surface and non-carpeted floor with a new, wet cloth. When compared against an EPA cleaning verification card, if the cloth does not “pass” then the cleaning shall be re-performed. The cleaning verification test is then performed again with another wet cloth. If the second cleaning does not pass the renovator shall re-clean, wait one hour and wipe the surface with a dry electrostatic charged cloth.

If the weatherization activity does not meet the triggers for the EPA Rule or the HUD LSH Rule, the Crew Supervisor shall conduct an on-site visual inspection of each work area to ensure that it has been cleaned properly. All final inspection and verification shall be completed and confirmed, then certified by the Renovator responsible for the project on the CSD 708 form final page.

5.0 PROHIBITED WORK PRACTICES

5.1 PROHIBITED ACTIVITIES

* The following activities are prohibited when working in pre-1978 homes:

- **NEVER—**reuse poly material used as protective containment sheeting. Polyethylene is the only acceptable protective containment sheeting and shall never be reused.
- **NEVER—**dry sweep using brooms and never use shop vacuums for any lead-safe work and cleanup. Wet cleaning and HEPA vacuums are the only acceptable methods for lead-safe weatherization work and clean-up.
- **NEVER—**cut a painted door inside a home.
- **NEVER—**use a conventional shop vacuum with HEPA filters. Only HEPA-designed vacuums are acceptable for LSW.
- **NEVER—**turn leaded paint into leaded dust by dry scraping or sanding (unless within 1' of electrical outlets/switches) or grinding, abrasive blasting or planing.
- **NEVER—**use machine/power sanders, grinders, abrasive blasting, or sandblasting without HEPA vacuum attachments (shroud)—even on a small surface—create a large amount of leaded dust that floats in the air and then settles on surfaces inside and outside the work area.
- **NEVER—**use an open-flame torch or heat gun (above 1100°F) to remove paint or window glazing. Open flame/high heat methods to remove paint create fumes that are dangerous for workers to breathe. Small lead particles created by burning and heating also settle on surrounding surfaces and are very hard to clean up.
- **NEVER—**smoke, drink, or eat in the work area or allow the occupants to do so.

6.0 RECOMMENDED PRACTICES FOR LEVEL 1 AND LEVEL 2 CONTAINMENT

If **ANY** painted surface will be "disturbed," appropriate DPH & DOE lead-safe work practices shall be followed for Containment, Clean-up, and Documentation/Certification.

All containment and cleaning work shall comply with the most stringent requirements of the California Department of Public Health (DPH), Department of Energy Weatherization Assistance Program (DOE WAP), Environmental Protection Agency (EPA), and Department of Housing and Urban Development (HUD), as applicable. All of these regulatory agencies require that appropriate containment and cleaning be performed to capture all (presumed) leaded dust.

The following pictures and text are examples of containment and cleaning practices, and are provided as types of actions that may be employed in the field when deemed appropriate by the on-site EPA-Certified Renovator. Ultimately, workers and the Certified Renovator are responsible for preventing dust and debris from leaving the work area, so it is very important to take appropriate precautions to make that happen. Documentation of containment and cleaning work with photographs is required in accordance with this section.

6.1 INTERIOR CONTAINMENT AND WORKSITE PREPARATION

Level 1 and Level 2 Containment Practices

* The certified renovator shall direct crews to post signs outside the work area or room where work will be performed (interior **5'** set-back of at least is recommended) to warn occupants and others not involved in the renovation to remain clear of the area.

* The certified renovator shall direct the containment of the work area so that dust or debris does not leave the area while the work is being performed.
* Objects left in the work area, HVAC ducts, and floors shall be covered with taped-down plastic, or other impermeable sheeting.
* Ensure containment does not interfere with occupant and worker egress in an emergency.
* Wear shoe/boot covers whenever working or walking on the floor/ground cover.
* No smoking, eating, or drinking by workers or occupants is allowed in the work area at any time that the work, containment, or cleaning is being performed (until certification finds that no dust is remaining).

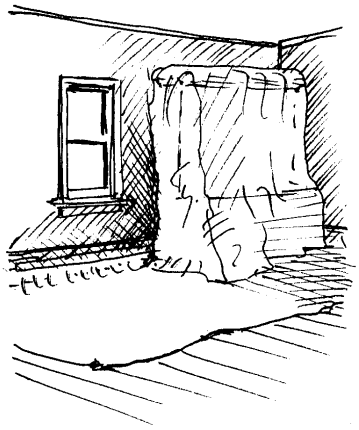


Illustration courtesy of the U.S. EPA

Depending on the type of work to be done and how much paint may be disturbed, the Work Area must be defined:

* Level 1 Containment: 6-mil polyethylene sheeting (also called “poly”) shall be spread immediately below the work area.
* Level 2 Containment: Poly should extend up to 6' on all sides from the work area, and an additional second layer of sheeting shall be added over the work area to facilitate clean-up of dust.
* All poly sheets shall be tightly secured above the baseboard using 2" painters’ tape. Duct tape perimeter of the poly sheet to the carpet.
* For Level 1 containment, it *may* be necessary to:
  - Close & seal all windows & doors in the work area.
  - Shut off or seal air flow—i.e., HVAC equipment or vents, or ceiling fans when present.

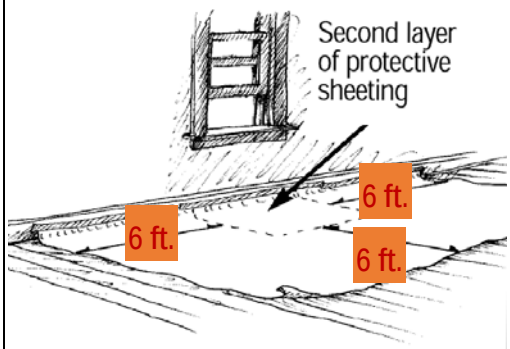


Illustration courtesy of the U.S. EPA

Note! Crews should be aware that polyethylene sheets can be very slippery, thus extreme caution should be observed when walking on sheets.

LSW Level 1 containment consists of methods that prevent dust generation and contains all debris generated during the work process. The containment establishes the work area and shall be kept secure.

* At a minimum, this may include use of:
  - Use of hand tools (instead of power tools).
  - Working wet (using water mist or foam).
  - HEPA-shrouded power tools.
  - Catch bags.

Additional Level 2 Containment Practices

* Level 2 containment is required when the EPA or HUD *de minimis* levels *will be exceeded*.
* Level 2 containment requires methods that define an expanded work area (6' beyond the immediate work for interiors) that will not allow any dust or debris from work area to spread.
  - Where practicable remove belongings and furniture from the expanded work area, including: furniture, rugs and window coverings.
  - If something can't be moved out of the expanded work area, cover all objects in protective poly sheeting. Seal the seams and edges with tape. Completely cover all immovable fixtures, furniture, carpets and other personal items with protective sheeting.
  - Secure protective sheeting to the floor with tape so that no dust can get onto the covered items.
* Level 2 containment also requires:
  - Covering of all horizontal surfaces,
  - Constructing barrier walls,
  - Closing and sealing doorways & windows in the work area,
  - Covering HVAC registers, turning off HVAC equipment.
  - Shutting off and covering ceiling fans, etc.

Photo above courtesy of DOE

RHA Collection

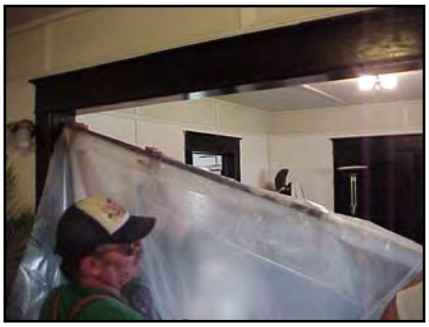


Photo above courtesy of DOE

* **Renovators may recommend one or more of the following methods to contain any dust created by the weatherization activity.**

Catch Bags

* Make a “catch bag” by taping a poly bag directly under the work to catch debris.
* Install a stiffening frame inside the bag to keep it open, when needed.
* Use painter’s tape to secure the catch bag to painted surfaces. Do not use duct tape; as it may remove the paint.
* If the debris (pieces of broken glass) is likely to break or cut the bag open, place the catch bag in a box or bucket.

Wet Misting

* Working wet is the most important LSW practice for minimizing the creation and spread of leaded dust.
* Wet mist the work area before and while drilling, sawing, or prying.
* Use battery-powered tools or hand tools when wet misting.
* Use a GFCI to prevent shocks if power tools are used.
* Do not spray water on the electric motor.

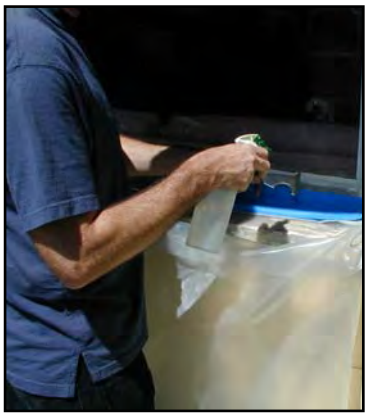
HEPA Vacuum

* Have one person hold the nozzle of a HEPA vacuum under the drill bit to catch the dust and debris as it is being produced.

Cutting or Taping Paint Edge

* Cut the paint bead between the trim and wall, and the trim and jamb, with a utility knife.
* If not possible to cut the paint, carefully tape the edge to help control any dust created.
* Gently pry off and remove object carefully (i.e., trim, door jamb, etc.) to disturb paint as little as possible.
* If dust is being generated, lightly mist it with water while removing it.

Photos on this page from the RHA Collection



When finished, clean the work area as described in “Worksite Cleaning.”

6.2 EXTERIOR CONTAINMENT AND WORKSITE PREPARATION

Level 1 and Level 2 Containment Practices

* The certified renovator shall direct crews to post warning signs to limit access at least **20'** from the work zone to prevent migration of dust into or out of the home from the work area.
* Move all play equipment, toys, furnishings, etc. at least 10' away from the work area, and cover them with poly.
* Ensure containment does not interfere with occupant and worker egress in an emergency.
* Wear shoe/boot covers whenever working or walking on the floor/ground cover.
* No smoking, eating, or drinking by workers or occupants is allowed in the work area at any time that the work, containment, or cleaning is being performed (until certification finds that no dust is remaining).

Photo above courtesy of DOE

* The certified renovator shall direct the containment of the work area so that dust or debris does not leave the area while the work is being performed.

Depending on the type of work to be done and how much paint may be disturbed, the Work Area must be defined:

* Level 1 Containment: 6-mil polyethylene sheeting (also called “poly”) shall be spread immediately below the work area.
* Level 2 Containment: Poly should extend a minimum of **10'** in each direction to define the work area.
  - Pay special attention and cover nearby plants, vegetable gardens, and children's play areas.
  - Place a 6-mil poly ground cover sheet 10 feet out from the base of the wall under where the activity will take place.
  - Secure the poly *to the base of the wall* using 2" blue painter’s tape, or anchor it so that there are no gaps between the plastic and the wall.
  - Anchor *the other end* with heavy objects to prevent movement of the poly.
  - Anchor ladders through a slit in the plastic directly to the ground, then tape around the slit.
* Use “Caution” tape to establish a 20' perimeter around the work area (10' beyond the work area), if space permits.

Photo courtesy of MT Wx Training Center

Photos above courtesy of DOE

Photos at right courtesy of DOE

LSW Level 1 containment consists of methods that prevent dust generation and contains all debris generated during the work process. The containment establishes the work area and shall be kept secure.

* At a minimum, this may include use of:
  - Use of hand tools (instead of power tools).
  - Working wet (using water mist or foam).
  - HEPA-shrouded power tools.
  - Catch bags.

Additional Level 2 Containment Practices

* Level 2 containment is required when Weatherization activities will disturb more than the EPA *de minimis* levels (or HUD *de minimis* levels, when a HUD dwelling) in homes built prior to 1978.
* Level 2 containment consists of methods that define a work area that will not allow any dust or debris from work area to spread to non-renovation/clean areas.

Vertical Containment

* When working in close quarters, containment options may be limited but still is required by the EPA. According to the EPA, if 10 feet of horizontal containment cannot be achieved, vertical containment is required. Sometimes creativity may be required. The ultimate goal is to prevent the migration of contaminants from the work zone.
* Additional methods are described in LSW and EPA RRP trainings.

Situations Requiring Extra Precautions:

* Some situations may require extra precautions to avoid the spread of dust to the home or to adjacent properties.
  - The simplest solution may be to extend the area of ground covered by plastic sheeting.
  - If conditions are windy, if space is limited, or if adjacent properties are relatively close to the work area, vertical containment systems may need to be constructed. Examples of vertical containment systems include plastic sheeting attached to scaffolding and plastic sheeting attached to vertical wood boards.
  - Note: On days with high winds, it is not advisable to perform dust creating activities. The HUD LSH Rule restricts exterior work in winds in excess of 20 miles per hour. The EPA RRP Rule does not specifically address wind speed, but when the wind is strong enough to move dust and debris, special precautions need to be taken to keep the work area contained. Some options are:
    1) to create a wind screen of plastic at the edge of the ground-cover plastic to keep dust and debris from migrating.
    2) more frequent cleanup of exterior work areas.

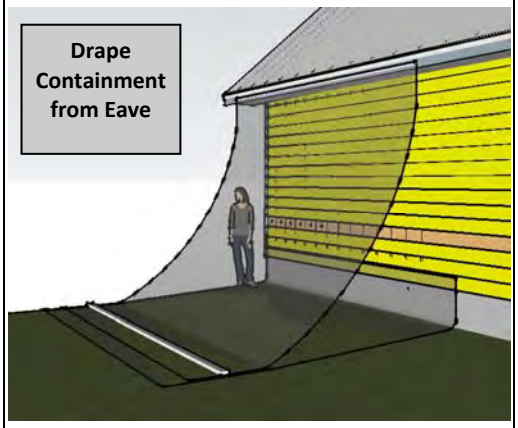


Illustration courtesy of MT Wx Training Center

* **Renovators may recommend one or more of the following methods to contain any dust created by the weatherization activity.**

Photos on this page from the RHA Collection

Create an Outdoor Lead-Safe Work Area

* Set up a "lead-safe" work area, outside away from the residence, with adequate poly sheeting and containment methods to prevent the spread of dust and debris, and preferably in a wind protected area. If wind may cause dust and debris to transfer to other areas, vertical containment is required as described in EPA Certified Renovator training.
* Place 6-mil poly sheeting on ground or floor so that it is at least 6 feet out around the cutting area (a 12' x 12' piece of plastic is generally adequate).
* Locate the work stands (saw horses) in the center of the plastic sheet.

Catch Bags

* Make a "catch bag" by taping a 6-mil poly bag directly under the work to catch debris.
* Install a stiffening frame inside the bag to keep it open, when needed.
* Use painter's tape to secure the catch bag to painted surfaces. Do not use duct tape; as it may remove the paint.
* If the debris (pieces of broken glass) is likely to break or cut the bag open, place the catch bag in a box or bucket.

Wet Misting

* Working wet is the most important LSW practice for minimizing the creation and spread of leaded dust.
* Wet mist the work area before and while drilling, sawing, or prying.
* Use battery-powered tools or hand tools when wet misting.
* Use a GFCI to prevent shocks if power tools are used.
* Do not spray water on the electric motor.

HEPA Vacuum

* Have one person hold the nozzle of a HEPA vacuum under the drill bit to catch the dust and debris as it is being produced.

RHA Collection

HEPA Vacuum-Attached Power Tools with Shroud

* Shrouded tools connected to HEPA vacuums help contain dust and debris.

Photo courtesy of MT Wx Training Center

Cutting or Taping Paint Edge

* Scoring paint before separating components helps prevent paint from chipping when a paint seal is broken.
* Cut the paint bead between the trim and wall, and the trim and jamb, with a utility knife.
* If not possible to cut the paint, carefully tape the edge to help control any dust created.
* Gently pry off and remove object carefully (i.e., trim, door jamb, etc.) to disturb paint as little as possible. Prying and pulling apart components is a cleaner work practice. Pulling nails instead of pounding creates less dust and fewer paint chips.
* If any dust is being generated, lightly mist it with water while removing it.

RHA Collection

When finished, clean the work area as described in "Worksite Cleaning."

7.0 WORKSITE CLEANING

7.1 INTERIM CLEANING OF THE WORK AREA

Cleaning is the most critical component of lead-safe weatherization work, it is the best thing you can do to protect your clients. There are two parts to the lead-safe cleaning process: 1) HEPA vacuuming; and, 2) wet washing with a detergent cleaner, the most critical part of the process. Wet washing consists of spraying a cleaner on the area to be cleaned and washing the area with a rag or disposable towel until it is clean, and then drying it.

Clean While You Work

* While working on a weatherization task, place debris directly in the 6-mil collection bags.

* Keep work areas clean by removing debris and HEPA vacuuming floor/ground cover immediately after completing each work activity.

* Use the HEPA vacuum to clean dust from all work surfaces and the surrounding area, then wet mist and wipe each surface clean prior to reinstalling.

* Before re-installing doors, thresholds, or windows, HEPA vacuum the rough opening to remove all dust and debris.

Photo courtesy of MT Wx Training Center

Photo courtesy of MT Wx Training Center

RHA Collection

7.1 FINAL CLEANING OF THE WORK AREA

Pick-up Visible Debris

* Pick-up all visible paint chips and debris and discard or wrap component parts in plastic sheeting.
* The main point of cleaning is not to let dust spread beyond the work area. For exterior jobs, focus specifically on the areas that children could have access to such as bare soil, play areas, exterior porches and exterior window sills. Always inspect beyond the work area.
* Secure containers or catch bags with duct tape.
* HEPA vacuum and wet-clean the containers.

Clean Tools

* While working on the floor containment poly sheeting, HEPA vacuum and damp wipe (using a detergent-soaked cloth) all tools, equipment and cords, including the HEPA vacuum and hose. Dispose all wipes in a 6 mil plastic bag.
* Once cleaned, all tools, except the HEPA vacuum can be stowed in sealed hard-sided tool container(s).
* Wet wipe and remove containers from the containment area.

RHA Collection

HEPA-Vacuum Surfaces from High to Low

* HEPA vacuum the entire contained work area surfaces from high to low. Start with the walls (house walls as well as any poly walls), tops of doors, and window troughs (high) and work your way down to the floor.
* HEPA vacuum all surfaces worked on or that are near the work area.
    * Vacuum the protective floor sheeting last.

Photo courtesy of MT Wx Training Center

Wet Clean Surfaces from High to Low

* Wet clean the surfaces using a household detergent or wet wipes.
* When cleaning wet, you can either mist the surface with cleaning solution or use a wet disposable cloth.
* Work from high surfaces to low.
* If a surface is very dirty use a moist paper towel before using the wet cloth.
* Replace cloths and change rinse water often.

Photo courtesy of MT Wx Training Center

Initial Cleaning of PPE

* While standing on the ground containment poly sheeting, HEPA vacuum and damp wipe personal protective clothing.

Photo courtesy of MT Wx Training Center

Remove Poly Sheeting

* Starting with wall and furniture poly indoors (or exterior vertical) poly containment, carefully remove the plastic and lay it on the floor poly sheeting. While standing on the floor containment, tightly fold the plastic together (do not shake or rattle plastic), with the lead exposed side folded to the inside. Once folded, tightly roll the plastic and place it in a large 6-mil plastic bag (or two heavy duty bags).
* HEPA-vacuum the floor/ground poly and all worker PPE thoroughly.
* Remove poly floor/ground cover(s) by carefully pulling the tape and folding the corners of the poly sheet to the middle of the sheet tightly, and continue folding with the lead-exposed side always on the inside of the fold.
* Tape the poly sheeting up and place the folded sheet in a 6-mil bag.
* Properly dispose of the poly film. **NEVER** re-use the poly sheeting.

Photos above courtesy of MT Wx Training Center.
Photo at left from the RHA Collection.

Clean Floor Surface (Interiors Only)

* Remove booties before stepping off the poly sheeting. If booties are not worn, shoes shall be carefully cleaned using a HEPA vacuum cleaner before stepping off the poly sheeting.
* HEPA vacuum area under the poly and up to 2 feet beyond.
* If the floor surface under the poly is washable (carpet is not), spray/mist the detergent solution on the surface and wipe it clean.
* For carpeted floors HEPA vacuum the area (with a beater bar) that was under the poly sheeting and at least 2 feet beyond it. The HEPA vacuum shall have a beater bar.

Photos above and at right from the RHA Collection

Final Personal Cleaning

* **Never** leave a work site wearing dirty/dusty work clothes or disposable clothing.
* HEPA vacuum work clothes before removing them. From outside the house, gently remove your personal protective clothing and dispose with other debris.
* Use disposable cleaning cloths to clean yourself and respirator before entering your work vehicle or re-entry into the home.
* Dispose the wipes with other debris.
* Secure your respirator in its protective container.
* **Before allowing occupants to re-enter the work area, visually inspect the area for dust—if necessary repeat HEPA vacuum and wet cleaning. If a clearance inspection or a Certified Renovator inspection is required, do not allow occupants into the work area until the inspection is complete and the work "passes" inspection.**

Photos courtesy of MT Wx Training Center

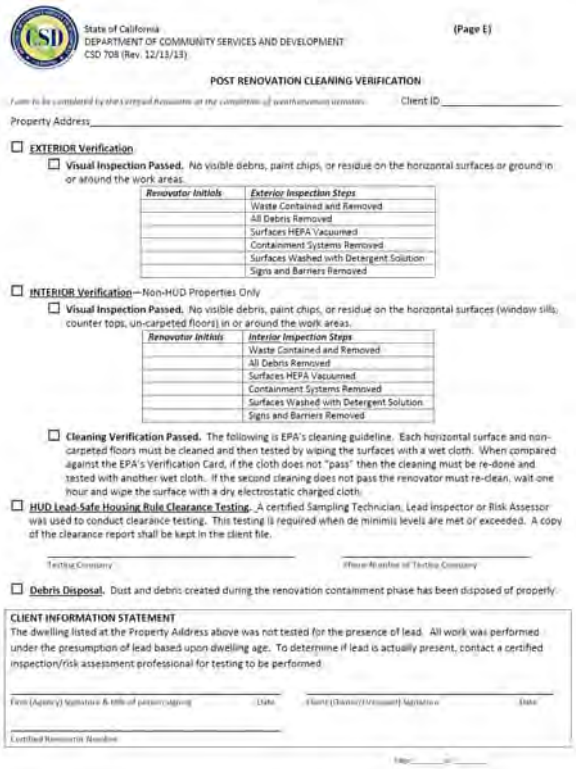
Inspection Requirements

* CSD Required Final Inspection—Certified Renovator shall complete the CSD 708 form, final page, at the right.

* EPA Final Inspection—Inspection by a Certified Renovator is required when the project disturbs more than the EPA *de minimis* level. Inspection consists of two parts:

  – Visual Inspection (Looking for paint dust and other leftover debris)
  – Post-Renovation Cleaning Verification (at right)

* HUD Clearance Inspection—A Clearance Inspection is required from a Certified Lead Inspector/Assessor when the work on a HUD home disturbs more than the HUD *de minimis* level (this person is **not** the same as a Certified Renovator, and a different report format is used).



State of California
DEPARTMENT OF COMMUNITY SERVICES AND DEVELOPMENT
CSD 708 (Rev. 12/13/13)

(Page E)

POST RENOVATION CLEANING VERIFICATION

Client ID_____

Property Address_____

☐ **EXTERIOR Verification**

☐ **Visual Inspection Passed.** No visible debris, paint chips, or residue on the horizontal surfaces or ground in or around the work areas.

Renovator Initials	*Exterior Inspection Steps*
	Waste Contained and Removed
	All Debris Removed
	Surfaces HEPA Vacuumed
	Containment Systems Removed
	Surfaces Washed with Detergent Solution
	Signs and Barriers Removed

☐ **INTERIOR Verification**—Non-HUD Properties Only

☐ **Visual Inspection Passed.** No visible debris, paint chips, or residue on the horizontal surfaces (window sills, counter tops, un-carpeted floors) in or around the work areas.

Renovator Initials	*Interior Inspection Steps*
	Waste Contained and Removed
	All Debris Removed
	Surfaces HEPA Vacuumed
	Containment Systems Removed
	Surfaces Washed with Detergent Solution
	Signs and Barriers Removed

☐ **Cleaning Verification Passed.** The following is EPA's cleaning guideline. Each horizontal surface and non-carpeted floors must be cleaned and then tested by wiping the surfaces with a wet cloth. When compared against the EPA's Verification Card, if the cloth does not "pass" then the cleaning must be re-done and tested with another wet cloth. If the second cleaning does not pass the renovator must re-clean, wait one hour and wipe the surface with a dry electrostatic charged cloth.

☐ **HUD Lead-Safe Housing Rule Clearance Testing.** A certified Sampling Technician, Lead Inspector or Risk Assessor was used to conduct clearance testing. This testing is required when de minimis levels are met or exceeded. A copy of the clearance report shall be kept in the client file.

Testing Company _____ Phone Number of Testing Company _____

☐ **Debris Disposal.** Dust and debris created during the renovation containment phase has been disposed of properly.

CLIENT INFORMATION STATEMENT

The dwelling listed at the Property Address above was not tested for the presence of lead. All work was performed under the presumption of lead based upon dwelling age. To determine if lead is actually present, contact a certified inspection/risk assessment professional for testing to be performed.

Firm (Agency) Signature & title of person signing _____ Date _____ Client (Owner/Occupant) Signature _____ Date _____

Certified Renovator Number _____

Date _____

Disposal of Debris and Restoring Home to Normal State

* Dispose of all collected debris in 6-mil plastic bags at a location that is in accordance with DPH requirements and local code.

* Replace all personal items moved from the work area.

8.0 ADDITIONAL CLARIFICATION FOR LOW-RISK/HIGH-RISK ACTIVITIES

De Minimis Levels and …

COMMON WEATHERIZATION FIELD ACTIVITIES

Clarifications obtained from http://www2.epa.gov/lead/renovation-repair-and-painting-program

1. If the amount of painted surface is *more than* the *de minimis* level (EPA or HUD), it is considered a "**renovation**" activity, and requires appropriate containment (High Risk or DOE Level 2).

   - A *minimum* of 6 sq. ft. of interior floor containment extending from the work area, or 10 sq. ft. of exterior ground containment extending from the work area, and
   - Appropriate vertical containment (for interiors and exteriors).

2. If the amount of painted surface is *less than or equal to* the *de minimis* level (EPA or HUD), it is considered a "**minor repair and maintenance**" activity, which requires *appropriate* containment (as determined by the Certified Renovator…Low Risk or DOE Level 1, typically).

   - **Per 40 CFR 745.83 in the definition of "Minor Repair and Maintenance":**
     "When removing painted components, or portions of painted components, the entire surface area removed is the amount of painted surface disturbed."
     - **Example 1:** A door that measured 7' x 3' would be equal to 21 sq. ft. Based on the size alone, you might think that replacement of the door blank would exceed the *de minimis* level. This is true if you were sanding disturbing the door surface. However, in accordance with the EPA FAQ: "Because doors are not cut-outs, the entire surface area is not counted for purposes of calculating the 6–sq. ft. threshold of minor maintenance and repair—unless removing the door also disturbs any paint on the door (e.g., because of the deteriorated condition of the paint or any dust-generating activities). Therefore, if unbolting and unscrewing a door disturbs paint only on the bolts, screws and/or hinges, but does not otherwise disturb a painted surface on the door, frame, trim or surrounding walls, then the activity likely disturbs less than 6 square feet of painted surface and would not be subject to the RRP Rule."
     - **Example 2:** If cutting a 1-inch strip off a door that is 36 inches wide, you calculate the area of painted surface disrupted based on the surface area of the component that is removed. Therefore, in this example you would "disrupt" 36 sq. in. of painted surface, regardless of the width of the cut made by the saw blade. This would not exceed the *de minimis* level.
     - **Example 3:** The addition/replacement of weatherstripping would typically be considered a minor repair and maintenance activity because of the limited amount of drilling that is required; however, replacement of a door jamb would depend upon the total area of component material that is disturbed.

- **Per EPA FAQ, the section is further clarified to read:** "In other cases, when painted surfaces are being disturbed or disrupted, but not completely removed, the disrupted surface area is the area being actively disturbed."

    - **Example 1:** When spot sanding to prepare a surface for priming, the area of the surface that was actually sanded is the surface area disrupted.

3. When a pane of glass or window hardware is replaced, you must measure the surface area of the affected component (Length x Width) to determine the amount of material disturbed. Activities such as replacing a piece of glass in a window can disturb paint. The glazing that holds the pane in place in older windows is painted, and this glazing has to be removed for the pane to be replaced.

    - If the area is *less than or equal* to the *de minimis* level, it shall be treated as a Low Risk/DOE Level 1 activity.

    - If the area is *more than* the *de minimis* level, the activity shall be considered High Risk/DOE Level 2.

4. Anytime a window unit is replaced, or demolition occurs, or a job exceeds the *de minimis* level, it is considered a High-Risk (DOE Level 2) renovation and must meet the requirements above.

    Note: Per **EPA FAQ, "Demolition" is further clarified to mean:** "…a renovation activity [that] removes or otherwise disrupts a painted component in a way that destroys or ruins the component."

    - **Example 1:** If I am using a hammer to make a hole in a wall (*not a recommended practice, by the way*) that is 2' on each side (a total of 4 sq. ft.), is it a renovation or a minor repair and maintenance activity?
      Although making the hole disrupts less than 6 square feet of painted surface, using a hammer to make the hole is considered demolition of the surface, so the minor repair and maintenance exception does not apply. Making the hole using a cut-out technique that does not destroy the section of the wall that is removed is not demolition, and the minor repair and maintenance exception would apply.

    - **Example 2:** Does drilling holes in window frames to install storm window clips or thermal shutters qualify as minor repair and maintenance?
      Yes, as long as the installation does not disturb more than six sq. ft. of painted surface per room (See Item 2, Bullet 2 above for the definition that applies).

9.0 LEAD-SAFE WEATHERIZATION REGULATIONS FOR AGENCIES

Purpose

CSD requires that its network weatherization agencies follow the specified requirements for Lead-Safe Weatherization (LSW) practices. Starting in April 2010, all contractors working on homes built prior to 1978 shall become EPA-certified Renovators to work on leaded homes. By enforcing CSD's LSW standards (as provided in this section), California Weatherization Assistance Program (WAP) network agencies increase the assurance that LSW is being followed properly and risks to the workers and/or residents are minimized.

For Use by

Weatherization Agency staff, Installation Crews, Inspectors, Assessors/Auditors, and the Weatherization Community.

Prepared by

California Department of Community Services and Development

Contents

This section contains the following topics:

9.1 CSD LEAD-SAFE WEATHERIZATION (LSW) CRITERIA

Introduction

The following criteria are to be used to determine whether lead-safe weatherization practices will apply under CSD, Department of Public Health (DPH), and the Environmental Protection Agency (EPA)/Department of Energy (DOE) requirements.

When CSD LSW Policy Applies

Lead-Safe Weatherization practices will apply if **any** of the following conditions are met:

- The unit was built before 1978; and paint will be disturbed during the weatherization process, or
- Weatherization agency assumes lead-based paint is present without testing.

When CSD LSW Policy Does Not Apply

Lead-Safe Weatherization practices will **NOT** apply if **any** of the following conditions are met:

- The unit was built after 1978;
- Paint will not be disturbed;
- A California-Certified Inspector/Risk Assessor conducted a lead paint inspection and found the unit as “lead free;” or
- A California-Certified Inspector/Risk Assessor conducted a limited lead paint inspection on surfaces which are to be disturbed by weatherization activities and found the surfaces to be “lead free;” or
- The structure is a factory-painted mobile home.

9.2 CSD LEAD-SAFE WEATHERIZATION POLICIES

CSD General LSW Policy

- It is the policy of the California Department of Community Services and Development (CSD) that weatherization workers shall be aware of conditions that cause lead hazards and conduct weatherization activities in a lead-safe manner on residential structures built prior to 1978 to avoid contaminating homes with lead and to avoid exposing the clients, themselves, and their families to this hazard.
- Weatherization funds may be used to minimize the potential lead hazard associated with the installation of measures and weatherization activities. Program funds cannot otherwise be used for abatement, stabilization, or control of lead-based paint hazards not directly associated with the installation of weatherization measures.
- If a structure was built before 1978 and painted surfaces will be disturbed, the following option is permissible to use to determine if Lead-Safe Weatherization practices in accordance with this document are required:
  - Assume lead-based paint is present on coated surfaces to be disturbed (presumed lead-based paint); or
- Lead-safe work practices are required whenever disturbing lead-based paint or presumed lead-based paint. The following regulations apply on pre-1978 residential structures:
  - State of California Title 17 regulations apply (lead-safe practices) if **any**

amount of lead-based paint or presumed lead-based paint is disturbed; and
  - EPA RRP Rule regulations apply if more than 6 sq. ft. of paint in an interior room, or more than 20 sq. ft. on the exterior is disturbed: and
  - HUD Lead-safe Housing Rule applies and clearance is required when HUD housing and more than 2 sq. ft. of an interior room, 20 sq. ft. of an exterior, or 10% of small building components is disturbed.
- When work does not disturb any lead-painted or presumed lead-painted surfaces in a pre-1978 unit, or the structure to be weatherized is a factory-painted mobile home, standard weatherization procedures can be used.
- All weatherization work in pre-1978 units where painted surfaces are disturbed shall be performed in conformance with:
  - CSD WIS, Section 1 (Health and Safety Requirements);
  - CSD WIS, Section 2 (Lead-Safe Weatherization Requirements)
  - CSD Field Guide;
  - EPA Regulation Residential Lead-Based Paint Hazard Act of 1992 "Pre-Renovation Education Rule" (Section 406);
  - EPA Renovation, Remodeling, and Painting Rule (40CFR745.80)
  - California Health and Safety Code and California Code or Regulations Title 17;
  - CAL/OSHA's Lead in Construction Standard, Title 8 CCR Section 1532.1 and all other applicable occupational safety rulings; and
  - HUD Regulation—Lead-Based Paint Hazard Control Rule Title 24 CFR35 (Part 35);
- Specific rules apply to HUD housing (refer to Section IV).

CSD LSW Deferral Policy

- It is the policy of the CSD Weatherization Program to not defer or abandon the weatherization of a home simply because it may contain lead-based paint.
- Deferral of services is not allowed on a measure-by-measure basis.
- Deferral of all weatherization work would mean postponing the work until another agency or the owner has corrected the problem before weatherization can be safely performed.
- Because the risk can be reduced using lead-safe weatherization work practices, activities should not be deferred just because the risk factor may be high. Any measure that will disturb a painted surface in a home built before 1978 could have a low risk factor at a minimum. The variation in risk depends on how much paint is disturbed and how it is disturbed.
- If it is determined that the condition of paint in pre-1978 housing is in seriously deteriorated condition or there is a large amount of paint chips over the ground or floor, weatherization services will be deferred until such time that the conditions have been corrected.
- Deferral of weatherization services shall be documented and retained in the client's file.
- Clients should be referred to the appropriate agency for assistance in remedying the problem that prompted the deferral.

Hazardous Conditions Policy

- If it has been determined during the assessment that the unit contains a hazardous condition to the occupants, such as carbon monoxide exposure, proper steps in accordance with CSD policy shall be taken to alleviate the imminent danger. In these cases, CSD Lead-Safe Weatherization Procedures and HUD Regulations would not apply and the work performed is strictly limited to the mitigation of danger.
- Weatherization measures will be deferred until such conditions have been alleviated.

Client Education Policy

- It is the requirement of the EPA RRP Rule and the policy of this department that current occupants of pre-1978 homes to be weatherized receive EPA's "Renovate Right: Important Lead Hazard Information for Families, Child Care Providers and Schools" prior to the start of any work on the unit.
- A copy of the Lead-Safe Education Confirmation of Receipt (CSD 321) is required to be completed and retained in the client's file.

Occupant Safety Policy

- Occupant(s) and pets residing in a pre-1978 unit shall not be in the work area when lead-safe weatherization activities are being conducted and cannot reoccupy the work area until it has been thoroughly cleaned in accordance with the CSD Weatherization Installation Standards, this policy, and if required to comply with the EPA RRP Rule, a cleaning verification procedure has been performed and passed.
- If containment cannot be achieved and there is risk of traffic through the work area (e.g., work will take several days involving kitchens, bathrooms, or bedrooms) agencies are advised to defer the work until other resources can be secured to offset relocation expense for the residents and pets.

Notification Policy

- For occupied homes, the Weatherization staff, crew, or contractor shall have an adult tenant or homeowner sign an acknowledgement after receiving the pamphlet. The pamphlet can also be sent by certified mail with receipt to be placed in the client file.
- In multi-unit housing, the agency shall:
  - Provide written notice to each affected unit (notice shall describe: general nature and locations of the planned renovation activities; the expected starting and ending dates; statement of how occupant can get pamphlet at no charge); or
  - Post informational signs (signs shall describe general nature and locations of the renovation and the anticipated completion date) and post the EPA pamphlet. (If pamphlet is not posted then agencies are required to provide information on how interested occupants can review a copy of the pamphlet or obtain a copy at no cost from the Weatherization Program). Warning signs shall be posted at entrances to the worksite when occupants are present; at the main and secondary entrances to the building; and at exterior work sites. The signs shall be readable from 20 ft. from the edge of the worksite. Signs should be in the occupants' primary language, when practical.
  - Delivery to owner/occupant. Owner's and/or occupant's signature with acknowledgment or certificate of mailing. The owner/occupant must acknowledge receipt of the EPA pamphlet prior to start of renovation that

contains the address of unit undergoing renovation, name and signature of owner or occupant, and the date of signature. It shall be in same language as "contract for renovation" for an owner-occupied (or the same language as the lease for occupant of non-owner occupied) target housing.

- If the Weatherization Program cannot obtain a signed acknowledgment (either the occupant is not home or refuses to sign the form), then the self-certification section of the form shall be signed to prove delivery.
- The acknowledgement form shall be filed and remain with the client file for three years from date of signature. In addition to providing a copy of the pamphlet to owners and occupants, designated local agency staff (e.g., intake specialist, auditor, crew chief) shall discuss the hazards associated with lead-based paint and lead dust, and describe how they will conduct LSW in the home.

9.3 FEDERAL REGULATIONS

EPA Requirements —When EPA's RRP Rule Applies

The EPA Renovation, Repair and Painting (RRP) Rule (40CFR Part 745.80) requires all contractors/firms performing renovation, repair and painting projects that disturb lead-based paint in pre-1978 target housing, child care facilities and schools to become Certified Firms and use Certified Renovators to supervise work, train workers, and verify cleaning.

Renovation is defined as "any activity that disturbs painted surfaces and includes most repair, remodeling and maintenance activities, including window replacement." Weatherization is included in the activities that trigger this rule.

The RRP Rule applies to weatherization work when the following conditions are true:

- It is pre-1978 housing, and
- Lead-based paint or presumed lead-based paint is present.

EPA Requirements —When the RRP Rule Does Not Apply

The EPA RRP rule does not apply to weatherization work when **ANY** of the following is present:

- Residential, child-occupied facilities and school structures built after 1977.
- If no lead-based paint is present on affected components.
- Housing for the elderly or persons with disabilities.
- Zero-bedroom units.
- Minor repair and maintenance activities that disturb less than 6 sq. ft. of lead-based paint in any interior room or 20 sq. ft. on exterior surfaces (EPA's *de minimis* exemption). Window replacement is the exception to this exemption and the Rule is required to be followed when windows are replaced. (Reglazing windows is not considered to be window replacement by the EPA.)

EPA Certified-Firm Requirements

The EPA RRP Rule requires that all contractors/firms performing renovation, repair and painting projects that disturb lead-based paint in pre-1978 homes, child-care facilities and schools, be certified by EPA, and to:

- Use Certified Renovators who are trained by EPA-approved training providers to follow lead-safe work practices.

- Before beginning work, provide owners, tenants and/or child-care facilities with a copy of EPA's lead hazard information pamphlet and obtain a signed acknowledgement.
- Use lead-safe work practices when disturbing leaded or presumed leaded surfaces.
- Document if lead-based paint was found or if presuming lead-based paint, the lead-safe practices used, that all work areas are clean and cleaning was verified.
- Retain documents for three years.

EPA Certified Renovators Requirements

The Certified Renovators are responsible for ensuring overall compliance with the Lead-Based Paint Renovation, Repair and Painting Program's requirements for lead-safe work practices. An EPA Certified Renovator shall:

- Determine if compliance with the RRP Rule is required.
- Use an EPA-recognized test kit to determine whether components affected by the renovation contain lead-based paint, or assume lead-based paint is present for housing and buildings covered by this rule, unless testing is done that determines the components affected are lead-free.
- Determine the type and extent of lead-safe work practices at each job site and provide on-the-job training to other workers (who have not taken the Certified Renovator training course) on the lead-safe work practices to be used in performing their assigned tasks.
- **Be *physically present* at the worksite when warning signs are posted, while the work area containment is being established and while work area cleaning is performed**.
- Regularly direct work being performed by other individuals to ensure that the work practices are being followed, including maintaining the integrity of the containment barriers and ensuring that dust or debris does not spread beyond the work area.
- Be available, either on-site or by telephone, at all times during renovation.
- Perform worksite cleaning verification.
- Have copies of their initial course completion certificate and their most recent refresher course completion certificate at the worksite.
- Prepare required records. (For a sample checklist of required records, see www.epa.gov/lead/pubs/samplechecklist.pdf.)
- Be recertified every five years.

HUD Requirements

HUD's lead regulations (24 CFR Part 35) apply to work performed on residences funded by federal housing programs, such as:

- Housing receiving a federal subsidy that is associated with the property rather than with the occupants (project-based assistance).
- Public housing.
- Housing occupied by a family receiving a tenant-based subsidy (such as a Section 8 voucher or certificate).
- Multi-family housing for which mortgage insurance is being sought.

- Housing receiving federal assistance for rehabilitation, reducing homelessness, and other special needs.

HUD's Lead-Safe Housing Rule

When weatherization work is conducted on federally-funded housing, HUD's Lead-Safe Housing Rule shall be followed if the housing was built before 1978 and lead-based paint or lead hazards are present, except when the amount of lead-based or presumed lead-based paint to be disturbed is less than HUD's *de minimis* level.

HUD's Lead-Safe Housing Rule requires the following lead-safe work practices:

- Occupant protection—occupants may not enter worksite.
- Worksite preparation and containment—use practices to minimize the spread of lead dust, paint chips, soil and debris, and place warning signs at entries to work areas.
- Prohibited methods of disturbing paint:
  - open flame burning or torching,
  - heat guns above 1100ºF,
  - machine removal of paint without HEPA vacuum attachment,
  - heat guns that char paint,
  - dry scraping or sanding farther than 1 ft. of electrical outlets, and
  - use of volatile strippers in poorly ventilated spaces.
- Worksite cleanup—HEPA vacuuming and detergent/wet-wash cleaning.
- Clearance—a clearance inspection conducted by a certified inspector/assessor or clearance technician is required when the project is completed.
- HUD requires a clearance inspection to be conducted by a **certified** inspector/assessor or clearance technician.

CSD Policy for HUD Regulations

- If it has been determined during the assessment that the HUD unit contains a hazardous condition to the occupants, proper steps in accordance with CSD policy shall be taken to alleviate the imminent danger. In these cases, CSD Weatherization Installation Standards, this document, and HUD Regulations would not apply and the work performed is strictly limited to the mitigation of danger. After such conditions have been alleviated, weatherization work can proceed with HUD regulations in effect.

Exception to HUD Regulations

- Residential structures built after Dec. 31, 1977
- Mobile homes with factory-applied paint
- If the *de minimis* levels are not exceeded.
- HUD-assisted property that is designated exclusively for occupancy by the elderly or disabled is exempt from HUD regulations; but is not exempt if a child of less than 6 years of age resides or is expected to reside there.

HUD *di minimis* Levels

The HUD *di minimis* levels are:

- 2 sq. ft. per room of interior surfaces, and/or
- 20 sq. ft. of exterior surface, and/or
- 10 percent of a small component (example: window sill, baseboards, and trim).

- When calculating the *di minimis* level, the entire surface of the component shall be included in the computation. For example, when replacing a 2 x 3 ft. window, the *di minimis* level would be six (6) sq. ft. and would exceed the maximum allowance for interior surfaces and the unit would be subject to HUD Regulation.

HUD Lead-Safe Certification Policy

- For all pre-1978 HUD units certified to be "lead-free," clearance inspections are not required and units are not subject to HUD's Lead-safe Housing Rule or other lead-safe practices.
- For all pre-1978 HUD units certified to be "lead-safe," clearances inspections are required if amount of paint disturbed was greater than the *di minimis* levels.
- For all pre-1978 HUD units not certified to be "lead-free" or "lead-safe," clearance inspections are required if amount of paint disturbed was greater than the *di minimis* levels.
- Clearance inspections shall be performed within 48 hours after the completion of weatherization services.
- If a clearance inspection is required, agencies are strongly encouraged to defer the costs of the clearance inspection to the property owner and/or local housing authority. In many cases, local housing authority staff has licensed inspectors and may conduct a clearance inspection of a HUD unit free of charge. In those instances where the property owner and/or the local housing authority are unable to incur the costs of the clearance inspection, contractors may seek a waiver allowing the cost of the inspection as a reimbursable activity. Waiver requests will be treated on an individual case-by-case basis and shall be approved by CSD prior to beginning weatherization services.
- Routine paint inspections, risk assessments, and clearance testing is not an allowable practice.
- EPA-approved chemical lead test kits are not an acceptable testing method to determine the presence of lead-based paint in HUD housing.

When HUD Lead-Safe Housing Policy Applies

HUD Regulations will apply if **all** of the following conditions are true:

- The unit was built before 1978;
- The unit is classified as HUD housing or receives federal funding;
- The dwelling has not been certified to be lead-free by a California Certified Inspector/Risk Assessor prior to weatherization commencing;
- Lead painted surfaces will be disturbed;
- Amount of disturbed lead-based painted surfaces exceeds *di minimis* levels.

When HUD Lead-Safe Housing Policy Does Not Apply

HUD Regulations will not apply if **any** of the following conditions are true, but the unit is still be subject to CSD lead-safe weatherization criteria above:

- The unit was built after 1977;
- The unit is not classified as HUD housing;
- The unit is designated exclusively for the elderly or disabled.
- The dwelling has been certified to be lead-free by a California Certified Inspector/Risk Assessor; or
- Amount of disturbed lead-based painted surfaces is less than *di minimis* levels.

Housing Components of Community Planning & Development Programs

The following Community Planning and Development programs qualify for Lead-Safe Housing practices if the units are weatherized:

- Community Development Block Grants (Entitlement)
- Community Development Block Grants (Non-entitlement) for States and Small Cities
- Community Development Block Grants (Section 108 Loan Guarantee)
- Emergency Shelter Grants
- The Home Program: HOME Investment Partnerships
- HOPE for Homeownership of Single Family Homes
- Housing Opportunities for Persons with AIDS (HOPWA)
- Innovative Demonstration Program
- Section 8 SRO Mod Rehab for Homeless Individuals
- Shelter Plus Care—Project-based Rental Assistance
- Shelter Plus Care—Sponsor-based Rental Assistance
- Shelter Plus Care—SRO Rental Assistance
- Shelter Plus Care—Tenant-based Rental Assistance
- Single-Family Property Disposition Homeless Initiative
- Special Purpose Grants
- Supplemental Assistance for Facilities to Assist the Homeless (SAFAH)
- Supportive Housing Demonstration Program Permanent Housing Component
- Supportive Housing Demonstration Program Transitional Housing Component
- Supportive Housing Program
- Surplus Properties (Title V)

Housing—Single-Family Programs

The following Single-Family programs qualify for Lead-Safe Housing practices if the units are weatherized:

- Adjustable Rate Mortgages (ARMs) (Section 251)
- Condominium Housing (Section 234)
- Graduated Payment Mortgages (Section 245)
- Homeownership Assistance for Low- and Moderate-Income Families
- [Section 221(d)(2)]
- Homes for Service Member (Section 222)
- Housing in Declining Neighborhoods [Section 223(c)]
- Housing in Military Impacted Areas (Section 238)
- Manufactured Homes (Title I)
- One- to Four-Family Home Mortgage Insurance [Section 203(b) and (j)]
- Rehabilitation Mortgage Insurance [Section 203(k)]
- Single-Family Home Mortgage Coinsurance (Section 244)

Housing—Multi-Family

The following Multi-Family programs qualify for Lead-Safe Housing practices if the units are weatherized:

Programs

- Cooperative Housing (Section 213)
- Emergency Low-Income Housing Preservation (Title II)
- Existing Multifamily Rental Housing [Section 223(f)]
- Flexible Subsidy (Section 201)
- HOPE 2: Homeownership of Multifamily Units (Title IV)
- Low-Income Housing Preservation and Resident Homeownership (Title VI)
- Mortgage and Major Home Improvement Loan Insurance for Urban Renewal
- Areas (Section 220)
- Multifamily Rental Housing (Section 207)
- Multifamily Rental Housing for Moderate-Income Families [Section 221(d)(3)]
- Multifamily Rental Housing for Moderate-Income Families [Section 221(d)(4)]
- Rent Supplements (Section 101)
- Supplemental Loans for Multifamily Projects (Section 241)
- Supportive Housing for Persons with Disabilities (Section 811)

Public and Indian Housing

The following Public and Indian Housing programs qualify for Lead-Safe Housing practices if the units are weatherized:

- Public Housing Development
- Public Housing Modernization (Comprehensive Grant Program)
- Public Housing Modernization (Comprehensive Improvement Assistance Program)
- Public Housing Operating Subsidy
- Section 8 Moderate Rehabilitation Program
- Section 8 Project-Based Certificate Program
- Section 8 Tenant-Based Certificate and Voucher Program

9.4 STATE REGULATIONS

California Department of Public Health

DPH Title 17 Requirements —When Title 17 Applies

The California Department of Public Health (DPH) Title 17 lead-related construction regulations apply when a weatherization project becomes a "lead activity":

- DPH defines "lead activity" as: "**any** activity which disturbs lead-based paint, presumed lead-based paint, or creates a lead hazard." Since many weatherization measures may disturb lead-based paint or presumed lead-based paint in pre-1978 structures, those activities are considered to be "lead activities" and lead-safe work practices are required.
- It illegal to create a "lead hazard" while performing work on a residential structure built before 1978 [HSC §105255(a)].

DPH Title 17 Requirements —When Title 17 Does Not Apply

Title 17 requirements do not apply when any of the following conditions are met:

- Residential structure built after Dec. 31, 1977.
- Paint was tested by a Certified Inspector/Assessor and found to be "lead free."
- Mobile home with factory-applied paint.

DPH Title 17 Requirements

Title 17 requires that anyone conducting "lead activities" shall use the following lead-safe work practices, which are incorporated in lead-safe weatherization activities:

- Contain—use a system, process, or barrier to contain lead hazards inside a work area;
- Clean—ensure that the work area has no visible dust or debris following the completion of a project;
- Comply—upon request, be able to demonstrate compliance with items (1) and (2) above to the Department or a local enforcement agency (environmental health, environmental agency, housing department, or building department).

California Dept. of Industrial Relations (DIR) aka CAL/OSHA

CAL/OSHA Requirements —When CAL/OSHA Applies

The CAL/OSHA workplace lead regulations (Title 8, Sec. 1532.1) apply when:

- Conducting new construction, alteration, repair, or renovation of structures, substrates, or portions thereof that contain lead or materials containing lead
- Any painted surfaces are disturbed and workers may be exposed to a lead.
- Exposure exceeds the AL (action level) of 30 micrograms/cubic meter ($\mu g/m^3$) per 8-hour TWA. The action level triggers several ancillary provisions of the standard such as exposure monitoring, medical surveillance, and training.
- Exposures the PEL (permissible exposure limit) of 50 micrograms/cubic meter ($\mu g/m^3$) per 8-hour TWA. Additional requirements shall be observed when the PEL is exceeded.

CAL/OSHA Requirements —When CAL/OSHA Does Not Apply	When CalOSHA Regulations ***do not apply***: • If the contractor conducting the work is exempt from CalOSHA requirements. • The CalOSHA Standard always applies; the amount of protection and measures taken varies according to the exposure. If the agency has objective data from test results, or similar operating experience, showing that the particular Weatherization activities being conducted do not exceed the action level, even when lead-based painted surfaces are disturbed, then most of the CalOSHA standards do not apply.

CAL/OSHA Requirements —What Is Required

All contractors who conduct construction work where an employee may be exposed to lead are required to:

- Conduct an initial exposure assessment to determine if employees are exposed to airborne concentrations of lead at or above the action level; and,
- Monitor the workplace while construction activities that may disturb lead are conducted, unless it can be proven that employees are not exposed to lead at or above the action level; or
- Treat employees as if they are working above the PEL if activities include manual demolition of structures, manual scraping, manual sanding, heat gun applications and power tool cleaning with dust collection systems (“Trigger Task Level 1”); and
- Have a written compliance program in place before starting a project where lead is or may be involved.

The CAL/OSHA regulations require that employers provide or include, if working at or above the PEL, the following:

- Engineering and work practice controls
- Signs
- Respiratory protection
- Protective work clothing and equipment
- Housekeeping, which includes cleaning of work areas as needed and the use of HEPA vacuums to remove lead dust
- Hygiene practices, including showers
- Lead abatement certification training
- Biological monitoring (blood lead testing)

When exposures are below the PEL, which includes most, if not all weatherization work, employers should provide:

- Housekeeping (HEPA vacuum, wet clean-up, or other effective methods).
- Hand-wash facilities.
- Training as specified in §1532.1.
- Appropriate respirator protection and personal protection equipment.
- For certain highly hazardous tasks, also known as trigger tasks, special protective measures shall be taken, including specified respirators, until the employer determines the workers’ airborne exposure to lead are below PEL.

9.5 LOCAL REGULATIONS

City of San Diego

City of San Diego Requirements —Applies to:

The City of San Diego instituted a lead ordinance in 2008. This local ordinance applies to:

- Renovators when disturbing lead paint that contains lead concentrations equal to or greater than 1,000 ppm or 0.5 mg/cm^2 on all pre-1979 buildings and structures.

City of San Diego Requirements

The City of San Diego instituted a lead ordinance in 2008. This local ordinance requires the use of lead-safe work practices at much lower threshold levels (0.5 mg/cm^2 or 1,000 ppm) than either the state or federal regulations (1.0 mg/cm^2 or 5,000 ppm) and includes homes built before 1979.

- Renovators are required to use lead-safe work practices when disturbing lead paint that contains lead concentrations equal or greater than 1,000 ppm or 0.5 mg/cm^2 on all pre-1979 buildings and structures.
- Ordinance provides for very specific minimum work practices taken from the HUD Guidelines, Chapter 8 tables.
- In some cases, relocation of occupants is required.
- Visual clearance by the renovator is required for all work where lead paint is assumed or tested above the 1,000 ppm or 0.5 mg/cm^2.
- Contractors shall use the City's form, maintain records for three years and make records available upon request.
- If a contractor disturbs lead-based paint (5,000 ppm or 1.0 mg/cm^2 or above), a clearance inspection by state-certified personnel is required.
- Lead-safe work practices are required and apply to all activities, which disturb or remove lead-based or presumed lead-based paint.
- The City's regulations also require:
  a) Occupant notification (7 days prior to start of job)
  b) Occupant protection
  c) Temporary relocation
  d) Worksite preparation
  e) Specialized cleaning
  f) Visible lead paint contaminants
  g) Disposal
  h) Inspections—visual and state clearance inspections
  i) Prohibited practices

City of San Francisco

City of San Francisco Requirements —Applies to:

The City of San Francisco instituted a lead ordinance to control lead paint on the exteriors of buildings in the City. This local ordinance applies to:

- Anyone removing or disturbing lead paint on the exterior of a building built before 1979.

City of San Francisco Requirements —Does Not Apply to:

This ordinance does not apply to:

- Anyone removing or disturbing lead paint on the exterior of a building built after 1978.
- Disturbing less than 10 sq. ft. of paint.

City of San Francisco Requirements

The owner or the contractor shall perform the following actions:

- Notify affected parties before work begins.
- Use containment barriers.
- Prevent lead paint from going beyond the containment barriers.
- Remove visible lead paint chips and dust before completing work.

It is the owner's responsibility to complete the following requirements:

- Notify residential tenants three business days before work begins; and,
- Provide residential tenants with the EPA pamphlet “Protect Your Family from Lead in Your Home.”

The owner or the contractor shall:

- Notify the Department of Building Inspection before work begins.
- Notify contract and subcontract bidders of any paint inspection reports before bid submittal.
- Post a “Lead Work in Progress” sign if containment is needed to prevent lead paint from migrating to another property and remove sign when work is complete. Where signage is not possible, a letter is to be provided to neighbors.

9.6 DOCUMENTATION OF LEAD-SAFE WEATHERIZATION

Record-keeping

- Agencies shall document that LSW was properly implemented (e.g., photos of the containment set-up and cleaning results, final inspection compliance records, etc.) and copies kept in the client’s file or electronically available at the agency.
- A copy of the Lead-Safe Education Confirmation of Receipt (CSD 321) is required to be completed and retained in the client’s file.
- Verification documents from the Certified Renovator shall be placed in each client’s file, attesting that all LSW standards were properly followed and the containment area was set up properly and not compromised during work. The results of the Cleaning Verification shall also be documented and placed in the client file. Agencies shall use form CSD 708 to meet the compliance requirement.
- CSD monitors shall have full access to these documents for the purposes of review and verification.

9.7 DISPOSAL REQUIREMENTS

Proper Disposal of Materials

Proper LSW Clean-Up and Debris Disposal

- All dust, dirt, material scraps, containers, wrappers, and work related debris shall be removed from the client's home. A HEPA vacuum should be used to clean up the work areas. Further cleaning may be necessary based on the hazard.
- At the conclusion of the job, once all workers have "cleaned" the work areas thoroughly, Weatherization workers shall adhere to the following:
  - Bag and gooseneck-seal all waste in 6-mil plastic bags
  - Safely dispose of all waste in accordance with federal, state, and local regulations.
- Visual Inspection Verification: A Two-Phase Process
  - Phase 1: Worker—visual inspection during the cleaning process; look for any visible paint chips, dust, or debris as you clean, using proper techniques.
  - Phase 2: Supervisor—visual inspection after cleanup. There should be no evidence of settled dust following a cleanup effort. If dust is observed, the weatherization crew shall be required to repeat the cleaning.
- If work is done outside the house, the grounds around the dwelling and all exterior horizontal surfaces should also be examined visually to make certain that all waste and debris have been removed and that paint chips were not left behind.

9.8 EMPLOYEE/SUBCONTRACTOR LSW TRAINING REQUIREMENTS

CSD LSW General Training Requirements

- At least one individual at each agency and subcontractor (who may disturb paint) is required to be a Certified Renovator. Certified Renovators shall be trained and certified through an EPA-Accredited training provider.
- DPH Lead-Related Construction certification is not required; however, anyone wishing to become a state-certified lead dust sample technician, paint inspector/risk assessor, supervisor, monitor, or worker are required to be trained by a state DPH-accredited training provider.
- DOE requires that weatherization workers shall be trained in LSW when the disturbance of painted surfaces exceeds the:
  - Di minimis levels specified in the EPA rule; or
  - Emissions levels under the OSHA rule.
- CSD requires that all weatherization employees of agencies and subcontractors are required to be trained in lead-safe weatherization practices using CSD-approved training materials or workshops.
- An assessor, worker, supervisor or inspector will not be allowed to enter, assess, weatherize or inspect a unit until they have completed LSW training.
- All WAP network agency weatherization employees and subcontractors shall receive and are required to complete CSD's online Health and Safety and Environmental Hazards Awareness Training (includes LSW) within the first 30 days of employment.
- All training shall be provided through a CSD-approved training center or representative, utilizing CSD-approved training curriculum. Training coursework

shall be successfully completed.

HUD LSW Training Requirements

- For weatherization services performed on HUD units, the EPA's RRP Rule certification and training requirements apply.

Approved Training Providers

- CSD-approved and/or sponsored lead-safe weatherization training workshops.
- EPA-accredited RRP training providers.
- DPH-accredited lead-related construction training providers.

Unacceptable Methods for Meeting Training Requirements

- In-house training shall no longer be an acceptable form of training to meet any CSD training requirements for weatherization services unless otherwise noted.
- Lead-safe weatherization training received from the PG&E Stockton Training Center during the Basic Weatherization course does not meet the lead-safe weatherization training requirement at this time.
- During the course of unit inspections, the CSD inspector will provide additional field training in lead-safe weatherization, environmental hazard awareness and health and safety issues when irregularities have been determined. This is not to be relied upon as the primary source of training.

Training Requirements —Online

- Agencies shall ensure that all Crew Members, Assessors, Inspectors, and Field Supervisors participate in and successfully complete CSD's online Health and Safety and Environmental Hazards Awareness Training (includes LSW) within the first 30 days of employment.

Training Requirements —LSW Minimum Standards Training

- Each training or sponsored workshop provided by CSD to address the LSW Minimum standards shall include a hands-on training component to augment the curriculum.
- The level of LSW training crews and contractors have received shall be recorded and maintained by each agency along with the date of training, type of training, and the name of the training provider.
- When need is determined for additional training based on CSD monitoring or third-party weatherization inspection findings, additional training shall be provided. Topics may include such subjects as: protective gear, safety practices, condition of the equipment, etc.
- Review of the work in progress by visiting job sites (announced or unannounced) may be implemented at CSD's discretion to ensure that crews/subcontractors understand and are following LSW procedures.

Training Requirements — EPA Renovator

- Certified Renovators are required on all pre-1978 job sites. Certified Renovators shall be trained and certified with an EPA-accredited trainer and be onsite at all LSW sites to perform the mandated functions of a Renovator.
- CSD has developed an approved (certified) Lead Renovator course per the following description:

Course Name	Total Class Length	Coursework + exam	Hands-on Session
Renovator (standard)	8 hours	5 hours	3 hours
Renovator (update)	4 hours	3 hours	1 hour

- Individuals who have successfully completed the following training courses may qualify to take the EPA-approved four-hour renovation refresher course training in lieu of the EPA-approved eight-hour initial renovation course training.
  - Abatement worker or supervisor course accredited by EPA, or an EPA authorized State or Tribal program.
  - Joint EPA-HUD Lead Safety for Remodeling, Repair and Painting, 2003 (EPA 747-B-03-001).
  - EPA Model Training Course Minimizing Lead-Based Paint Hazards During Renovation, Remodeling, and Painting, 2000 (EPA 747-B-00-005).
  - HUD Addressing Lead-Based Paint Hazards During Renovation, Remodeling and Rehabilitation in Federally Owned and Assisted Housing Course.
  - HUD Lead-Based Paint Training for Remodelers and Renovators Course.
  - Occupational Knowledge Interim Controls/Lead-Safe Work Practices and Awareness Training.
- Based upon previous training and experience, CSD agency workers will be categorized in the “standard” or “update” categories for training.
- Agencies will be required to provide documentation of each Certified Renovator’s credentials to perform the specific functions of that role.
- State monitors/inspectors shall also receive the training and be EPA “certified renovators.” This ensures quality control and procedures being performed on the homes are in accordance with LSW and EPA requirements.

Required Employee Materials

- Every assessor, inspector, and work crew is required to maintain and have available for reference the most current CSD Conventional and Mobile Home and Weatherization Installation Standards and CSD Weatherization Policy and Procedures Manual when providing any weatherization services.

Training Records

- Agencies and their subcontractors are required to maintain a training log for current employees. The training log shall document for each employee all CSD-required training received and shall include for each training session/course the source, type, and completion date. Such training logs for each agency and subcontractors shall be maintained in the each agency’s file and shall be made available for review by CSD upon request.

9.9 NON-COMPLIANCE

Agency Non-Compliance

- In the event that CSD determines that an agency, its employees, or subcontractor(s) is in non-compliance of material or other legal requirements of the LSW policy, CSD shall provide the observations, recommendations, or findings in writing, along with a specific action plan for correcting the non-compliance.
- In the event that prescribed policies are not followed and/or corrective action is not taken to meet these policies, it shall be deemed a material breach of Agreement, and CSD shall take appropriate action, including but not limited to withholding of payments and initiation of the suspension and termination procedures as described in State and federal WAP Agreements.

9.10 DEFINITIONS

Lead-Based Paint

Lead-based paint means paint or other surface coatings that contain an amount of lead equal to, or in excess of:

(a) one milligram per square centimeter (1.0 mg/cm^2); or

(b) half of one percent (0.5%) by weight.

Presumed Lead-Based Paint

Presumed lead-based paint means paint or surface coating affixed to a component in or on a structure constructed prior to January 1, 1978. “Presumed lead-based paint” does not include paint or surface coating that has been tested and found to contain an amount of lead less than one milligram per square centimeter (1.0 mg/cm^2) or less than half of one percent (0.5%) by weight.

Lead-Safe

“Lead safe” certification means that lead-based paint is present on the structure and all lead hazards have been remediated. The structure is considered to be “lead safe,” as lead-based paint may still be present on site.

Lead Hazard

A lead hazard is defined as: deteriorated lead-based paint; lead-contaminated dust and soil; disturbing lead-based paint or presumed lead-based paint on a residential structure built before 1978 without containment; or any other nuisance which may result in a persistent and quantifiable lead exposure.

Renovation

Renovation is defined as “any activity that disturbs painted surfaces and includes most repair, remodeling and maintenance activities, including window replacement.”

9.11 RESOURCES

Department of Community Services and Development (CSD)	• CSD Weatherization Installations Standards • CSD Weatherization Program Field Guide • CSD Lead-Safe Requirements (CSD WIS Section 2) • CSD Health and Safety Requirements (CSD WIS Section 1) • All CSD manuals are available by calling 916-576-7131, or emailing to wx@csd.ca.gov
California Dept. of Public Health (DPH)	• The DPH Childhood Lead Poisoning Prevention Branch: http://www.cdph.ca.gov/programs/clppb/Pages/default.aspx • The DPH Lead-Related Construction page: http://www.cdph.ca.gov/programs/CLPPB/Pages/LRCNav.aspx
CAL/OSHA	• Cal OSHA's Lead in Construction Standard, Title 8 CCR Section 1532.1 • http://www.osha.gov/SLTC/constructionlead/index.html • http://www.osha.gov/SLTC/personalprotectiveequipment/index.html • http://www.dol.gov/elaws/oshalead.htm • Download from http://ccr.oal.ca.gov/linkedslice/default.asp?SP=CCR-1000&Action=Welcome
Department of Energy (DOE)	• Department of Energy Weatherization Program Notice 09-6, Effective Date: January 7, 2009 • Department of Energy Weatherization Program Notice 08-6, Effective Date: September 22, 2008 • Department of Energy Weatherization Program Notice 02-6, Effective Date: July 12, 2002 • Department of Energy Weatherization Assistance Program for Low-Income Persons Final Rule, 10 CFR Part 440, February 1, 2002 • Download from http://www.waptac.org/sp.asp?id=1812
Department of Housing and Urban Development (HUD)	• HUD Regulation—Lead-Based Paint Hazard Control Rule Title 24 CFR35 (Part 35) • HUD's Renovation and Remodeling Course (1-day course), download from www.hud.gov/offices/lead/training/training_curricula.cfm • "Lead-Based Paint Poisoning Prevention in Certain Residential Structures," September 15, 2000, download from www.hud.gov/offices/lead/
Environmental Protection Agency (EPA)	• EPA Regulation Residential Lead-Based Paint Hazard Act of 1992 "Pre-Renovation Education Rule, Section 406, download from http://www.epa.gov/region09/toxic/lead/statusx.html • EPA RRP Rule: http://www2.epa.gov/lead/renovation-repair-and-painting-program • EPA 747-K-94-001—Protect Your Family From Lead in Your Home • EPA 747-B-99-004—The Lead-Based Paint Pre-Renovation Education Rule • EPA's publications are available to non-profit agencies or government entities by calling 1-800-424-5323. Fifteen copies or less can be ordered on-line or downloaded from http://www.epa.gov/lead/

PRE-/POST-INSTALLATION REQUIREMENTS

Lead Paint Risk Factor
NONE

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PRE/POST INSTALLATION REQUIREMENTS

UNIVERSAL REQUIREMENTS

1. GENERAL REQUIREMENTS

a. The information contained in this section shall apply to **ALL** sections of the WIS manual, except where noted as specific to a certain measure or measure classification.

b. These requirements are printed here to prevent repetition of the information in each individual measure section.

c. Application and enforcement of these requirements shall have the same force and effect as all other installation requirements included in this Weatherization Installation Standards Manual.

d. Meeting the CAL/OSHA worker safety regulations is the responsibility of the agency, subcontractor, and all workers. To do this, all workers shall be aware of conditions in all work areas that can produce injuries. No worker is required to work at a job he/she knows is not safe or healthful. All field workers' cooperation in detecting hazards and, in turn, controlling them, is required in conformance with CAL/OSHA and the agency or subcontractor internal policy.

PRE-INSTALLATION REQUIREMENTS

2. LEAD-SAFE WEATHERIZATION

- **Lead-safe practices shall be followed:**
  - In homes of pre-1978 construction, as outlined in CSD WIS Section 2 (Lead-Safe Weatherization Requirements).
  - In accordance with the Risk Factor for each measure.
  - In conformance with the California Department of Public Health (DPH), CAL/OSHA, Environmental Protection Agency (EPA), and U.S. Department of Housing and Urban Development (HUD) lead-safe weatherization requirements.

3. CLIENT EDUCATION (UNIVERSAL—TO BE APPLIED TO ALL MEASURES)

- **Client shall be supplied with both verbal and written instructions for proper operation and maintenance for all measures installed.**
  - Clients shall be given written documentation that describes components of the system, maintenance requirements, and health and safety considerations, at a minimum.
  - Information will be provided in simple terms, combining text and pictures.
  - Documentation may be provided electronically.
  - Literacy levels and language of occupants will be considered in selecting appropriate materials.
- **Client shall be advised of:**
  - Potential fire and explosion dangers of storing items in appliance enclosures, particularly combustible or volatile chemical materials.
  - Purpose, operation, and maintenance (clearing) of vents for air quality, safety, and proper ventilation.
  - Potential hazards of unvented combustion appliances (primary or secondary) within a living space.
  - Client education specific to individual measures is described in the WIS section to which it applies.
  - Clients shall be informed about unit registration for manufactured housing (a mobile home) if the work requires a permit from HCD.

4. INSULATION CERTIFICATE

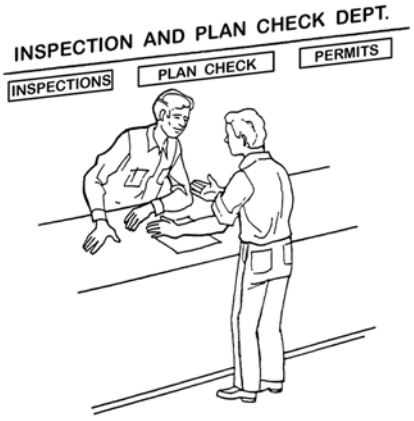
- **Any Insulation Installation**
  - In accordance with Title 24, when Insulation is installed (Ceiling, Wall, or Floor), completion of the Insulation Certificate (form CSD 610) shall be required and a copy provided to the client.
  - The Certificate shall be completed and signed by the contractor responsible for installing the insulation. The manufacturer, brand, R-value, etc. of the insulation installed in the roof/ceiling, walls, floor, and slab edge are documented. The installer also verifies compliance with the applicable mandatory measures (i.e. infiltration and exfiltration) for the building envelope.

5. WARRANTY

- **All Installations**
  - All parts and labor shall be covered in accordance with the minimum warranties described in the CSD WIS Appendix B (Warranty Requirements).
  - All written warranty information shall be supplied to, and reviewed with, the client.
  - Contact information for the installation company shall be provided.

6. PERMITS

- **Client Education for Permits**
  - When a permit will be required by the local jurisdiction CSD requires that the client receive an explanation of the permitting process.
  - When the dwelling contains obviously un-permitted work (i.e., questionable construction or installation of additions or appliances, etc.), the assessor shall explain that the building inspector may elect to inspect these additional components and that findings or fines related to this additional examination shall be the responsibility of the property owner.
- **Conventional Home Permits**
  - Permits shall be secured and finalized with the local jurisdiction when:
    - Required by the local jurisdiction.
  - Examples of “alterations” for which the local jurisdiction may require a permit are:
    - Alterations made to an appliance gas line (e.g., size, configuration, or location changed). *Exception*: Simple replacement of a gas shutoff valve, or flexible gas connector do not require a permit.
    - Alterations made to an electrical circuit (e.g., amperage/wattage changed, location changed, or grounding of the circuit added).
    - Installation of a heating/cooling appliance (i.e., HVAC equipment, water heater, etc.).
    - Addition of insulation.
    - Replacing or adding windows to existing walls (does not include replacing glazing within sashes or replacing sashes within a frame).
    - Extending or replacing an existing duct system.
    - Installing a hardwired fixture in a new location.
    - Installation of a mechanical ventilation system.



PERMIT OBTAINED AND FINALIZED WHEN REQUIRED BY THE AUTHORITY HAVING JURISDICTION

- **Manufactured Housing/Mobile Home Permits**
  - Permits shall be secured and finalized.
    - When work is to be performed on or in a mobile home, the permit shall be obtained from the Department of Housing and Community Development (HCD).
    - Work performed outside of a mobile home shall be the jurisdiction of the local building department.

GENERAL INSTALLATION REQUIREMENTS

7. ALL INSTALLATIONS

- **Installations shall be in compliance with:**
  - Manufacturer's instructions and specifications.
  - Local building code and Title 24 regulations regarding system/measure installation, precautions, zoning, noise abatement, access, etc.
  - Current applicable codes, including:
    - California Residential Code
    - California Mechanical Code (CMC)
    - California Electrical Code (CEC)
    - California Building Code
    - California Plumbing Code

8. QUALIFIED SERVICE TECHNICIANS

- **Appliance Repairs/Replacements**
  - Technician/Installer shall:
    - Have a C-20 HVAC license or a C-36 for water heater repair/replacement); OR
    - Have a different specialty credential if required by the Contractors' State License Board (for conventional homes) or the Department of Housing and Community Development (for manufactured housing/mobile homes).
    - Obtain and finalize a building permit, in accordance with the local jurisdiction's requirements.
    - Calculate size (capacity) of new heating or cooling appliance in conformance with Title 24 and keep a copy of this documentation shall be kept in the client file.

REPAIR/REPLACEMENT REQUIREMENTS

9. APPLIANCE REPAIR/REPLACEMENT AND MATERIAL POLICIES

- **All repair and replacement appliances and parts/materials shall:**
  - Be in conformance with the material specifications as identified in CSD WIS Appendix A (Material Specifications).
  - Only basic material type(s) shall be allowed for each measure.
  - No upgrades shall be allowed to enhance appliances, add decorative items, etc.
  - Client/occupant cannot contribute to the cost in order to have an upgrade for premium or higher end materials or to pay for work outside the scope of the program.
  - Installed appliances shall conform to the CEC standards for efficiency, as verified by inclusion on the CEC's database of certified appliances, an equivalent federal director, or an approved trade association directory.

Section 3

POST-INSTALLATION REQUIREMENTS

10. CLEAN-UP AND DISPOSAL

- **Clean-up**
  - Paint dust and chips, scraps, and other debris resulting from all measure installation activities shall be removed from the premises—using lead-safe practices when applicable in accordance with the Lead-Safe Requirements in CSD WIS Section 2.
- **All Installations**
  - All packing materials and installation debris shall be cleaned up and removed from the premises.
  - Replaced appliances shall be de-manufactured in compliance with all applicable laws and regulations.
  - All replaced equipment and parts shall be removed from the premises and disposed of properly, and in accordance with the special disposal procedures provided in each WIS section.

CARBON MONOXIDE (CO) ALARMS

Lead Paint Risk Factor
LOW

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CARBON MONOXIDE (CO) ALARMS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

CO ALARM REPAIR

Not allowed for this measure.

CO ALARM INSTALLATION

1. EXISTING CO ALARMS

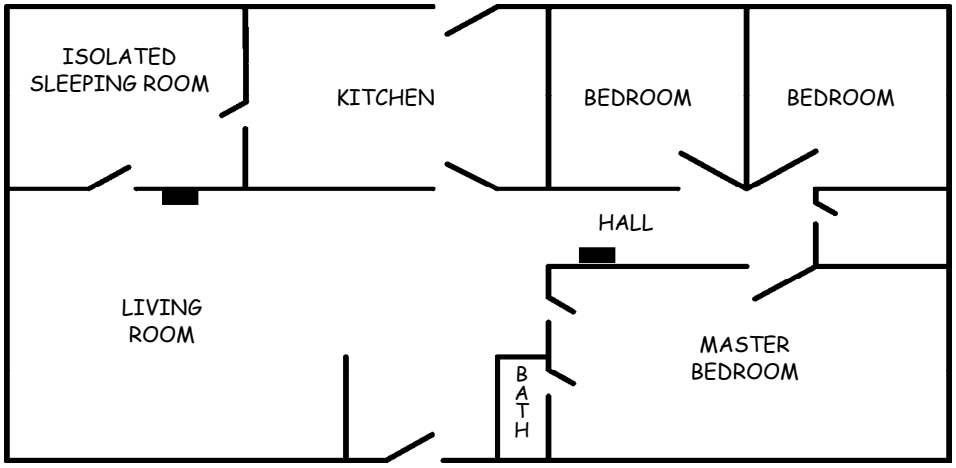
- **Existing Alarm**
  - The alarm shall be checked for age and proper operation in accordance with the measure-specific policies in the CSD Field Guide.

2. INSTALLATION REQUIREMENTS

- **Instructions**
  - Installation of the Low-Level Display CO Alarm shall be in compliance with this section, manufacturer's instructions, and local code.
  - When a conflict occurs, the more restrictive provision shall be followed.
    - Installation is limited to lithium battery-powered CO Alarms and the minimum number required to protect all sleeping areas and every level of the dwelling, in accordance with the CSD WIS.
- **Installation Date**
  - Date of installation shall be written in permanent ink in the space when there is a space provided on the alarm.
- **Replacement Date**
  - The date by which the alarm should be replaced shall be written with permanent ink in the space provided on the alarm (typically on the bottom or side).
  - The replacement date is the date of installation plus the expected life of the alarm.
  - The expected life is 5 years or as stated by the manufacturer, if greater.
    - *Note*: Typical life expectancy of a new UL Listed CO Alarm is 5 years, and the 5-year life expectancy applies to *new* installations. However, CSD's policy (when evaluating existing CO Alarms) allows replacement when they are more than 2 years old from the date of manufacture to ensure occupant protection.
- **Battery Compartment**
  - The alarm manufacturer's original battery shall be used, and the battery compartment shall not be modified.

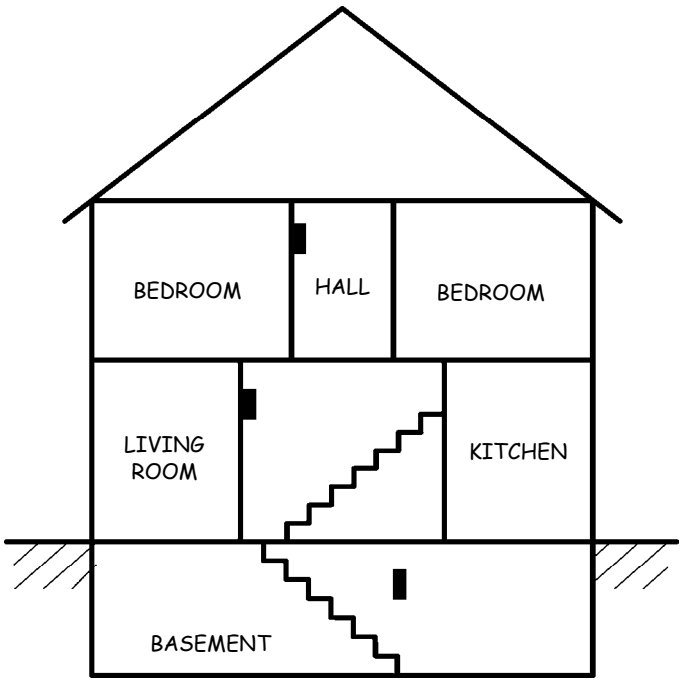
3. REQUIRED CO ALARM PROTECTION LOCATIONS

- **Sleeping Rooms/Areas**
  - A properly-functioning low-level display CO alarm shall be present in the following locations:
    - Outside (within 15') of:
      - All bedrooms and other areas used for sleeping (such as living room, den, converted garage, etc.)
    - Inside sleeping room(s) when:
      - There is no acceptable location to install the alarm outside the room, or
      - The sleeping room contains a combustion appliance or fireplace/insert.
  - When heat is provided by a non-ducted combustion source (wall or floor furnace or room heater), the low-level display CO Alarm shall be installed:
    - Inside a bedroom when the heat source is located in the bedroom.
    - Outside the bedroom(s) and within 15 feet of the non-ducted heat source, when the heat source is not located inside a bedroom.
    - Example: If there are two separate sleeping areas at different distances from the heat source (but both within 15-feet), a low-Level Display CO Alarm would be installed in the required location that is nearer to the heat source.



CO ALARMS IN 1-STORY HOUSE (WITHIN 15' OF EACH BEDROOM)

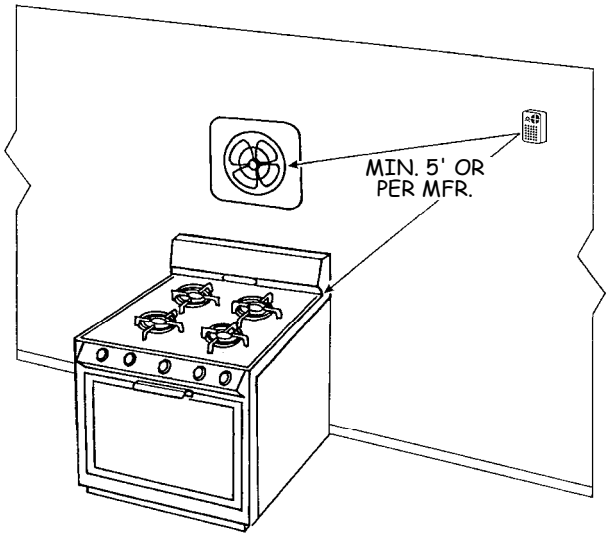
- **Dwellings with Basement or Multiple Stories**
  - In addition to sleeping area protection, a CO alarm shall be installed on each of the other levels (stories) of the dwelling, including basement and habitable attic.
  - Basement location: On the wall near the entry to the stairs.
  - Other stories and habitable attic: On the wall in a central location.



CO ALARMS IN 2-STORY HOUSE

4. ALARM LOCATION RESTRICTIONS

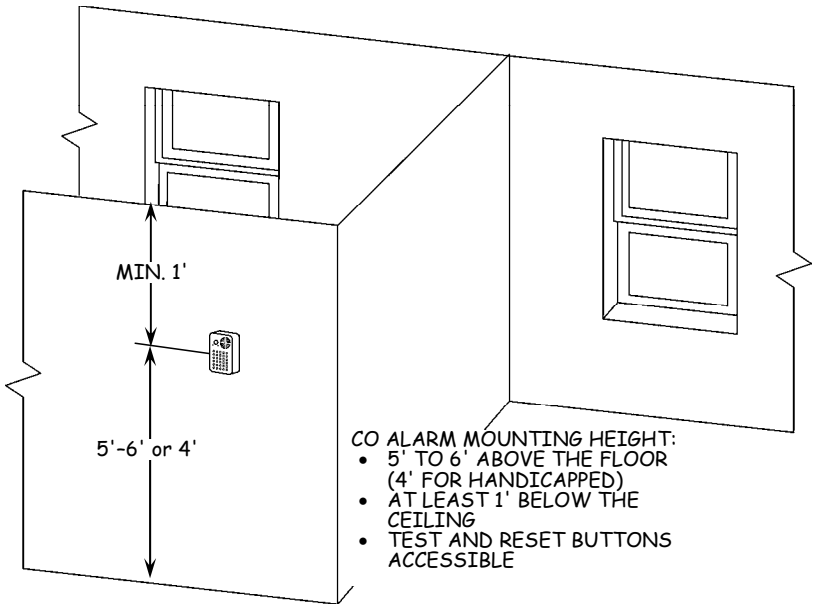
- **Locations Not Allowed**
  - On an outside wall.
  - In an appliance enclosure or garage.
  - In an unconditioned space (*except the basement,* where a *CO* alarm is required.).
  - Locations with limited air circulation, such as:
    - Behind furniture or draperies, or behind a door in opened position.
    - Near an inside corner, in an alcove or closet, etc.
  - In a storage area for household chemicals.
  - An area that may get hotter or colder than the alarm's high and low temperature limits.
  - Areas that are excessively greasy, dusty or humid.
  - All other locations specified by the manufacturer to be avoided.
- **Minimum Distances**
  - Alarm shall be installed at least 1 foot away from the ceiling/wall junction.
  - Alarm shall be installed at least 3 feet away from:
    - The air path of supply registers, return grille, fresh air vents, and exhaust fans.
    - The door or opening to:
      - A bathroom that contains a bathtub or shower,
      - A laundry room with washer or sink, or
      - Another moisture-producing source.



  - Alarm shall be installed at least 5 feet horizontally away from the following:
    - Cooking appliances (gas or electric).
    - Openable windows or entrance doors from outdoors.
    - Ceiling fans.
    - Drafty locations (such as shell leaks).
    - A floor furnace (minimum 5' horizontally from the edge of the furnace grille).
    - Other furnace/heater and water heater (minimum 5' horizontally from the appliance).
    - Source of chemical odor, such as diaper pail or cat litter box.
  - Distances specified by the manufacturer, *which may be greater*.

5. ACCEPTABLE CO ALARM LOCATIONS

- **Interior Walls**
  - Whenever possible, CO alarms shall be mounted on an interior wall.
  - Alarms shall be mounted 5' to 6' above the floor and at least 1' below the ceiling (measured to center of alarm).
    - *Exception:* Alarm may be mounted as low as 4' above the floor for adult occupants when an:
      - Occupant is handicapped and using a wheelchair, or
      - Occupant's height justifies a lower location.
  - Alarms shall be in a position where the occupant can:
    - Reach the control buttons (test and reset), and
    - See the visual display (colored lights and/or readout).



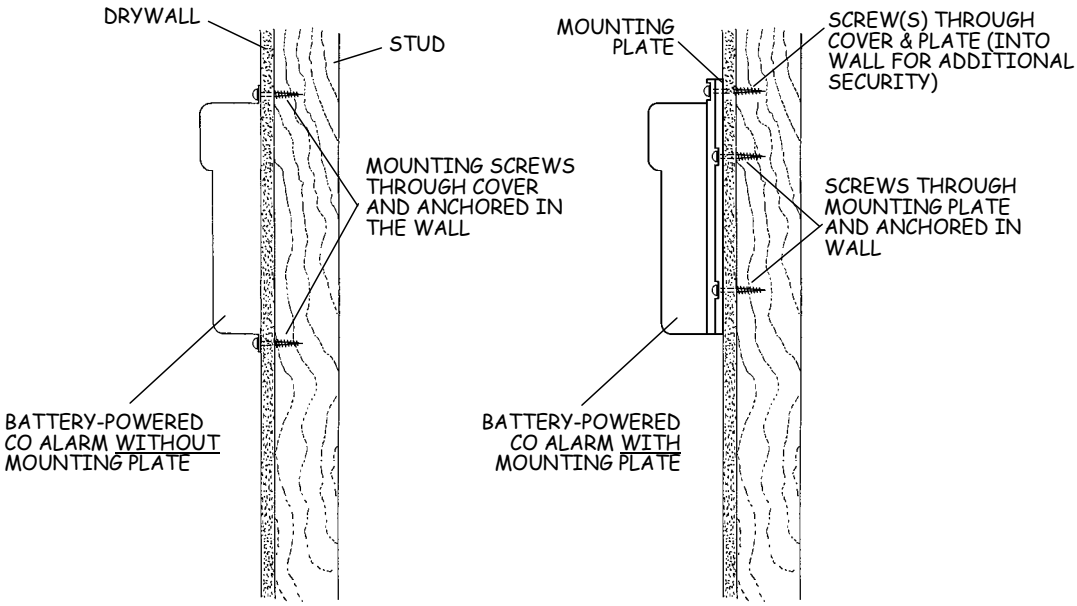
- **Ceilings**
  - CO alarm installation on an insulated ceiling is allowed *only when* there is no acceptable wall location and textured ceiling does not contain asbestos material.
  - CO alarms shall not be installed on a poorly-insulated or uninsulated ceiling (such as in an older mobile home).
  - When feasible, alarms shall be centrally-located on the ceiling to the extent feasible.
- **All Installations**
  - Location of alarm shall be in accordance with Item 4.

6. CO ALARM MOUNTING

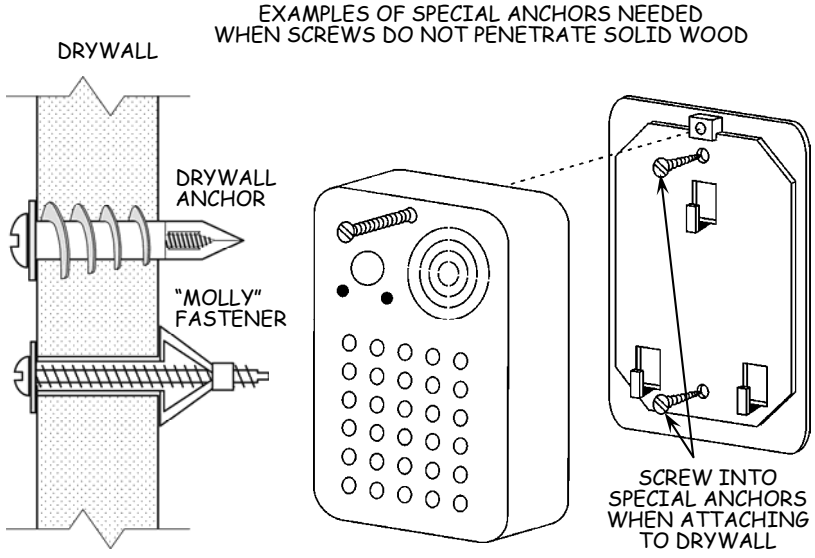
- **All CO Alarms**
  - Alarm shall be secured so it cannot be detached without removing one or more screws.
  - The Alarm manufacturer's original mounting system, battery compartment, and all other alarm components shall not be modified.
- **Alarms with Mounting Plate**
  - Mounting plate shall be secured to the wall with at least two standard screws (i.e., Phillips or slotted) that are properly anchored in the wall.
  - Alarm shall be secured to the mounting plate with one or more standard screws that extend through the alarm cover/body and into the mounting plate and/or the wall.

6. CO ALARM MOUNTING (cont.)

- **Alarms <u>with</u> Mounting Plate (cont.)**
  - Tamper-resistant screws are allowed only in accordance with CSD Field Guide measure-specific policy (e.g., when requested by the owner) and the tool to remove screws is clearly labeled and provided to the owner).
- **Alarms <u>without</u> Mounting Plate**
  - Alarm shall be secured to the wall with at least two standard screws (i.e., Phillips or slotted).
  - The screws shall:
    - Extend through the alarm cover/body and into the mounting surface, and
    - Be properly anchored in the wall.



- **Screw Installation/Anchoring**
  - Mounting screws shall penetrate a framing member or solid wood sheathing when possible.
  - Screw-in or expansion anchor (e.g., drywall anchor, "molly" fastener, toggle bolt) shall be used when screw does not penetrate solid wood (e.g., is attached to drywall, plaster, paneling, etc.).



7. HARD-WIRED CO ALARMS

- **All Units**
  - Hard-wired carbon monoxide alarms shall only be installed when:
    - Required by the local jurisdiction, or
    - Replacing existing hard-wired unit with battery-powered individual carbon monoxide alarm is not feasible/allowed by the local jurisdiction.
  - Installation and wiring shall be in conformance with manufacturer's instructions and local code.
    - When required by the local jurisdiction, a hardwired alarm shall be installed by a licensed and certified electrician.
  - Circuit powering the alarm(s) shall be:
    - 24-hour, 120V AC 60 Hz.
    - Not controlled by a switch, dimmer, ground fault circuit interrupter (GFCI), or arc fault circuit interrupter (AFCI).
  - Alarm shall be mounted over a standard wiring junction box.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

8. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

9. OPERATIONAL CHECK

- **Alarm Test**
  - Installer shall test Alarm upon completion of installation.
  - Alarm sound shall be muffled during the testing process.
  - Alarm shall function properly in accordance with manufacturer's specifications.

10. RENTAL PROPERTY CO ALARMS

- **Tamper-Resistant Installations**
  - The landlord or property owner shall be given a wrench that will remove the tamper-resistant screws. The wrench shall be in an envelope or plastic bag labeled to describe contents and purpose (e.g., "Wrench to remove CO alarms in units 1, 2, 3….").

11. CLIENT EDUCATION

- **Both verbal and written *instructions* shall be provided regarding:**
  - Maintenance of the alarm (e.g., periodic cleaning, protection from being painted, etc.).
  - Testing of the alarm.
  - How to check for a low-level reading.
  - Response to an activated alarm.
  - Response to failure signal (how to request replacement of the alarm or battery should failure occur during the five-year [or longer] warranty period).

- **Both verbal and written *educational information* shall be provided about:**
  - Carbon monoxide.
  - The effects of CO on the human body.
  - The symptoms associated with CO poisoning.

12. DISPOSAL REQUIREMENTS

- **All Alarms**
  - When disposing of your old alarm, remove or deactivate the batteries and recycle the alarm and batteries appropriately.
  - Contact the local waste management company to determine requirements for the recycling of batteries and the alarm in the local area.

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NOTES

SMOKE ALARMS

Lead Paint Risk Factor
LOW

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SMOKE ALARMS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

SMOKE ALARM REPAIR

Not allowed for this measure.

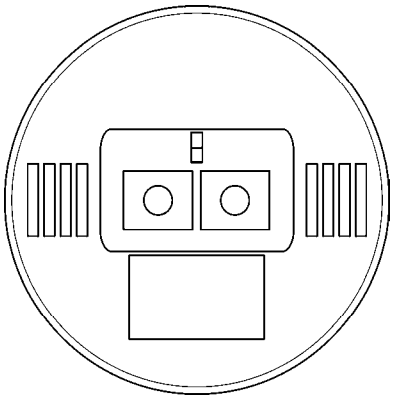
SMOKE ALARM INSTALLATION

1. EXISTING ALARMS

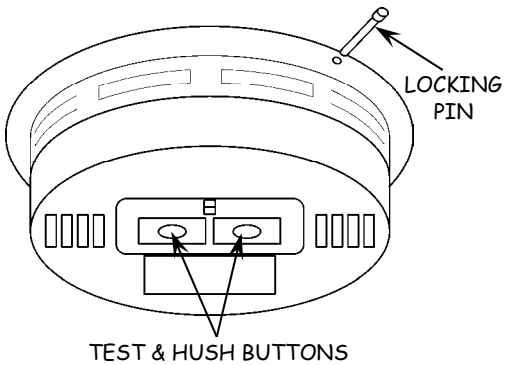
- **Existing Alarm**
  - The alarm shall be checked for age and proper operation in accordance with the measure-specific policies in the CSD Field Guide.

2. INSTALLATION REQUIREMENTS

- **Smoke Alarms**
  - A properly-working smoke alarm shall be present in each required location specified in Item 3, and in accordance with measure-specific policy in the CSD Field Guide.
  - A new alarm shall be installed in each required location that does not have protection.
- **Installation Date**
  - Date of installation shall be written in permanent ink in the space provided on the alarm.
- **Replacement Date**
  - The date by which the alarm should be replaced shall be written with permanent ink on the bottom or side of the alarm (as described by manufacturer).
  - The replacement date is the date of installation plus the expected life of the alarm.
  - The expected life is 10 years or as stated by the manufacturer, if greater.
- ***Note*: Typical life expectancy of a new UL Listed Smoke Alarm is 10 years, and the 10-year life expectancy applies to *new* installations. However, CSD's policy (when evaluating existing Smoke Alarms) allows replacement when they are more than 8 years old from the date of manufacture to ensure occupant protection.**
- **Instructions**
  - Installation shall be in compliance with this section, manufacturer's instructions, and local code.
  - When a conflict occurs, the more restrictive provision shall apply.
- **Battery Compartment**
  - The alarm manufacturer's original battery shall be used, and the battery compartment shall not be modified.

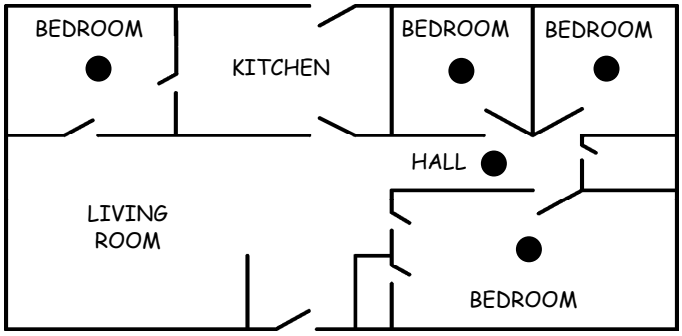


BATTERY-POWERED SMOKE ALARM



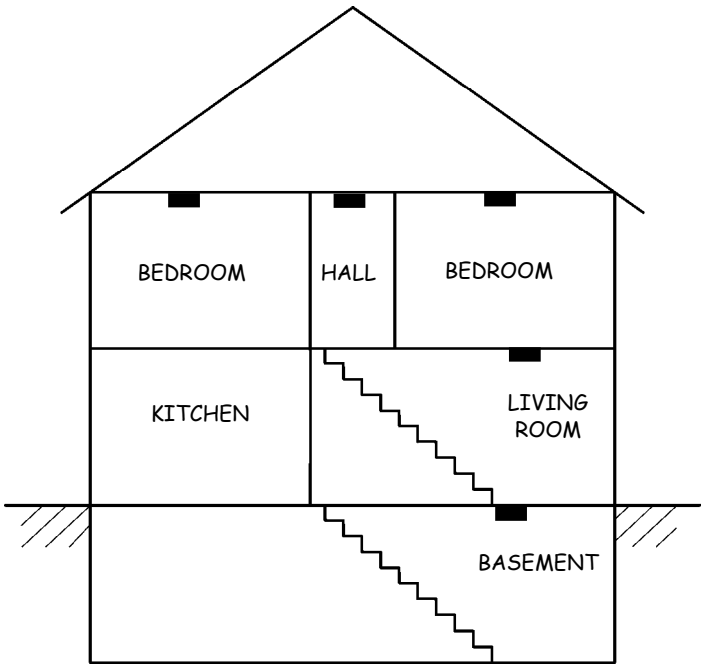
3. REQUIRED SMOKE ALARM PROTECTION

- **Sleeping Rooms/Areas**
  - A properly-functioning smoke alarm shall be present in all of the following locations:
    - Inside each bedroom, and
    - Inside each separate area used for sleeping (den, family room, etc.), and
    - Outside each sleeping area in the immediate vicinity of the bedrooms (within 15').



SMOKE ALARMS IN 1-STORY HOUSE

- **Dwellings with Basement or Multiple Stories**
  - In addition to sleeping area protection, a smoke alarm shall be installed on each of the other levels (stories) of the dwelling, including basement and habitable attic.
  - In a dwelling with split levels (less than one full story between levels) without an intervening door between adjacent levels, a smoke alarm installed on the upper level satisfies the protection requirement for the adjacent lower level.
- **Stairway Locations**
  - When there is a stairway leading from one floor to another, a smoke alarm shall be installed at the top of the stairway.
    - Alarm must be in a location where an intervening door or obstruction will *not* prevent rising smoke from reaching the alarm.
    - When the alarm in an upstairs hallway can be placed at the top of the stairway, and it is located within 15' of the upstairs bedrooms, a second alarm is not required in that hallway.
- **Basement Location**
  - When there is a basement: Install on the basement ceiling near the entry to the stairs.



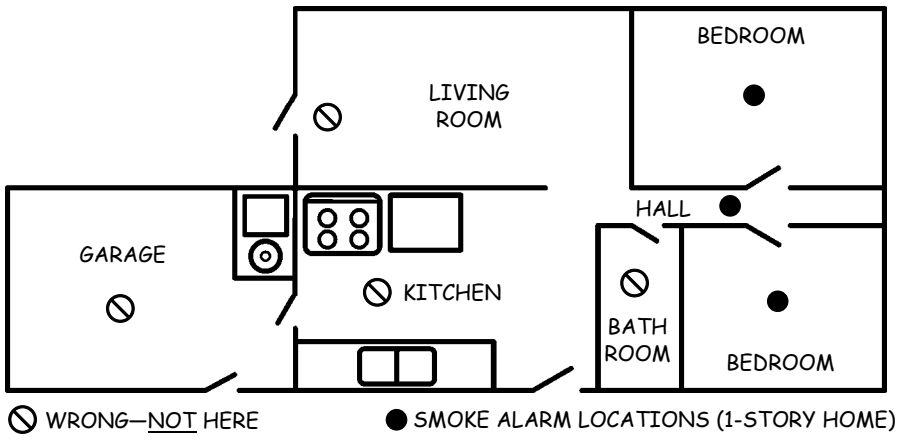
SMOKE ALARMS IN 2-STORY HOUSE

4. LOCATION RESTRICTIONS

- **Ionization or Photoelectric Smoke Alarms shall be installed a minimum distance of:**
  - 1' horizontal distance from fluorescent lights.
  - 3' horizontal distance from:
    - The door or opening to a:
      - Bathroom that contains a bathtub or shower.
      - Laundry room with washer or sink, or other moisture source.
    - The outlet of a forced air supply register (and outside the direct flow from the register).
    - The return grille, an exhaust fan intake, and the blades of a ceiling fan.
    - A whole-house exhaust fan intake (does not apply to a mechanical ventilation unit).
    - Openable window or entrance door.
    - Source of draft or air movement.
  - 20' horizontal distance from open combustion appliances (space and water heaters, cooking appliances), or as specified by the manufacturer.
    - *Exception:* In areas where a 20' distance is not possible (e.g., modular/mobile or small home), the smoke alarm shall be placed as far away as possible, but no closer than 10'; and
    - When the distance is less than 20', a *photoelectric-type* alarm must be installed.
  - When distances specified by the manufacturer are greater, the manufacturer's specifications shall be followed.
- **Locations Not Allowed**
  - In kitchen, garage, unconditioned space, or insect-infested area.
  - Over an electrical junction box (if alarm is battery-powered).
  - Locations with limited air circulation, such as:
    - Less than 4 inches from the ceiling/wall junction or the peak of a sloped (cathedral) or peaked (A-frame) ceiling (see Item 5).
    - Behind furniture or draperies, near an inside corner, in an alcove or closet, etc.
  - All other locations specified by the manufacturer to be avoided, such as an area that:
    - Is excessively greasy, dusty, or humid.
    - May get hotter or colder than the alarm's temperature limits (e.g., on an outside wall or a poorly-insulated ceiling).

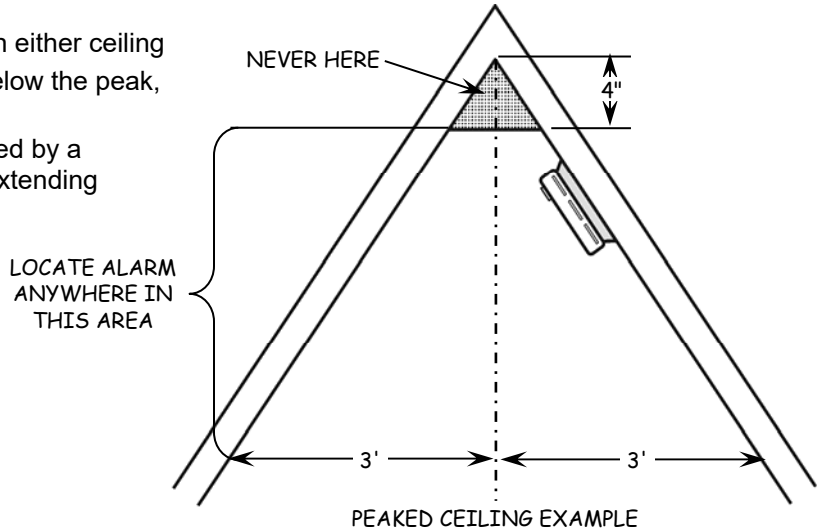
5. SMOKE ALARM PLACEMENT

- **Acceptable Locations**
  - Alarms shall be installed on the ceiling, when feasible.
  - *Interior* wall location acceptable, when ceiling installation is not feasible (e.g., when attic/roof cavity has less than R-11 existing insulation).

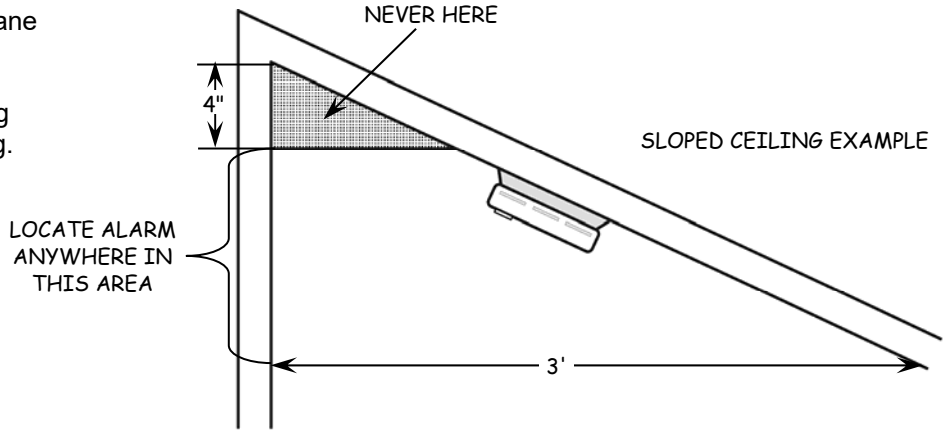


5. SMOKE ALARM PLACEMENT (cont.)

- **Flat Ceilings**
  - Alarm installed on the ceiling shall be:
    - Positioned at least 4" from the wall.
    - Located as close as feasible to the center of the room.
    - Centered between hallway walls.
  - Alarms installed on the wall shall have the top edge located from 4" to 12" below the ceiling.
- **Peaked (A-frame) Ceilings**
  - Alarm shall be installed on either ceiling
    - At least 4" vertically below the peak, and
    - Above the plane created by a 6-foot horizontal line extending ceiling-to-ceiling.



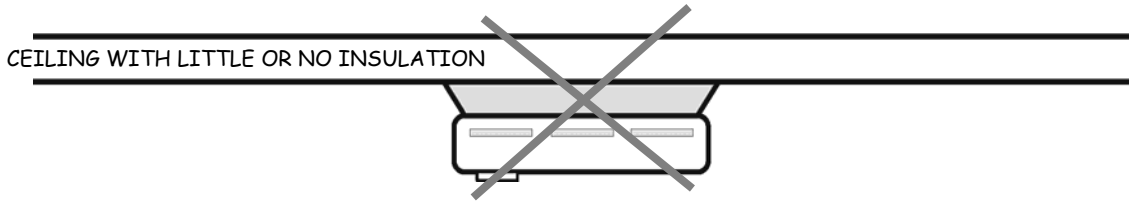
- **Sloped (Cathedral) Ceilings**
  - Alarm shall be installed on the ceiling or wall and located:
    - At least 4" vertically below the peak, and
    - Above the plane created by a 3' horizontal line extending wall-to-ceiling.



- **Coffered Ceilings (Tray-shaped with Sunken Panels)**
  - Alarm shall be installed on the:
    - Highest portion of the ceiling, or
    - Sloped portion of the ceiling within 12″ vertically down from the highest point.
- **Ceilings with Joists or Beams**
  - For ceilings with beam depth less than 10% of the ceiling height, alarm shall be located on the bottom of a beam, or as specified by the local jurisdiction, if more stringent.
  - For ceilings with greater beam depths, alarm shall be located in accordance with NFPA 72 §17.7.3.2.4 and requirements of the local jurisdiction.

5. SMOKE ALARM PLACEMENT (cont.)

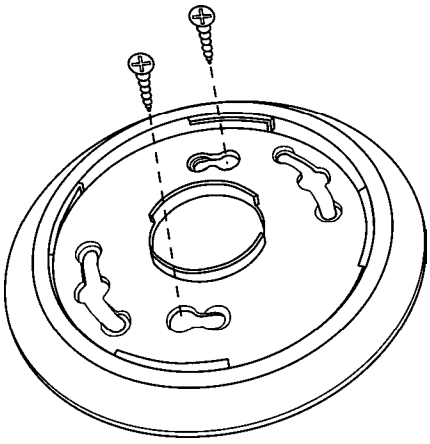
- **Ceilings with Little or No Existing Insulation**
  - Applies to homes with little or no insulation in the attic/roof cavity (e.g., in old houses and older, especially pre-1978, mobile homes).
  - Smoke alarms shall be installed on *interior walls* (not on the ceiling, and not on outside walls), unless a ceiling-mount insulation in a hot or cold installation location is specifically allowed by the manufacturer.



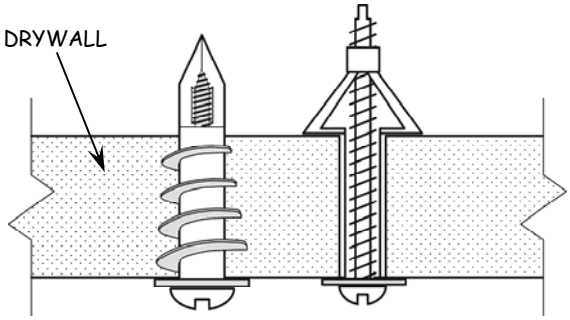
SMOKE ALARM IS NOT INSTALLED ON A CEILING (OR WALL) THAT WILL BECOME VERY WARM OR COLD DURING EXTREME WEATHER

6. SECURE INSTALLATION

- **Mounting System**
  - Mounting plate shall be secured to the ceiling or wall with at least two screws.
  - Alarm shall be secured to the mounting plate per manufacturer's instructions.
- **Screw Installation/Anchoring**
  - Mounting screws shall penetrate a framing member or solid wood sheathing.
  - Screw-in or expansion anchor (drywall anchor, "molly" fastener, toggle bolt, etc.) shall be used when screw does not penetrate solid wood.



MOUNTING PLATE SECURED TO CEILING OR WALL WITH AT LEAST TWO SCREWS

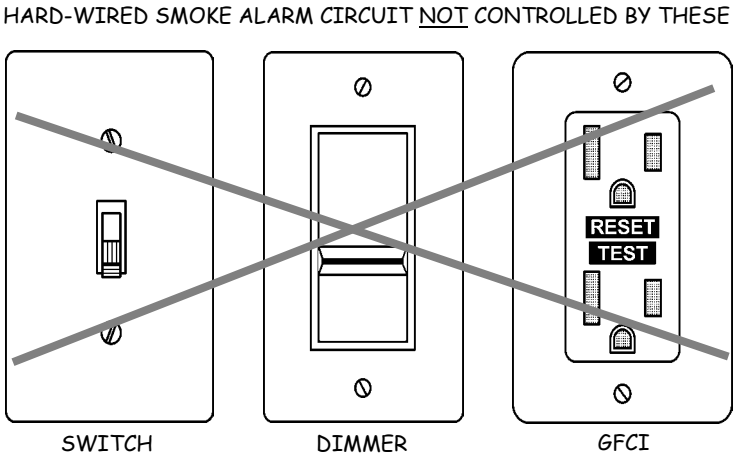


SCREW-IN & EXPANSION ANCHORS USED WHEN SCREW DOES NOT PENETRATE SOLID WOOD

- **Tamper-Resistant Screws**
  - Tamper-resistant mounting screws are not to be used to anchor the alarms to the wall unless requested by a landlord or property owner.
  - For rental units, a signed request specifying the units in which tamper-resistant mounting screws are to be used shall be placed in the client file for each dwelling covered by the request.

7. HARD-WIRED SMOKE ALARMS

- **All Units**
  - Hard-wired smoke alarms shall only be installed when:
    - Required by the local jurisdiction, or
    - Replacing existing hard-wired smoke alarms.
  - Installation and wiring shall be in conformance with manufacturer's instructions and local code.
    - When required by the local jurisdiction, a hardwired alarm shall be installed by a licensed and certified electrician.
  - Circuit powering the alarm(s) shall be:
    - 24-hour, 120V AC 60 Hz.
    - Not controlled by a switch, dimmer, ground fault circuit interrupter (GFCI), or arc fault circuit interrupter (AFCI).
  - Alarm shall be mounted over a standard wiring junction box.
- **Interconnected Alarms**
  - If more than one hard-wired alarm is installed, they shall be interconnected, if required by code.
  - If multiple hard-wired smoke alarms are present and interconnected, and at least one within the group shall be replaced:
    - The replacement alarm shall be compatible with the existing interconnection system, or
    - All of the interconnected smoke alarms shall be replaced, when required by the local jurisdiction (condition shall be documented in the permanent file).



PART 2: MOBILE HOME CRITERIA

8. CEILINGS WITH INADEQUATE INSULATION

- **Older Mobile Homes**
  - Smoke alarms shall be installed on *interior* walls, instead of the ceiling, as prescribed in Item 5.
  - Alarms shall not be installed on *outside* walls.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

9. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

10. OPERATIONAL CHECK

- **Alarm Test**
  - Alarms shall be tested after installation.
    - Alarm sound shall be muffled during the testing process.
  - Alarm shall function properly in accordance with manufacturer's specifications.

11. CLIENT EDUCATION

- **Both verbal and written instructions shall be provided regarding:**
  - Maintenance of the alarm (e.g., periodic cleaning, protection from being painted, etc.).
  - Testing of the alarm.
  - Response to an activated alarm.
  - Response to failure signal (how to request replacement of the alarm or battery should failure occur during the warranty period).

12. DISPOSAL REQUIREMENTS

- **All Alarms**
  - When disposing of your old alarm, remove or deactivate the batteries and recycle the alarm and batteries appropriately.
  - Contact the local waste management company to determine requirements for the recycling of batteries and the alarm in the local area.

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NOTES

DUCT SYSTEM REPAIR AND SEALING

Lead Paint Risk Factor
NONE

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DUCT SYSTEM REPAIR AND SEALING

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

1. DUCT SYSTEM SEALING—ALL HOMES

- **General Requirements**
  - All material selection, surface preparation, and material installation shall comply with these CSD standards, all manufacturer's instructions, and local codes, with the more stringent requirements taking precedence.

> ⚠ **Remember:** Sealing of catastrophic duct leakage is required *before* any duct leakage testing and duct sealing work is performed by Assessors or Crews (1st Priority).

PART 1, TASK 1: DUCT INSTALLATION/INSTALLATION TO RESOLVE CATASTROPHIC LEAKAGE

2. ALL DUCTWORK INSTALLATIONS

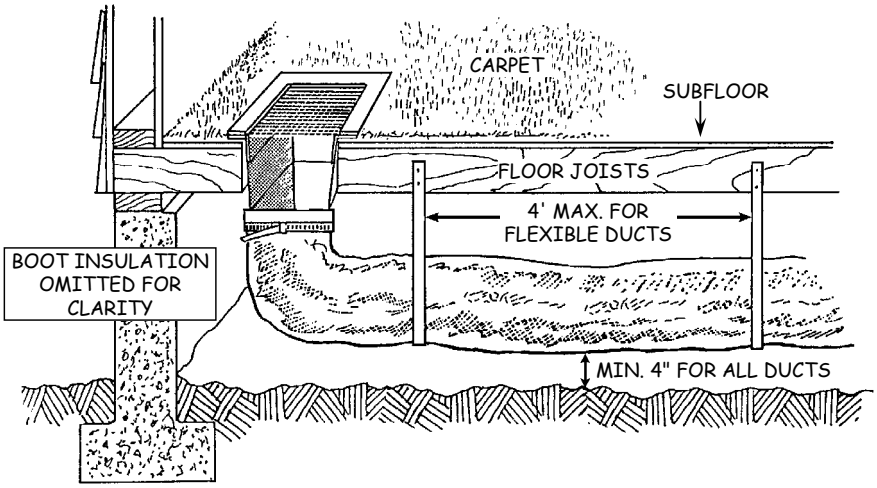
- **Materials, surface preparation, and duct installation shall comply with the CSD WIS and Field Guide, manufacturer's instructions, and local codes, with the most stringent requirements taking precedence.**
  - New ducts shall be:
    - Installed with at least 4" of separation from earth.
    - Protected from physical damage.
    - Installed in locations not exposed to the weather, *unless* designed for exterior use.
    - Supported as prescribed in Items 6-9.
  - Ducts installed within a closet or room shall be enclosed within a cavity constructed of materials equivalent to those used in construction of the closet/room.
  - A building cavity shall not be used as a duct without a sealed duct board or metal liner.
  - Existing platform returns shall be sealed.

3. DUCT PREPARATION

- **Special Conditions**
  - When unfeasible to add a damper to separate a FAU and evaporative cooler that share a duct system, duct sealing shall be limited to correcting catastrophic leakage and sealing the plenum. Vent covers (interior) shall not be a feasible measure.
- **Installation Surfaces**
  - Duct surfaces shall be cleaned prior to application of tapes and sealants, and
  - Free of dust, dirt, oil, grease, moisture and similar substances.

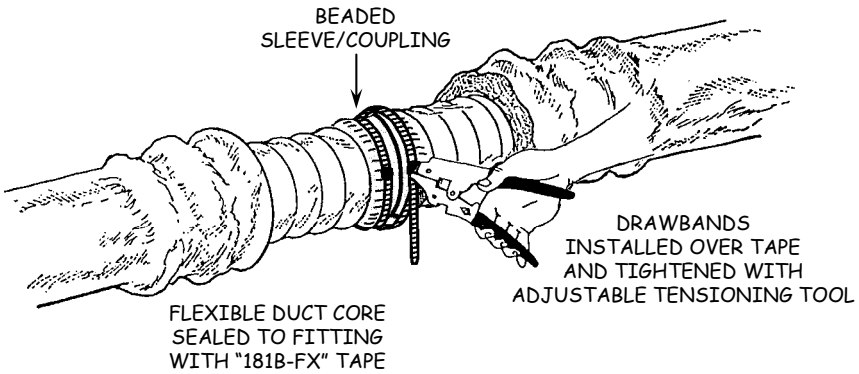
4. AIR HANDLER OPERATION

- **Forced Air Unit**
  - Air handler shall be off during the application of all tapes and sealants, and
  - Remain off for the drying time specified by sealant manufacturer.



5. DRAWBAND INSTALLATION FOR NEW DUCTS

- **Install drawbands to secure flexible non-metallic ducts:**
  - In accordance with manufacturer's instructions.
  - Behind the bead when the fitting is beaded.
  - Tightened appropriately with an adjustable tensioning tool.
  - With the excess (tail) removed.
  - Stainless steel worm-drive clamps are also acceptable for use.

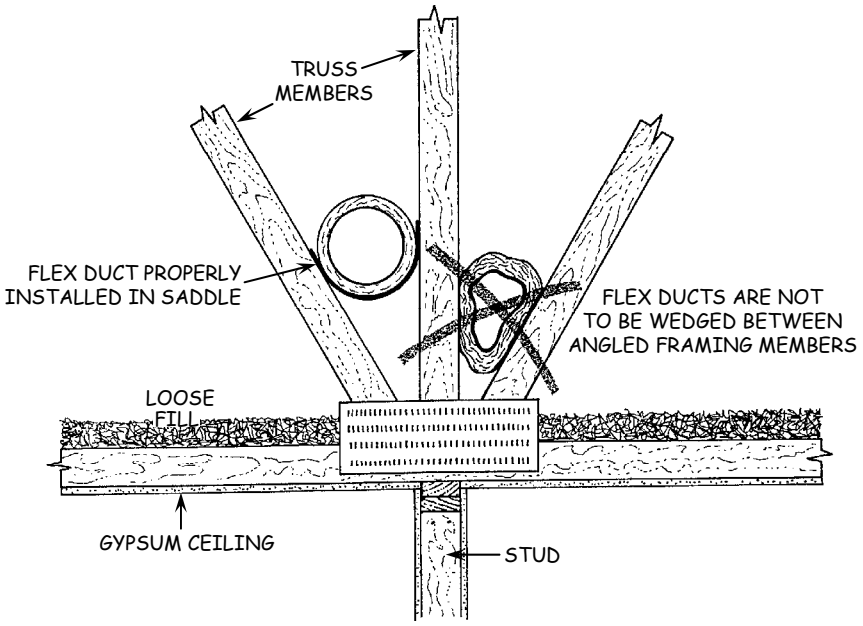


6. DUCT SUPPORTS FOR NEW DUCTS

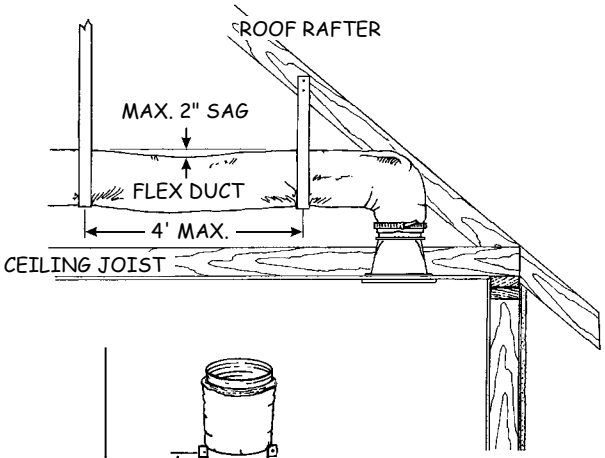
- **All new ducts shall be installed with supports that:**
  - Comply with support manufacturer's instructions.

7. SUPPORT OF FLEXIBLE DUCTS

- **Straps and other means of support shall not constrict the duct below its rated internal diameter.**
  - Non-Metallic Support Straps:
    - Shall be acceptable when allowed by the local jurisdiction.
    - At each end, at least 2" shall be folded over and secured by two or more anchors that penetrate both layers of strap material.
    - Support material shall be no smaller than 1 1/2" wide.
  - Duct may rest on ceiling joists or truss members, if:
    - Support spacing and sag limitations are met.
    - Duct is not wedged between truss members.
  - Termination devices (e.g., register boots) shall be properly secured and shall not rely upon duct for support.

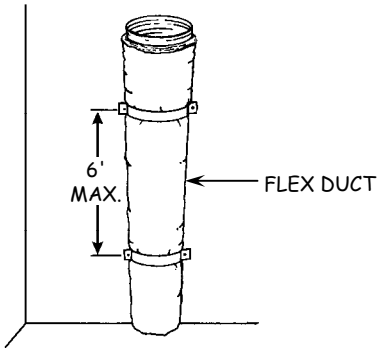


- **Horizontal Flexible Ducts**
  - Spacing between supports shall be 4' maximum.
  - Sag shall be no more than:
    - 1/2" per foot of distance between supports.
    - 2" total between supports.
- **Vertical Flexible Ducts**
  - Spacing between supports shall be 6' maximum.



8. SUPPORTS FOR RIGID DUCT

- **Rigid Round Metal Ducts**
  - Horizontal Installations
    - Spacing between supports shall be 10' maximum.
    - Support shall tightly encircle the duct.
  - Vertical Installations
    - Spacing between supports shall be 12' maximum.
- **Rigid Rectangular Metal Ducts**
  - Horizontal Installations
    - Spacing between supports shall be 10' maximum.
    - Support straps shall be secured to sides of duct with sheet metal screws, rivets or bolts.
  - Vertical Installations

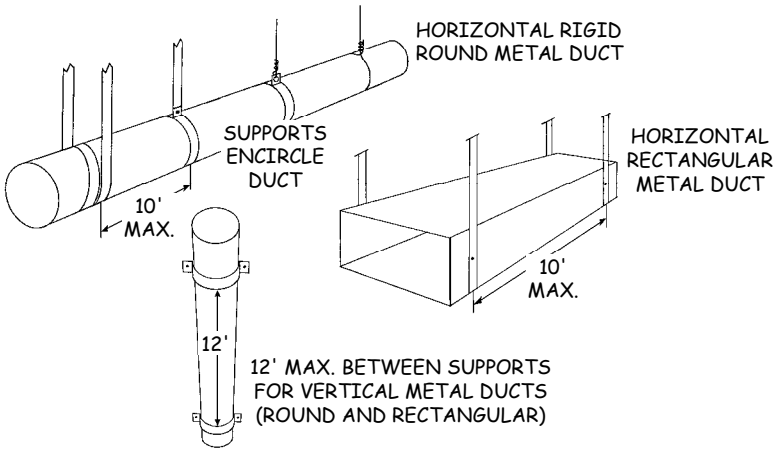


- Spacing between supports shall be 12' maximum.

- **Rigid Fiberglass Ducts**
  - Ducts shall be supported and reinforced in conformance with the CMC and local code.

9. PLENUM SUPPORTS

- **Horizontal Plenums (Metal and Fiberglass Duct Board)**
  - Shall not rely on furnace for support.
  - Shall be independently supported at each end, and intermediately if over 10' in length by 1/2" or wider 18-gage strapping or 12 gage or thicker galvanized wire.
  - Duct board ducts and plenums shall be supported every 4' with a minimum 1 1/2" wide supports.



PART 1, TASK 2: REPAIR AND SEALING OF EXISTING DUCTS BY METHOD

10. DUCT SEALING METHODS

- **Methods**
  - Crews shall install all sealants in accordance with manufacturer specifications and building codes. A complete, continuous durable seal shall be achieved. Standard methods for duct sealing are described in Table 6-1.

Table 6-1: DUCT SEALING METHODS FOR CONVENTIONAL HOMES

ALL DUCTS AND SEALING MATERIALS	Shall be in compliance with CSD WIS Appendix A (Material Specifications) for Conventional Homes.
PRESSURE-SENSITIVE TAPE	Tape is the most common material, and is allowed for gaps 1/4" or smaller for all duct types. Pressure sensitive tapes shall be marked in conformance with: • UL 181B for flexible metallic and non-metallic ducts. • UL 181A or 181B for rigid metal ducts and components. • *Exception*: Butyl tape without UL 181 markings may be used to seal rigid metal-to-metal connections only.
MASTIC	The 2nd most common material, mastic is a textured, spreadable, paste-like substance that is used to seal holes, gaps, or jacket repairs *up to*: • 1/4" for all duct types, and • 1" when used with mesh for rigid metal and fiberglass ducts only. Note: Mastic is never intended to hold ducts together. Hold ducts together with mechanical fasteners (#8 screws, drawbands, etc.). Mastic shall be labeled in conformance with: • UL 181B for flexible metallic and non-metallic ducts. • UL 181A or 181B for rigid metal ducts and components.
FIBERGLASS MESH	Fiberglass mesh is used to reinforce mastic for gaps up to 1" for rigid metal and fiberglass

	ducts. It is embedded in layers of mastic.
FIBERGLASS DUCT LINER	For gaps larger than 1", this material is used to seal rigid fiberglass duct only, and is sealed with mastic or metallic tape.
DRAWBANDS	Drawbands are installed using a special tensioning tool, and are used to secure flexible non-metallic ducts. For oval flexible duct to metal connections, drawbands cannot be used; use appropriate mechanical fasteners.
SHEET METAL PATCHES	Sheet metal patches are made of the same weight material as the existing ducts, and are used for gaps larger than 1" in rigid metal and rigid fiberglass ducts only. To secure the patches #8 sheet metal screws are required.
PVC CEMENT	PVC-to-PVC materials shall be fastened with manufacturer approved PVC cement.
CLINCH STAPLER	Duct board to duct board joints shall be fastened with a clinch stapler.
DUCT BOARD	Connect duct board plenum to air handler cabinet with a termination bar or metal strip fastened with screws. Duct board shall be installed between the screw and the termination bar.

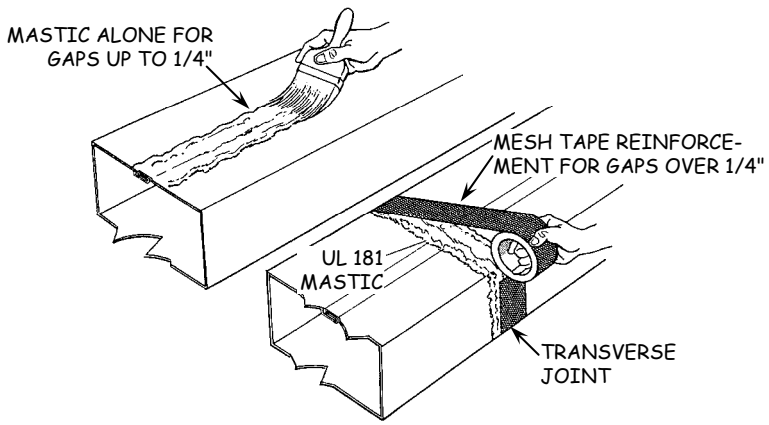
11. GAP SIZE AND SEALING MATERIALS

- **Select sealing materials shall be in conformance with Table 6-2.**

Table 6-2: GAP SIZE AND APPROVED SEALING MATERIALS

GAP SIZE	FLEXIBLE METALLIC & NON-METALLIC DUCT		RIGID METAL & FIBERGLASS DUCT	
	Sealing with MASTIC	Sealing with TAPE	Sealing with MASTIC	Sealing with TAPE
≤ 1/4"	Mastic only.	Tape only.	Mastic only.	Tape only.
> 1/4" - < 1"	Replace duct or fitting with proper size	Replace duct or fitting with proper size	Mastic & mesh	Mastic over tape
1" OR MORE			Sheet metal patch or sleeve & mastic	Sheet metal patch or sleeve & tape

- **Externally-Applied Closure Systems**
  - Sealing materials shall:
    - Be centered over the joint or gap, and
    - Extend at least 1" onto each of the two joined/sealed surfaces.



12. SEALING WITH MASTIC

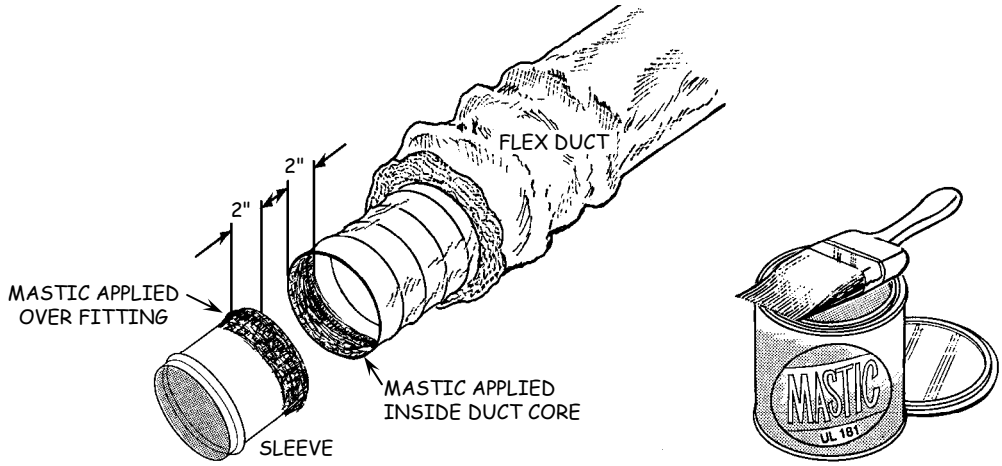
- **Mastic Use by Gap Size**
  - Install mastic in conformance with Table 6-3.
  - Install per manufacturer's instructions for:
    - Surface preparation/cleaning.
    - Temperature and moisture limitations.
    - Thickness and set-up time.

Table 6-3: SEALING WITH MASTIC

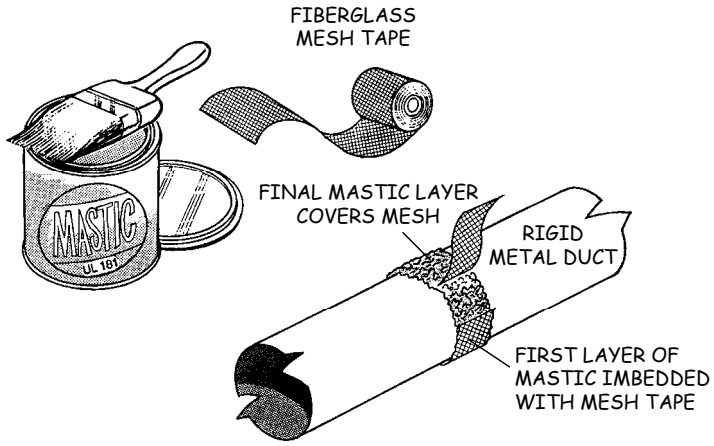
DUCT TYPE	GAPS LESS THAN 1/4"	GAPS 1/4" TO < 1"	GAPS LARGER THAN 1"
GENERAL INSTRUCTIONS	Seal according to duct type, below.		
FLEXIBLE NON-METALLIC DUCT	Mastic used to seal core-to-fitting connections shall be: • Internally placed between the core and the fitting (best practice); or • Externally applied over the duct core and rigid fitting	When a gap greater than 1/4" exists between the duct core and the fitting (starting collar, coupling, elbow, wye, etc.), duct and/or fitting must be replaced with the proper size.	
FLEXIBLE METALLIC DUCT			
RIGID METAL DUCT & COMPONENTS	Mastic only.	Mastic with fiberglass mesh tape.	Install sheet metal patch per Item 14.

12. SEALING WITH MASTIC (cont.)

- **Internally-Placed Mastic (Core-to-Fitting Joints)**
  - Only mastic may be applied either:
    - Inside the duct core, or
    - Onto the rigid component over which the core is attached.
  - Mastic coating shall be at least 1/8" thick and 2" wide.



- **Mastic Reinforced with Fiberglass Mesh Tape**
  - Embed mesh fabric between two layers of duct mastic to form a mastic closure system.
    - The first layer of mastic shall:
      - Be centered over the joint or gap to be sealed.
      - Extend at least 1" onto each of the joined surfaces.
      - Extend beyond the width of the mesh.
    - The mesh fabric shall be:
      - Embedded in the mastic.
      - Applied at least one layer thick over the entire joint or gap.
      - Wrapped around the entire circumference on transverse joints (e.g., where two sections of duct are joined together).



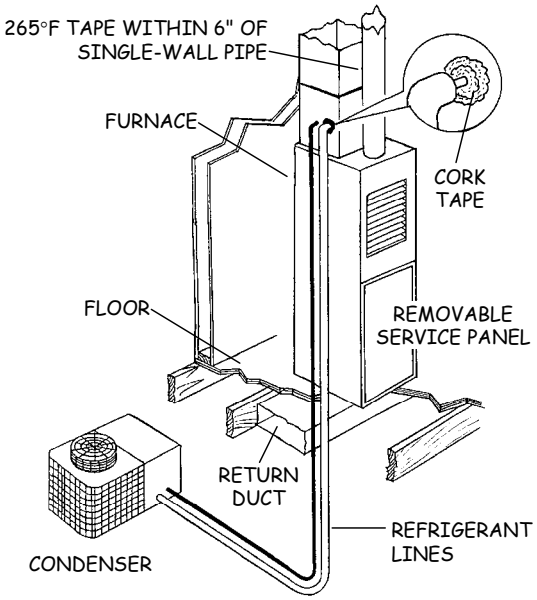
- A second layer of mastic shall be installed over the mesh, filling the scrim pattern completely and covering the mesh.

13. SEALING WITH PRESSURE SENSITIVE TAPE

- **Pressure Sensitive Tape Use by Gap Size**
  - Install tapes in conformance with Table 6-4.
  - Install per manufacturer's instructions for:
    - Surface preparation/cleaning.
    - Application of pressure/rubbing.
    - Temperature and moisture limitations.

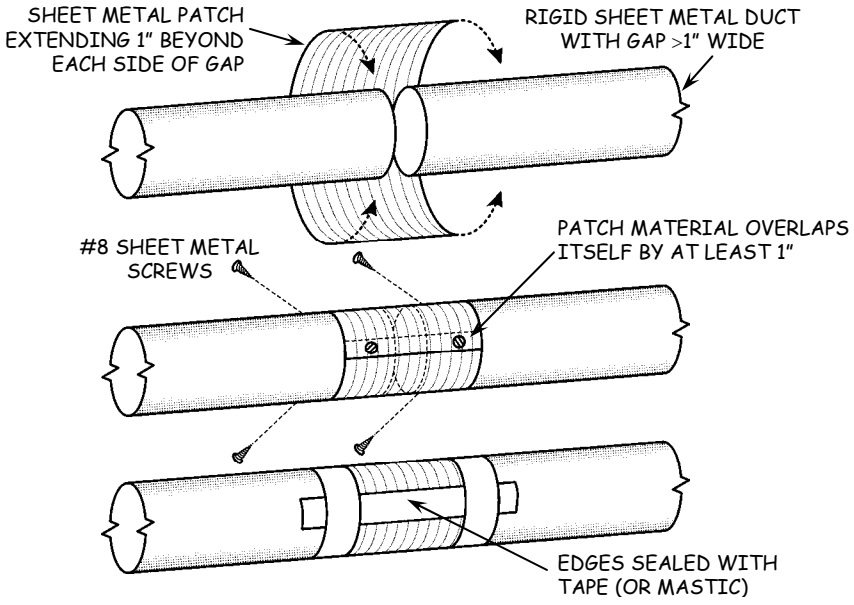
Table 6-4: SEALING WITH PRESSURE-SENSITIVE TAPE

GENERAL INSTRUCTIONS	Seal according to duct type, below. • Overlap tape wrapping by 50-75% of tape width for each successive wrap. • At least 3 wraps of tape shall be applied when sealing: – Transverse joints at splices/connections in round or rectangular metal ducts. – Flexible duct core-to-fitting attachments (with a drawband also installed to secure the core). – Jacket (vapor barrier) splices on flexible ducts.
DUCT TYPES	
FLEXIBLE NON-METALLIC DUCT	• Tape-only is allowed only for gaps less than 1/4". • Tapes shall have markings that include "181B-FX", and be minimum 2" wide. • Cloth-back butyl-adhesive tapes are allowed if CEC-approved for use in California (e.g., indicated by "CA" in the product number).
FLEXIBLE METALLIC DUCT	• Tape-only is allowed only for gaps less than 1/4". • Tapes shall have markings that include "181B-FX", and be minimum 2" wide. • Cloth-back butyl-adhesive tapes are allowed if CEC-approved for use in California (e.g., indicated by "CA" in the product number).
RIGID METAL DUCT & COMPONENTS	• Tape-only is allowed only for gaps less than 1/4". • Tape must be covered by mastic for gaps 1/4" to < 1". • A sheet metal patch or sleeve with tape is required for gaps larger than 1". • Metallic tapes shall be marked "181A-P" or "181B-FX", and be minimum 2" wide. – *Exception*: "Butyl tape" without "181A-P" or "181B-FX" markings may be used to seal rigid metal-to-metal connections.
RIGID FIBERGLASS DUCT	• Tape-only is allowed only for gaps less than 1/4". • Tape must be covered by mastic for gaps 1/4" to < 1". • A sheet metal patch or sleeve with tape is required for gaps larger than 1". • Metallic tapes shall be marked "181A-P", and be minimum 2-1/2" wide.
SEALING ADDITIONAL AREAS WITH PRESSURE-SENSITIVE TAPE	
HIGH TEMPERATURE LOCATIONS	• Use metallic pressure sensitive tape with a service temperature rating of at least 265°F when sealing: – Within 1" of a double-wall gas flue/vent pipe. – Within 6" of a single-wall gas flue/vent pipe.
SEALING REMOVABLE SERVICE (ACCESS) PANELS	• If a pre-manufactured or site manufactured durable filter slot cover cannot be installed, use UL 181A or 181B metallic pressure sensitive tape with non-butyl (e.g., acrylic) adhesive shall be used to seal service panels, filter access covers, etc.
SEALING REFRIGERANT LINES	• Cork tape shall be used for sealing gaps where refrigerant lines penetrate the coil box/plenum.



14. SEALING WITH SHEET METAL PATCHES

- **Sheet Metal**
  - Patch material shall match the existing duct material (i.e., galvanized patch for galvanized duct, or aluminum patch for aluminum duct).
  - Gage of the patch shall equal or exceed gage of the existing duct.
- **Installation**
  - Patch material shall:
    - Extend at least 1" beyond each edge of the gap, and
    - Overlap itself by at least 1".
  - The patch shall be wrapped tightly around the duct and secured with #8 sheet metal screws.
    - Where the patch overlaps itself, at least 1 screw shall be installed on each side of the gap.
    - At least 2 more screws shall be evenly-spaced around the duct on each side of the gap.



15. CONNECTION OF DUCT BOARD TO FLEXIBLE DUCTS

- **Sealing Methods**
  - Metal take-off collar specifically designed for the thickness of the duct board shall be used.
  - All finger tabs shall be bent down securely.
  - Finger tabs will be longer than the thickness of the duct board and the shank shall not extend beyond the thickness of the duct board.
  - There must be an internal metal backer inside the duct board through which three evenly spaced screws can be secured. The metal backer shall not interfere with airflow.

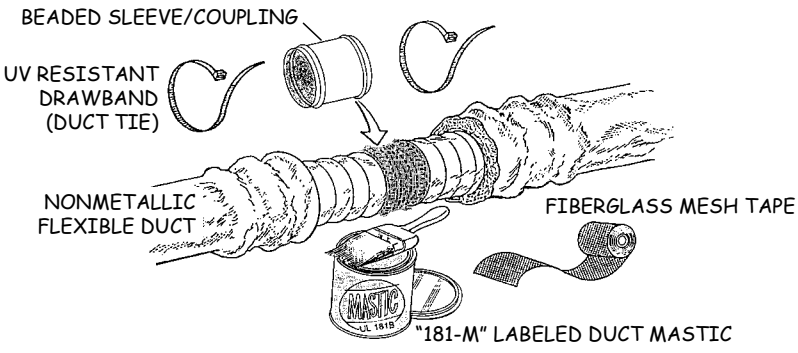
16. SEALING AT AIR HANDLER

- **Standard Sealing**
  - Joints shall be closed.
    - Cracks and holes not needed for proper function of unit shall be sealed using removable sealant (e.g., foil tape) or in accordance with the original equipment manufacturer directions (if available).
- **Sealing of Duct Board Plenum to Air Handler Cabinet**
  - Flange/c-channel shall be fastened with screws with the duct board installed between C-channel flanges.
  - Duct board plenum shall be connected to air handler plenum with flexible duct in upflow units.

PART 1, TASK 3: REPAIR AND SEALING OF EXISTING DUCTS BY DUCT TYPE

17. FLEXIBLE NON-METALLIC DUCTS (REPAIR AND SEALING)

- **Beaded Fittings—Mastic Sealants**
  - Apply a uniform coat of mastic to the outside of the fitting.
  - Pull at least 2" of duct core onto the fitting, with at least 1" extending past the bead.
  - Install a drawband (or metal clamp) behind the bead.
  - Apply mastic externally as needed to ensure a complete seal.
- **Beaded Fittings—Pressure Sensitive Tapes**
  - Pull at least 2" of duct core onto the fitting, with at least 1" extending past the bead.
    - Fitting must provide additional 1" surface beyond duct core for application of tape.
  - Install a drawband (or metal clamp) behind the bead.

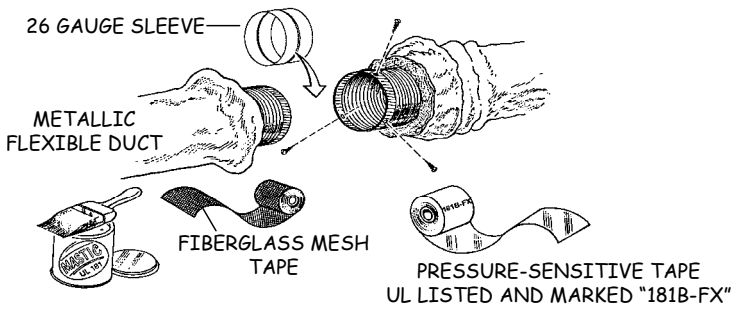


  - Seal the connection with at least 3 staggered wraps of tape applied uniformly over both the core and the fitting.
- **Non-Beaded Pre-Existing Fittings—All Sealants**
  - Secure the duct core to the fitting with internally-placed mastic and a drawband, or
  - Secure the duct core's wire coil to the fitting with evenly-spaced #8 sheet metal screws that capture the wire.
    - Screws must penetrate "181B-FX" pressure sensitive tape applied over the duct core to protect it from tearing.
    - 3 screws for diameters up to 12";
    - 5 screws for diameters over 12".
  - The connection is sealed with duct mastic or 3 staggered wraps of pressure sensitive tape.
- **Core Repairs**

- Repair holes/damage in the duct core by removal of the damaged section and insertion of a sleeve/coupling.

18. FLEXIBLE METALLIC DUCTS (REPAIR AND SEALING)

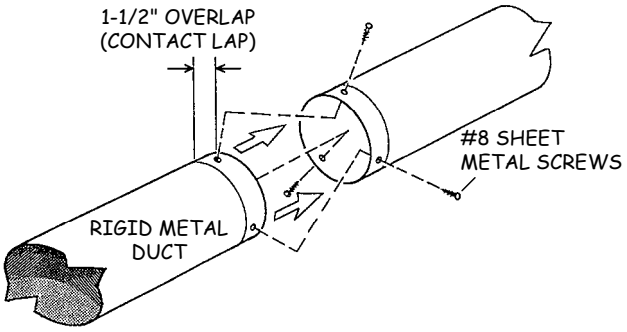
- **Factory-Installed Sleeve Present**
  - Crimp joints shall overlap at least 1-1/2" (e.g., connection of duct to fitting, or two sections of duct).
- **Factory-Installed Sleeve Not Present**
  - Trim the end of the core squarely, insert a minimum 26-gauge metal sleeve/fitting between the two trimmed ends, and then secure and seal as described below.
  - Seal with Mastic
    - Apply a uniform coat of mastic to outside of the fitting.
    - Pull at least 1" of the duct core over the fitting and secure with screws.
    - Apply mastic externally as needed to ensure a complete seal.
  - Seal with Pressure Sensitive Tape
    - Pull at least 1" of duct core over the fitting and secure with screws.
    - The fitting must provide an additional 1" surface beyond duct core.
    - Seal the connection with at least 3 staggered wraps of tape applied uniformly over both the core and the fitting.
  - Installation of Screws
    - Secure the core to the fitting with #8 sheet metal screws positioned at least 1/2" from the end of the core.
    - Screws shall be equally spaced.
      - 3 screws for duct diameters under 12".
      - 5 screws for diameters 12" and over.
- **Core Repairs**
  - Repair holes/damage in the duct core by removing the damaged section and inserting a sleeve/coupling.



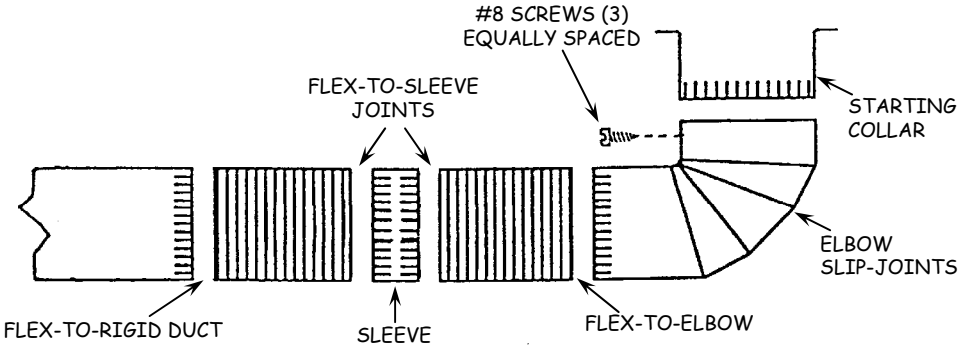
19. RIGID METAL DUCTS (REPAIR AND SEALING)

- **Rigid Metal Connection Contact Lap**
  - Overlap crimp joints at least 1-1/2" (e.g., connection of duct to fitting, or two sections of duct).
- **All Fittings**
  - Fittings shall be beaded at each core connection (e.g., both ends of a sleeve) when flexible non-metallic ducts are attached.
  - *Exception*: When a pre-existing fitting is not beaded, the core's wire coil shall be secured to the fitting as prescribed.
- **Mechanical Fasteners**
  - Secure rigid metal duct connections with equally-spaced #8 sheet metal screws.
  - Round Ducts
    - 3 screws on diameters up to 14".
    - 4 screws on diameters 15" to 19".
    - 5 screws on diameters 20" to 24".
  - Rectangular Ducts: At least 1 screw per side.
  - Lapped Seams (field-fabricated metal plenums, etc.)
    - Overlapped surfaces shall be:

- In substantial contact with each other along the entire seam.
- Fasten securely together (e.g., with #8 sheet metal screws at intervals of 12" or *less*).



- **All Connections**
  - Mastic and fiberglass mesh tape shall be installed per Item 12.
  - Metallic pressure sensitive tapes shall be installed per Item 13.
  - Sheet metal patches shall be installed per Item 14.



- TAPE OR MASTIC ON GAPS LESS THAN 1/4"
- MASTIC & MESH, OR METALLIC TAPE COVERED BY MASTIC, ON GAPS 1/4" UP TO 1"

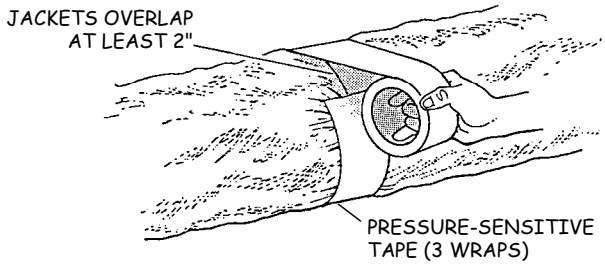
PART 1, TASK 4: ADDITIONAL SEALING AREAS

20. FLEXIBLE DUCT INSULATION AND JACKET (VAPOR BARRIER) SEALING

- **Surrounding Insulation**
  - Surrounding insulation shall be cleared to expose joints being sealed.
  - If intact, material may be reused.
- **Insulation shall completely cover a flexible duct's core and fitting.**
  - Pull the jacket back over the insulation after duct sealing is completed.
    - The jackets shall overlap at least 2" at splices.
    - Secure jacket with a drawband and/or 3 staggered wraps of pressure sensitive tape.

21. JACKET (VAPOR BARRIER) REPAIRS

- **Repair to Jacket**
  - Repair rips and holes in the vapor barrier with pressure sensitive tape or with mastic and mesh tape.
  - For ducts with an *air-permeable* core: Overlap the jackets at least 2" at splices.



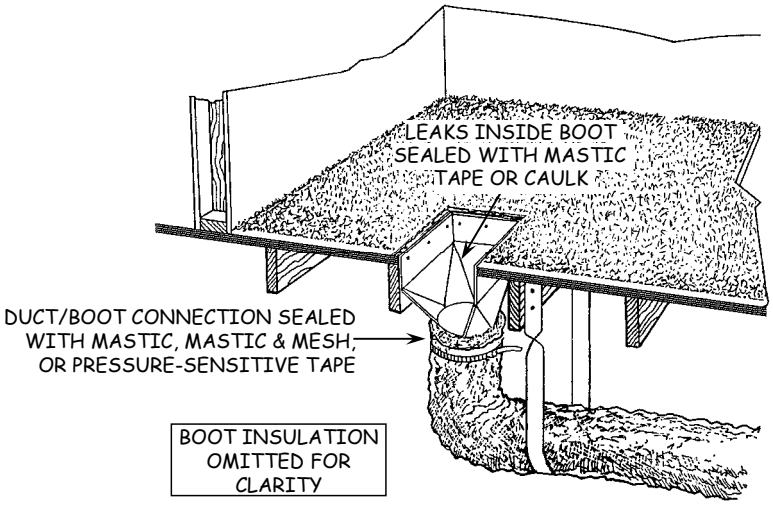
Secure and seal the ends with:

- 3 staggered wraps of minimum 2" pressure sensitive tape, or
- Apply mastic between the jackets and secure with a drawband.

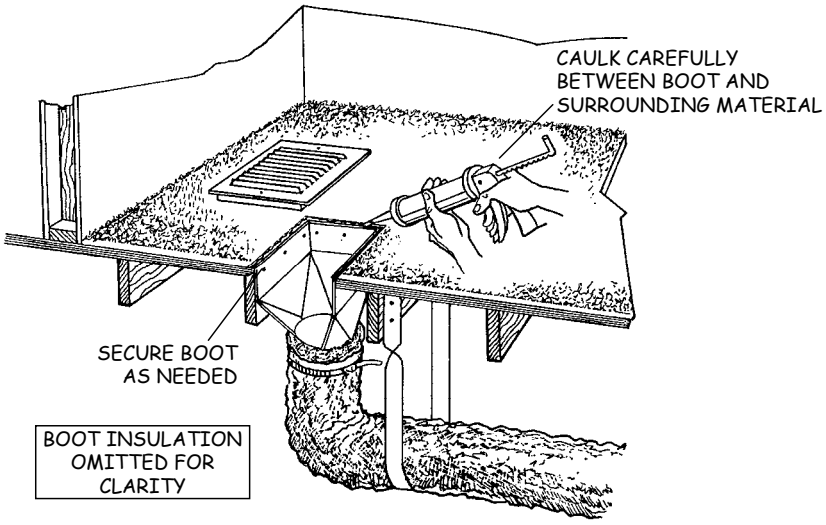
- Seal breaches in the outer vapor barrier with pressure sensitive tape, or mastic and mesh.

22. REGISTER BOOTS

- **Boot-to-Duct Connection**
  - Proper boot-to-duct sealing shall be performed in compliance with the duct type listed in Items 17 through 19.
  - Integral snap boots shall be installed.
- **Leaks in the Boot**
  - Gaps shall be sealed in accordance with Table 6-2 with the following *exceptions*:
    - Gaps up to 3/8" may be sealed with elastomeric caulk.
    - Gaps 1" or wider shall be repaired with sheet metal and #8 screws, and sealed with tape or mastic.



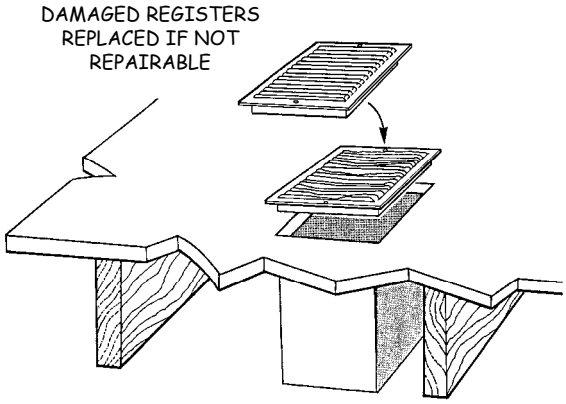
- **Boot-to-Floor/Wall/Ceiling Connection**
  - Boot shall be mechanically secured to the structure and shall not rely on the duct for support or stability.
  - Gaps between boot and surrounding material shall be sealed with one of the following:
    - Elastomeric caulk (gaps up to 3/8").
    - Elastomeric caulk supported by backer rod (gaps 7/16" to 5/8").
    - Duct mastic or metallic pressure sensitive tape (gaps up to 1/4").
    - Duct mastic reinforced with fiberglass mesh, or metallic tape covered with mastic (gaps over 1/4" and up to <1").
    - Gypsum edge shall be wetted before applying water-based sealant.



- **Unhindered Register Removal/Replacement**
  - Sealants applied to the boot shall not interfere with the removal and replacement of the register.
  - Exposed sealant may be covered with metallic pressure sensitive tape to prevent adhesion to the register.

23. REGISTER GRILLES

- **Repair and Replacement**
  - Damaged registers which do not allow proper airflow shall be repaired or replaced.
  - Dampers shall function properly.
  - Dampers which will not open or stay open shall be removed if register replacement is not feasible.
- **Removal and Reinstallation**
  - Boot sealing shall not cause any register to be difficult to remove or reinstall.



24. SEALING BUILDING CAVITIES

- **Building cavities being used as ducts (e.g., platform return, panned joists, building cavity/chase, cabinet toe-kick supply terminal, etc.) shall be sealed everywhere that is accessible.**
  - Remove all dirt and debris before sealing.
  - Seal accessible leaks in accordance with Table 6-2.
  - Acceptable liner materials shall be sheet metal, plywood, and fiberglass duct board.
    - Liner made of foam board, foam sealants, and gypsum wallboard shall not be allowed.
  - Acceptable sealants shall include:
    - Duct mastic alone for gaps up to 1/4".
    - Duct mastic plus fiberglass mesh tape or metallic tape covered with mastic for gaps larger than 1/4" and up to 1".)
    - Approved caulk (elastomeric sealants) rated for use in returns.
    - Pressure-sensitive tape (for metal and foil surfaces).

25. PLATFORM PLENUM INSULATION

- **Insulation When Accessible by Return Grille Removal**
  - When un-insulated platforms are sealed as in Item 24, they shall also be insulated.
    - Insulate open stud cavities.
    - Do not insulate when liner or metal box/can is present.
  - Insulation requirement may be met by:
    - Filling stud cavities inside the plenum with flexible insulation, when lining/sealing with sheet metal, or
    - Installing fiberglass duct board to both line/seal and insulate the plenum.

26. RETURN PATH IN CONDITIONED SPACE (E.G., “CHASE RETURN”)

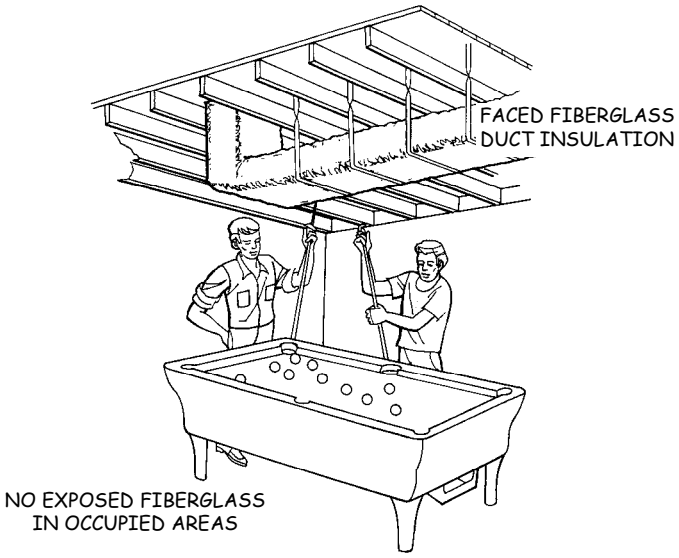
- **Sealing Priorities:**
  - Accessible supply leaks in the attic,
  - Supply register boots, and
  - Accessible leaks to outside in the chase/cavity used for return path.
- **Alternative Method for Chase**
  - Installation of a return duct through the cavity, when possible.

27. DUCT INSULATION

- **All Ducts**
  - Insulation removed for duct sealing and repair shall be reinstalled or replaced.
  - New insulation shall be installed in conformance with CSD WIS Section 19 (Duct Insulation).

28. EXPOSED DUCTS

- **Ducts Located in an Exposed Area**
  - New ducts located outdoors or in areas not protected from the elements (e.g., under floors without foundation walls) shall be rigid metal.
  - Ducts shall be insulated with materials intended for exterior applications and installed per manufacturer's instructions and local code.
- **Ducts Located in Area Subject to Human Contact**
  - New ducts in an area subject to human contact shall be rigid metal.
  - When fiberglass insulation is installed to cover the rigid metal duct, it shall be faced.
    - It is not required to wrap existing fiberglass insulation that is exposed.
  - Fiberglass edges shall <u>not</u> be left exposed in the living space.



<u>PART 2: MOBILE HOME CRITERIA</u>

29. INSTALLATION METHODS FOR <u>NEW</u> MOBILE HOME DUCTS

- **Mobile home duct materials shall meet the specifications in Table 6-5 when installing <u>new</u> ducts to correct catastrophic duct leakage:**

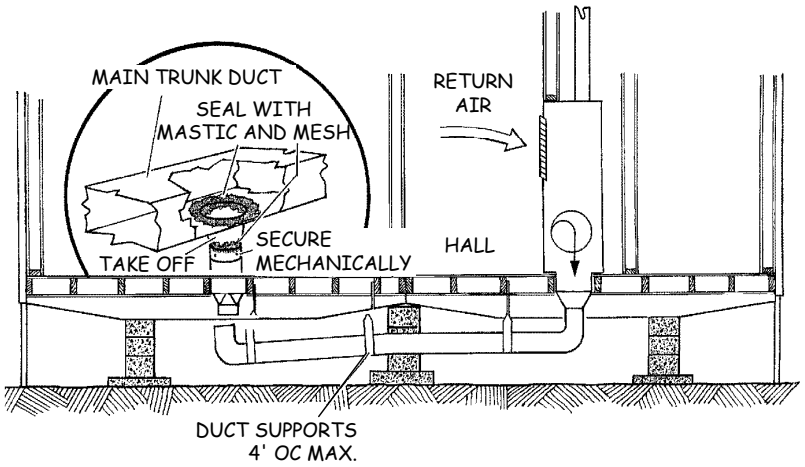
Table 6-5: MOBILE HOME DUCT SEALING METHODS FOR MOBILE HOMES

DUCT TYPE	DUCT SPECIFICATIONS
ALL DUCTS AND SEALING MATERIALS	Sealing materials shall be in compliance with CSD WIS Appendix A (Material Specifications) for Mobile Homes.
FLEXIBLE DUCT	In crawlspaces <u>not</u> accessible to animals, flexible ducts may be used to: • Replace damaged or deteriorated flexible ducts (e.g., crossover ducts). • Install a new ducted return system.
RIGID METAL	Where crawlspaces are accessible to animals, only internally-insulated rigid metal duct shall be used.

30. DUCT SUPPORT AND PROTECTION FOR <u>NEW</u> MOBILE HOME DUCTS

- **All ducts shall be installed and supported above the ground in conformance with manufacturer's instructions and applicable code.**
  - Flexible
    - Supports shall be spaced <u>no</u> *more* than 4' apart.
    - Maximum sag 1/2" per foot of spacing (total 2") between supports.

- Rigid
  - Shall not flex *more* than 1" between supports.



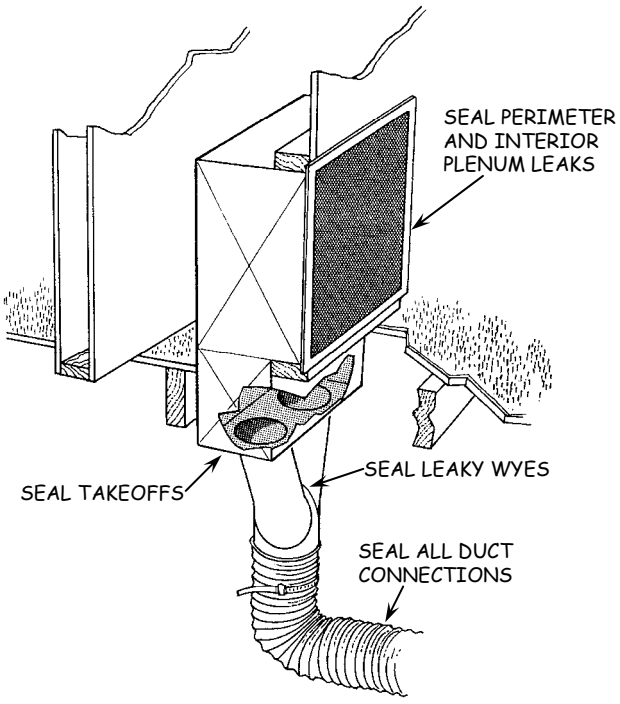
- **Hangers or Saddles**
  - 1-1/2" minimum width for flexible ducts.
- **Protection**
  - Shall be protected from animals.
    - Applies to all flexible ducts and all other ducts with external insulation.
  - Shall not be exposed to the weather.

31. MOBILE HOME SEALING ACTIVITIES

- **The following activities in Items 32 through 44 are arranged from highest to lowest priority.**
- **If an item does not apply to the mobile home being weatherized, the item shall be skipped and the next item becomes the next highest priority.**

32. EXISTING MOBILE HOME DUCTED RETURNS

- **All Accessible Components**
  - All accessible components shall be inspected for decay, damage, and leaks, and shall be repaired as needed in order of highest priority to lowest. Inspection and sealing work shall include:
    - Rodent barrier (bellyboard) sections shall be removed for access as needed.
    - Accessible leaks shall be repaired.
    - Access holes made in the rodent barrier shall be repaired.

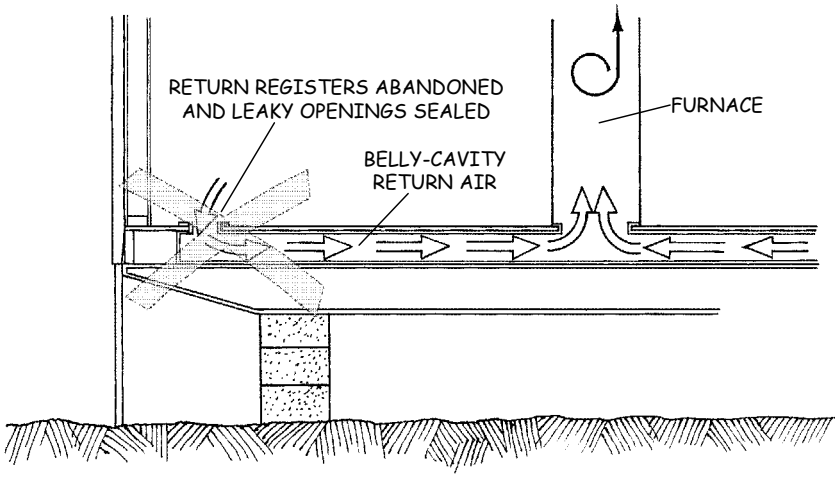


33. UPFLOW FURNACE WITH A BELLY RETURN — WHEN PRESENT

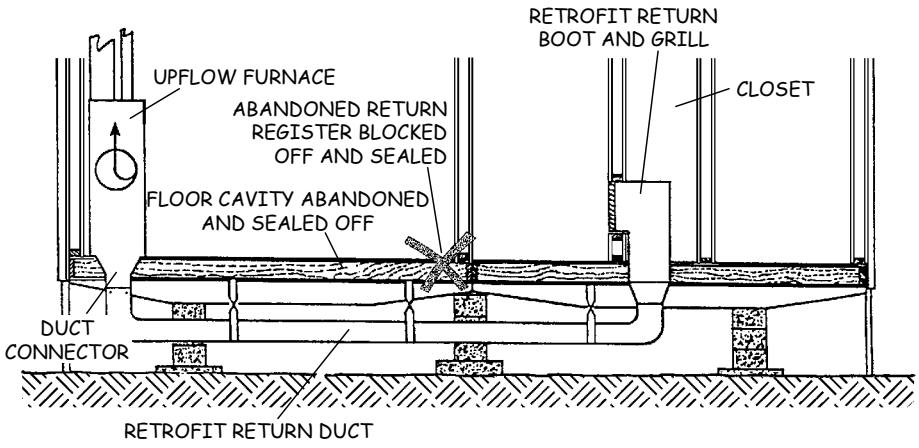
- **When a mobile home has an existing upflow furnace with belly cavity return it is considered catastrophic leakage and shall be corrected before Duct Testing is performed, when feasible.**

33. UPFLOW FURNACE WITH A BELLY RETURN—WHEN PRESENT (cont.)

- A new ducted return shall be installed, supported, and sealed to correct the catastrophic leakage situation.
- The system shall:
  - Be properly sized by a qualified HVAC technician).
  - Provide a balanced air flow throughout the mobile home.
- When a new central return is installed:
  - Abandon the existing belly-cavity return.
  - Abandoned register openings shall be blocked off and permanently sealed.
- Return grille shall be:
  - Sized to provide a minimum of 2 sq. in. of NFVA for each 1,000 Btu/hr furnace input.
  - Installed in the outside wall of a closet when possible, or in the floor when necessary.
  - Located in a hallway or other open area.
  - Centrally-located within the mobile home.



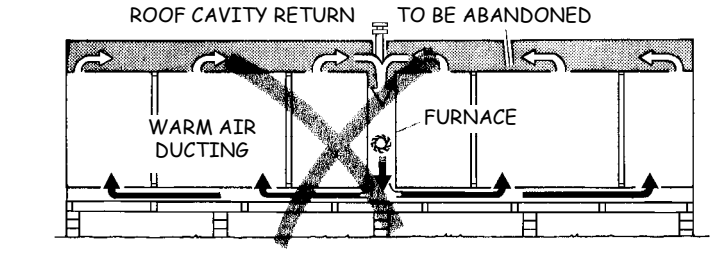
- Proper air flow shall be provided for each room containing a supply register utilizing one of the following methods:
  - An un-closeable grille may be installed in the door or wall which provides a NFVA equal to at least 1 sq. in. for every 5 sq. ft. of total living area in the room.
  - 2" to 2-1/2" may be removed from the door bottom; however, no *more* than half the NFVA so created shall be counted as return air area.
- System balance shall be checked and modifications shall be made as needed to provide proper balance.

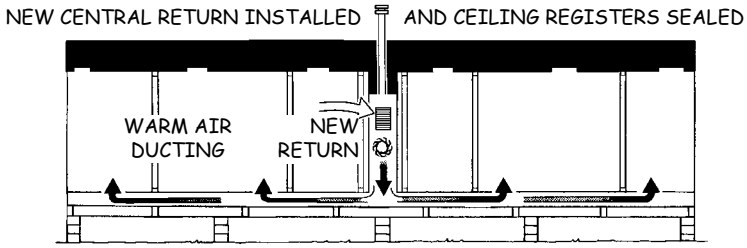


Note: If installation of a central ducted return is not feasible, duct testing is not feasible. Prescriptive duct repair/sealing shall be performed: 1) on accessible portions of the *supply* side first (e.g., visible gaps in the plenum, ductwork, and register boots), and then 2) on the *return* plenum.

34. DOWNFLOW FURNACE WITH BELLY OR ROOF CAVITY RETURN—WHEN PRESENT

- **When a mobile home as an existing downflow furnace with belly/roof cavity return it is considered catastrophic leakage and shall be corrected before Duct Testing is performed, when feasible.**
  - The existing return air path and all abandoned register openings shall be blocked off and permanently sealed.
  - The furnace enclosure and/or cabinet shall be modified to provide a retrofit central return path of adequate size.
    - A return grille shall be installed when appropriate.
    - The grille shall have a minimum 2 sq. in. of NFVA for each 1,000 Btu/hr. furnace input capacity.
  - Proper airflow shall be provided for each room containing a supply register utilizing one of the following methods:
    - An un-closeable grille may be installed in the door or wall which provides a NFVA equal to at least 1 sq. in. for every 5 sq. ft. of total living area in the room.
    - 2" to 2½" may be removed from the door bottom; however, no *more* than half the NFVA so created shall be counted as return air area.
  - System balance shall be checked and modifications shall be made as needed to provide proper balance.

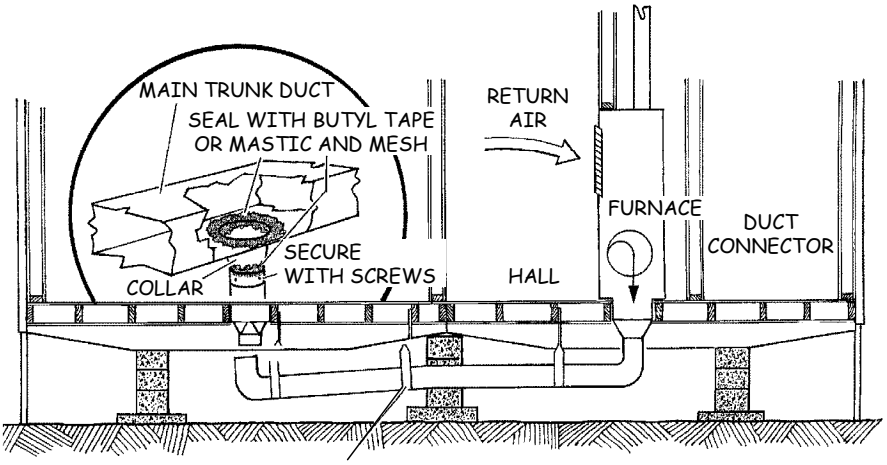




35. CROSSOVER DUCTS — WHEN PRESENT

- **Repairs to Crossover Ducts**
  - Ducts shall be installed, secured, supported, and sealed as prescribed in this section.
  - Disconnections shall be reconnected, mechanically secured, and sealed.
  - Other major leaks that are repairable shall be repaired and sealed.
  - Disconnected and damaged duct components that cannot be feasibly repaired shall be replaced in conformance with CSD WIS Appendix A (Material Specifications).
  - All ducts shall be installed at least 4" above the earth.
  - Whenever possible, rigid elbows or equivalent shall be installed in crawlspace crossover ducts.
  - Floor insulation shall be in contact with the outer liner of the crossover duct.

- Crossover duct vapor retarder shall be sealed to the bottom liner (e.g., belly fabric).
- New flex duct installation shall be insulated to a minimum of R-8.
- When feasible, 26-gage rigid duct shall be installed.
- If a new crossover is required, it shall be insulated to at least R-8 and be air-sealed.



36. THROUGH-THE-RIM CROSSOVER DUCT

- **Crossover Duct**
  - Through-the-rim crossover ducts shall be located and accessed through the bottom liner and branch duct; all branch crossover duct connections and end caps shall be located and accessed.
  - Hole size (air pathway) shall be maximized between branch crossover and trunk.
  - All connections shall be mechanically fastened and sealed inside duct.
  - End caps shall be sealed.
- **Repair Work Access**
  - Access hole in the trunk duct shall be repaired and sealed.
  - Insulation shall be reinstalled.
  - Bottom liner/belly shall be repaired.
  - Access location and holes shall be repaired, when necessary.
  - Access to the attic shall be created for all attic areas that contain crossover ducts, where feasible.
  - Plenum boxes and crossover duct connections shall be rebuilt, mechanically fastened, and sealed.

37. ATTIC CROSSOVER

- **Repair**
  - Access to the attic shall be created for all attic areas that contain crossover ducts, where feasible.
  - Plenum boxes and crossover duct connections shall be rebuilt, mechanically fastened, and sealed.
  - Access holes shall be repaired.

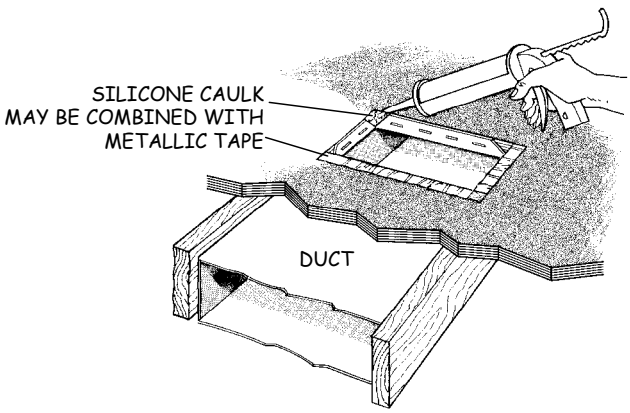
38. SUPPLY PLENUM SEALING IN BOTH UPFLOW AND DOWNFLOW AIR HANDLERS

- **Work Assessment**
  - Installer pre-work assessment shall be conducted to determine:
    - Size of plenum

  - Alignment
  - Connection method
  - Existing sealing
- **Preparation**
  - Debris shall be removed.
  - Surface shall be prepared for work (e.g., remove tape, oil).
  - Floor shall be prepared to receive the appropriately sized plenum.
- **Plenum rebuild or repair**
  - Plenum shall be rebuilt or repaired using compatible materials and must be:
    - Mechanically fastened.
    - Sealed.
    - Durable.
    - Structurally sound.
    - Insulated.
    - Equipped with a vapor retarder, where climate appropriate.
  - If possible, flow diverter or turning vanes shall be installed for air flow and/or balancing (e.g., bullhead Ts, offset air handler).
- **Repair Work Access (Point of Access Options)**
  - Option 1: Through the trunk duct
    - Repair and seal access hole in the trunk duct.
    - Install insulation.
    - Repair belly/bottom liner.
  - Option 2: Remove crossover duct
    - Reattach crossover duct.
    - Seal and insulate crossover duct.
    - Repair belly/bottom liner.
  - Option 3: Remove air handler
    - Install new gasket, if necessary.
    - Mechanically attach furnace to the structure.
    - Reconnect utilities.
    - Replace and seal panels.
  - Option 4: Through the furnace panel
    - Replace and seal panels
- **Safety testing**
  - Equipment will be cycled.
  - Combustion Appliance Zone (CAZ) test will be performed where combustion appliances are utilized.
- **Performance testing**
  - Pre- and post-retrofit duct leakage will be performance tested using a duct blaster or pressure pan, and results will be documented and reported to the homeowner and/or program.

39. REGISTER BOOT/RISER (REPAIR AND SEALING)—ALL DUCTS

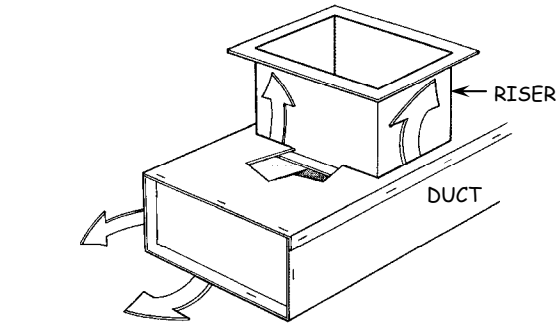
- **Seal boot/riser termination to the floor.**
  - All duct boots and risers that are loose or detached from the floor shall be reattached and mechanically secured (e.g., with screws, staples, or nails).
  - Seal gaps up to 1/4" wide with:



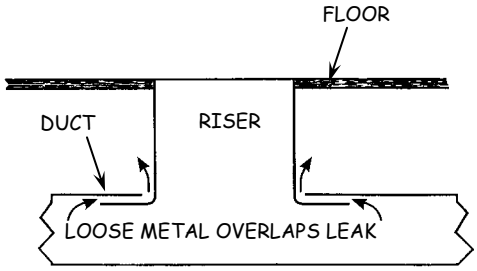
- Elastomeric caulk (e.g., polyurethane or silicone), or
- Duct mastic applied at least 1/8" thick.

- Gaps over 1/4" wide:
  - Seal with butyl tape, or with duct mastic reinforced with mesh tape.
  - Alternative: Elastomeric caulk and pressure-sensitive metallic tape shall be used together where a thinner repair is required.

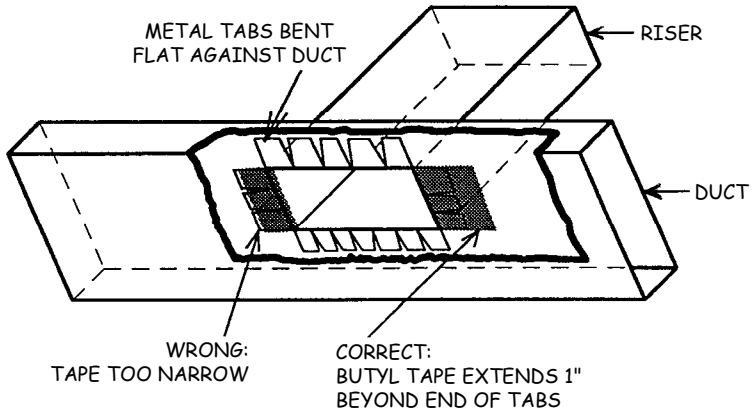
- **Prepare Joint**
  - In addition to the termination, repair and permanently seal metal overlaps/tabs at joint between the riser and trunk duct (e.g., with butyl tape) as shown at right.
  - Bend metal overlaps/tabs as needed to achieve the best possible metal-to-metal contact.
  - Remove dust and dirt to the extent feasible from surfaces to which sealant will be applied (e.g., with vacuum cleaner hose/nozzle, with a brush, or with a damp rag).



LEAKY DUCT TERMINATION
(DEAD END)



- **Apply Sealant**
  - Seal joint overlaps/tabs with:
    - Butyl tape (3" width is best practice), or
    - Duct mastic and embedded fiberglass mesh tape.
  - Cover all tab slits with sealant and extend approximately 1" beyond the ends of the overlaps/tabs.
  - Pre-existing metallic tape:
    - If loose, remove to the extent feasible.
    - If not loose, cover existing with new sealant to achieve a complete, permanent seal.



40. SEALING LEAKS WITHIN REACH

- **Seal accessible leaks that can be reached through the register opening utilizing materials and methods prescribed in the CSD Field Guide. Such leaks may include:**
  - Duct joints/splices and other loose metal overlaps.
  - Duct terminations (dead ends).
  - Leaks in the duct connector underneath the furnace (accessed through removable bottom panel on the front of unit).

41. BRANCH DUCTS (RIGID AND FLEX)

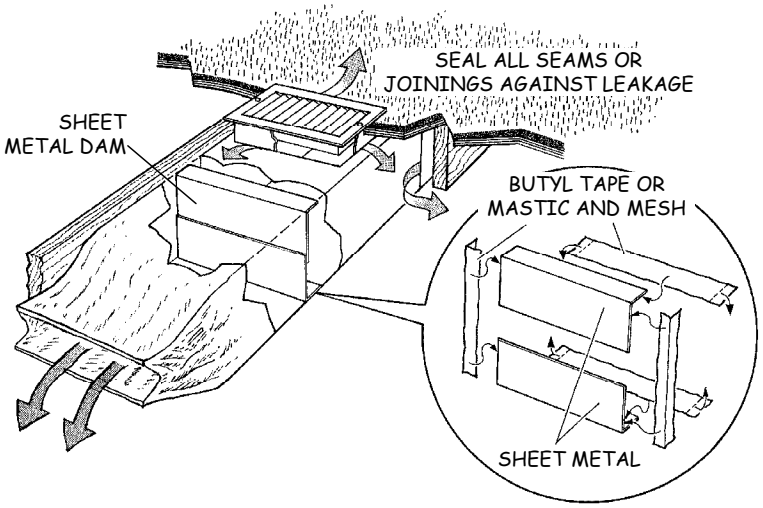
- **When leaks are present:**
  - Access holes will be created for the work done at each location.
  - Excess flex duct will be removed between the takeoff at trunk and floor register boot.
  - Hard and flex duct branch connections will be rebuilt or repaired using compatible materials and will be mechanically fastened and sealed.
  - Ends shall be sealed.
  - Access hole in the trunk/branch duct shall be repaired and sealed

42. REPAIR OF LEAKY DUCT TERMINATIONS BEYOND REACH

- **A leaky or open duct termination (dead end) that cannot be reached through a register shall be:**
  - Repaired/sealed from underneath the mobile home, or
  - By installing a sheet metal dam.
  - Securely blocked internally (e.g., with a sheet metal dam) and permanently sealed.

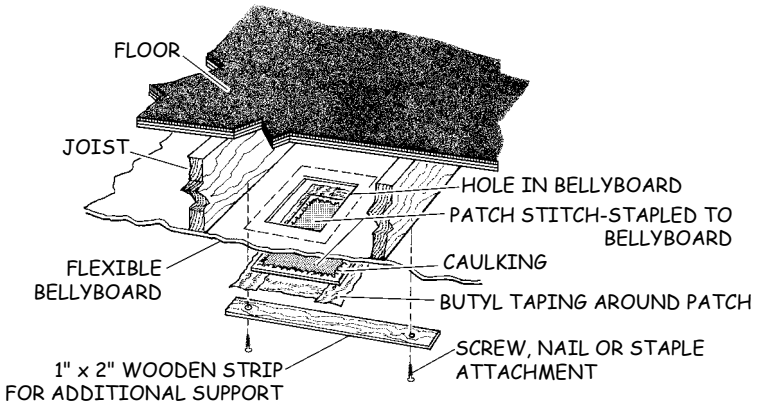
43. SHEET METAL DAMS

- **Dams shall be:**
  - Placed as far from the register opening as feasible.
  - Attached securely (mechanically when possible).
  - Sealed completely.
- **Dams shall be sealed with:**
  - Butyl tape, and/or
  - Duct mastic and/or mastic and mesh tape.



44. RODENT BARRIER (BELLYBOARD) REPAIR

- **All holes in the rodent barrier (bellyboard) created to access ducts from under the mobile home shall be repaired.**
  - All holes shall be repaired in rigid or flexible rodent barrier with a material equivalent or superior to the existing material.
  - All patches shall be securely and permanently attached and create a complete and permanent seal.
- **Existing holes within 3 feet of a duct:**
  - Rodent barrier shall be repaired, or
  - Areas adjacent to ducts shall be filled with mineral fiber batts.
- **Patches in Flexible Rodent Barrier**
  - Secure and seal all patches by using self-adhesive backing, or caulk/adhesive sealant.
  - Additionally, secure patches mechanically, to ensure a permanent seal, using one or more of the following:



- Outward clinch ("stitch") staples, or equivalent, spaced to attach the patch directly to the existing bellyboard.
- Install fasteners that penetrate the wooden joists a minimum of 1/2" and spaced a maximum of 4" OC.
- Attach permanent wooden strip supports (e.g. with screws into floor joists, or wedged above adjacent girders).

- Lastly, butyl tape or other sealant shall be placed around the perimeter, as needed, to ensure a complete and permanent seal.

- **Patches in Rigid Rodent Barrier**
  - Seal patches with suitable caulk/adhesive sealant and secured mechanically.
  - Approved mechanical techniques include:
    - Fasteners that penetrate the wooden joists a minimum of 3/4" and spaced a maximum of 6" OC.
    - Wooden strip supports spanning beyond the patch and secured mechanically into the framework above.
    - Wedging the patching material between the existing bellyboard and the metal framing of the undercarriage.
    - Fasteners that penetrate only the existing bellyboard, for small patches in high density material.
    - A combination of methods which will provide a stable, permanent repair.

45. MOBILE HOME DUCT INSULATION

- **Exposed Ducts**
  - Ducts exposed by missing or deteriorated bellyboard shall be protected by repairing bellyboard or installing mineral fiber insulation in accordance with CSD WIS Section 19 (Duct Insulation).

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

46. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

47. CONVENTIONAL HOME SYSTEM BALANCING

- **Tight-Fitting Doors**
  - When tight-fitting doors are likely to cause excessive room pressurization, a digital gauge shall be used to detect and measure the pressure differential of the affected rooms.
  - Installation crews shall test duct systems to ensure adequate air movement throughout the living space with interior doors closed.
  - Guidelines for room-to-room air testing shall be followed as set forth in the CSD Field Guide Appendix A (CAS Protocol).
  - When excessive pressurization exists (i.e., 3 Pa or more), corrections shall be made to provide a permanent return air path for rooms closed off by doors from the FAU return intake in accordance with guidelines in the CSD Field Guide Appendix A (CAS Protocol).
  - Examples are:
    - A transfer or jump duct from the room to the hallway.
    - Un-closeable grilled or louvered venting (transfer grille) in the door or wall.

- An undercut door leading to the hallway.

48. MOBILE HOME SYSTEM BALANCING

- **FAU Separated from Living Space by Enclosure Door/Wall with Return Grille**
  - When performing pressure balancing activities, crews shall ensure that a transfer grille is present in the enclosure door/wall that separates the FAU return intake from the living space. The transfer grille Net Free Venting Area (NFVA) shall:
    - Equal or exceed NFVA of the FAU return intake grille, or
    - Be calculated with the equation: [Return CFM/2 = NFVA in sq. in.].
  - Note: The transfer grille shall provide adequate return airflow (e.g. pressure in the space between the FAU and the transfer grille *no greater than* –3 Pa).
- **Grille in Additional Door or Wall Separating Return Airflow from Main Body of Home**
  - When a second door or wall separates the FAU from the main body of the home, a transfer grille shall be present in that door/wall and sized as prescribed above.

49. PERFORMANCE TESTING

- **Pre- and Post-tests**
  - Pre- and post-retrofit duct leakage tests shall be performance tested using a Duct Blaster in accordance with CSD Field Guide Appendix B.
  - Test results shall be documented in the CSD 706 (Duct Leakage Data Sheet) Form and reported to the homeowner and/or weatherization program.

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NOTES

MINOR EVELOPE REPAIR (MER)

Lead Paint Risk Factor
LOW-HIGH

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MINOR ENVELOPE REPAIR (MER)

UNIVERSAL MER REQUIREMENTS

1. GENERAL REQUIREMENTS

- **Minor Envelope Repair (or MER) is a category of shell sealing that is limited to the following activities:**
  - Infiltration repairs, including the patching of holes in the building envelope (ceiling, floor, or walls) to the exterior that are too big to caulk;
  - Sealing of thermal bypasses;
  - Installation of an attic/crawlspace access where one does not exist, or enlargement of an existing access;
  - Replacement of missing or broken attic/crawlspace access covers; and
  - Fireplace chimney damper repair or installation, or installation of glass fireplace doors when a damper is not feasible.

Other shell sealing activities such as Duct Sealing, Caulking, Cover Plate Gaskets, Glass and Window Repairs/Replacements, Sliding Glass Door Repair/Replacements, Interior Vent Covers, Kitchen Exhaust (damper replacement only), Door Repair/Replacements, and Weatherstripping have separate standards that are provided individually in the CSD WIS.

2. MER LIMITATIONS

- **MER shall be:**
  - Installed in accordance with the feasibility criteria for “Minor Envelope Repair” and “Infiltration-Reduction/Shell Sealing” in the CSD Field Guide.
  - Prioritized and installed in accordance with the sealing order described in the CSD Field Guide “Infiltration-Reduction/Shell Sealing” measure-specific policy.
  - All work performed shall be compliant with applicable local codes and regulations.
  - All work shall be performed in accordance with manufacturer’s installation instructions.
  - These guidelines shall apply, unless superseded by manufacturer or local code.

RESTRICTED MATERIALS

All MER Sealing Materials shall be used in accordance with Safety Data Sheet (SDS) instructions, CSD WIS Appendix A (Material Specifications), and manufacturers’ instructions. The following special restrictions also apply:

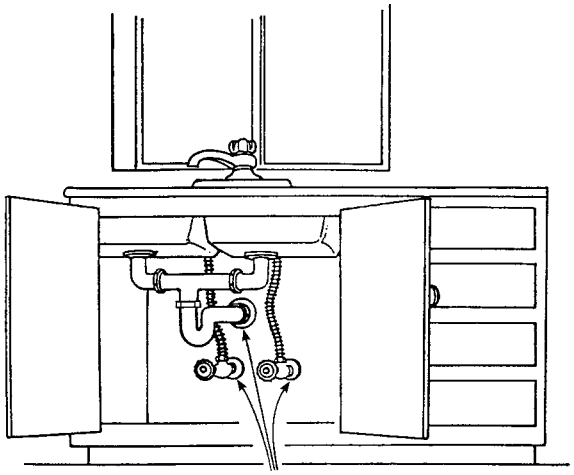
- **UL 181 Metallic Tape**
  - Shall not be used for any shell sealing purpose in any location (exposed or non-visible).
- **Foam Board**
  - Foam board may be left exposed only in the attic and crawlspace.
  - Foam board installed in other locations shall be covered in conformance with local codes.
- **Foam Sealant**
  - Foam sealant may be used to seal gaps in penetrations (e.g., plumbing and electrical), subject to the following limitations:
    - Gap size and use shall conform with foam manufacturer’s specifications and local code.
    - Fire-resistant foam (e.g., orange or red) shall be used to seal penetrations in common walls/floors/ceilings between adjacent residences (e.g., MUD units).

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

TASK 1: SEALING OF INTERIOR BYPASSES

3. INTERIOR BYPASSES

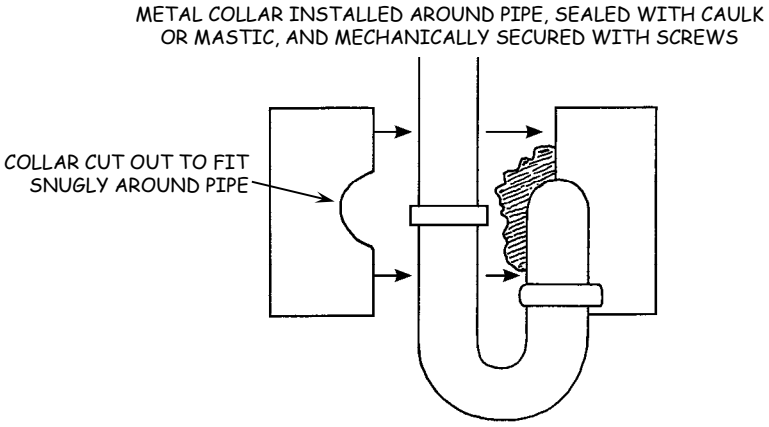
- **Infiltration Source Identification**
  - Dwelling shall be inspected to identify all sources of thermal bypasses (areas of potential leakage from inside the living space), including wall(s) between house and garage and ceilings.
    - Cracks and gaps shall be sealed from the house-side, whenever feasible.
    - Cracks and gaps up to 5/8" wide shall be caulked in accordance with CSD WIS Section 8 (Caulking).
    - Gaps *larger* than 5/8" shall be sealed with barrier material and/or filler board and sealants as described in this section.
    - Duct board, gypsum, sheet metal, or other approved barrier material shall be used.
    - Barrier shall be secured, as needed, with mechanical fasteners (screws, staples, or nails) to ensure a complete and permanent seal.
    - All cracks in house and garage separation wall will be sealed, including cracks between mud sill, rim joists, subfloors, and bottom of gypsum board.
    - Ensure sealing enhances the fire resistance of the wall(s) between house and garage.



PLUMBING PENETRATIONS

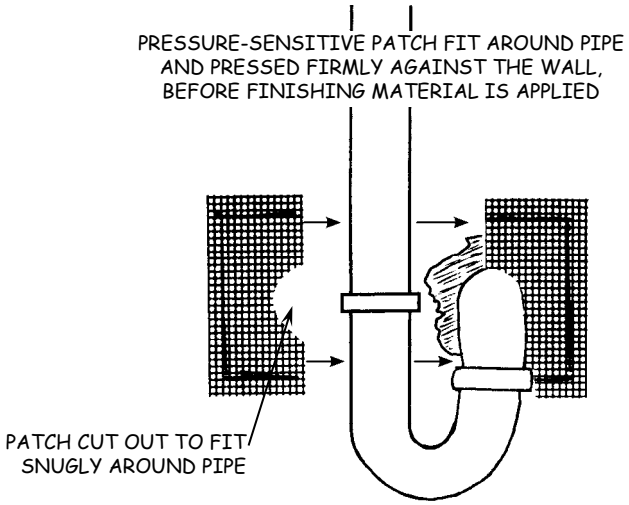
4. PLUMBING PENETRATIONS UNDER SINKS

- **Patching of Penetrations**
  - Gaps over 5/8" wide shall be covered with a sheet metal collar or mesh plumbing patch that is sealed and secured.
    - Commercially-available plumbing patches and pipe collars shall be used; or
    - A metal collar may be fabricated using one or two pieces of galvanized sheet metal or aluminum, notched (cut out) to fit around the penetration.
- **Installation of Field Fabricated Metal Collar**
  - Required on wall or floor penetration, including on floors in exposed locations (i.e., not inside a cabinet).
  - Apply sealant (e.g., elastomeric) to the back side.
  - Press patch/collar into place and each separate piece secured with at least two anchors (e.g., sheet metal screws) that penetrate solid wood where possible.
  - Remaining gaps 1/16" or wider also shall be caulked.

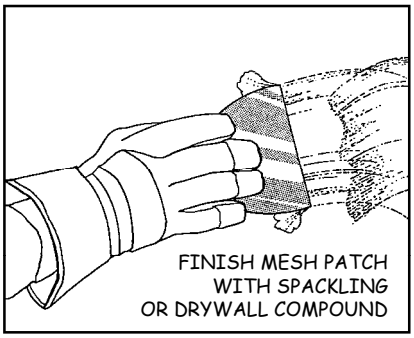


4. PLUMBING PENETRATIONS UNDER SINKS (cont.)

- **Installation of Mesh Plumbing Patch**
  - Surfaces shall be free of:
    - Loose or cracked caulking or patching material.
    - Loose drywall material, dirt, debris, and oily substances.
    - Moisture.
  - Install patches in conformance with manufacturer's instructions and the following guidelines:
    - Patches shall be 28-30–gauge non-corrosive metal with strong self-adhesive backing.
    - Backing shall be reinforced with fiberglass mesh or equivalent.
    - Patches shall be cut to fit snugly around pipes (e.g., pre-cut for installation around 2", 1-1/2", 3/4", and 1/2" pipes).
    - Firm pressure shall be applied to adhesive to eliminate gaps along edges.
    - Patch shall be sealed to mounting surface along the entire perimeter of the patch.
  - Gaps 1/16" or larger between patch and pipe also shall be sealed with caulk.

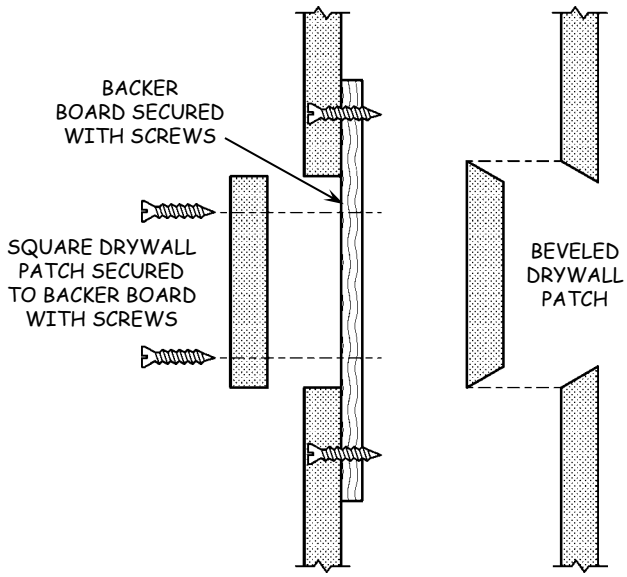


- **Finishing Mesh Patches on Walls**
  - Cover plumbing patch with a good quality finishing material (e.g., light-weight spackling or drywall joint compound).
  - Finishing material shall:
    - Be installed in conformance with manufacturer's instructions.
    - Completely cover patch and overlap onto wall.
  - Patch shall be finished to blend with surrounding wall surface.
- **Finishing Mesh Patches on Floors**
  - Install mesh floor patches only inside a cabinet (not in exposed locations) directly onto the cabinet bottom floor/sheathing.
  - Install fasteners (e.g., sheet metal screws, nails, or staples) as needed to ensure permanent attachment.
  - Cover patches shall be covered with lightweight, non-shrinking, exterior-grade spackling compound, drywall joint compound, or equivalent.



5. WALL (DRYWALL) PATCHES

- **Factory-made Mesh Patches**
  - Apply patch (e.g., adhesive mesh patch with steel reinforced backing) in accordance with manufacturer's instructions.
  - Finish patch to match the surrounding surface (e.g., with mesh covered by at least two coats of drywall mud sanded between each coat, or with light-weight spackle).
- **Field-fabricated Patches for Large Holes**
  - Field-fabricate patch using a piece of drywall that matches the thickness of the drywall covering the wall (or ceiling).
  - Patches shall be:
    - Beveled to fit securely in the hole, or
    - Supported by backer boards screwed to the wall inside the hole.
  - Gaps between the patch and wallboard shall be filled (e.g., with drywall mesh and mud).
  - Patch shall be finished to match the surrounding surface (e.g., with drywall mesh covered by at least two coats of drywall mud sanded between coats).
  - Patches in exposed locations (not inside a cabinet) shall be sealed with primer and/or paint to prevent moisture intrusion.



6. FOAM SEALANTS AND FOAM BOARD—INTERIOR LOCATIONS

- **Plumbing/Electrical Penetrations and Other Bypasses**
  - Foam sealant may be used to seal gaps, subject to the following limitations:
    - Gap size, location, and use shall be in conformance with foam manufacturer's specifications and local code.
    - Fire-resistant foam (e.g., orange or red) shall be used to seal penetrations in common walls/floors/ceilings between adjacent residences (e.g., MUD units).
  - Finished Foam Sealant
    - The foam surface shall be even with the surrounding surface.
    - When an escutcheon is present, it shall be placed over the finished foam sealant.
- **Foam Board**
  - Foam insulation board shall <u>not</u> be installed to patch the interior of a dwelling (including attached room(s) or garage).

7. ATTIC ACCESS COVER REPLACEMENT—HORIZONTAL

- **Rough Opening Size and Location**
  - Minimum 22" x 30", or as wide as possible when ceiling joists are less than 24" OC.
  - Located where unobstructed headroom at some point above the access is at least 30" measured vertically from the bottom of ceiling joists.
- **Cutting the Opening**
  - Cuts shall be located along the edges of the ceiling joists.
  - Ceiling material shall be cut out neatly and carefully, and set aside for use as the access cover.
- **Blocking the Opening**
  - Open ends of the hole shall be blocked (framed).
  - Blocks shall be:
    - Cut to fully extend from joist to joist.
    - Placed perpendicular to the joists at the edges of the opening.
- **Anchors**
  - Blocks shall be secured (anchored) at each end with minimum 3" nails or comparable screws driven through the joists.
  - Minimum two anchors for 2" x 4" and three anchors for 2" x 6".
- **Cutting Ceiling Joist**
  - If removal of part of an obstructing joist is absolutely necessary:
    - Cut-off joist ends shall be supported with blocks (framing), installed across the ends and secured to the adjacent joists.
    - Framing shall be secured with minimum 3" nails or comparable screws driven through the joists at each end of the joist, and through the block into the cut-off joist.
    - Minimum two anchors for 2" x 4" and three anchors for 2" x 6", or as required by local code.
    - Cutting and blocking the cut joist shall not violate local code.
- **Securing Ceiling**
  - Blocks shall be installed against the ceiling.
  - Ceiling material shall be secured to the blocks with anchors (e.g., drywall nails or screws) that penetrate the blocks at least 1/2".
  - Anchors shall be located at each corner of the opening and at intervals not exceeding 6".
- **Access Cover**
  - Cover material shall be sized to fit the rough opening, with gaps along edges not to exceed 1/4" per side.
  - Cover material options include:
    - Material (e.g., gypsum) removed to create the access hole.
    - New 5/8" gypsum.
- **Installing Trim**
  - Trim/molding shall:
    - Be cut with mitered corners.
    - Extend into the opening at least 5/8".
    - Positioned so nails will penetrate framing at least 5/8".
  - Trim/molding shall be secured with finish nails
    - Countersunk nails shall be at each corner, and spaced at intervals not exceeding 6".
    - Nail holes shall be filled with spackle or wood putty (not caulk).
- **Finishing**
  - Bare wood shall, at a minimum, be primed.

- **Weatherstripping and Insulation**
  - Required only when access is located in conditioned space.
  - The access shall be weatherstripped as prescribed in WIS Section 9 (Weatherstripping).
  - Flexible or rigid insulation, with an R-value equal to attic floor, shall be attached to the cover in accordance with WIS Section 20A (Ceiling Insulation for Conventional Homes).

8. ATTIC ACCESS COVER REPLACEMENT—VERTICAL

- **Knee Wall**
  - Access shall be installed between two knee wall studs.
  - Minimum 22" x 30", or as wide as possible when studs are less than 24" OC.
- **Cutting the Opening**
  - Cuts shall be located along the edges of the knee wall studs.
  - Wall material shall be cut out neatly and carefully, and set aside if it will be incorporated into the access cover.
- **Access Cover/Door**
  - Material options include:
    - Gypsum-clad cover/door:
      - New 1/2" gypsum or gypsum removed to create the access hole, bonded to plywood backing material.
      - Gypsum shall be bonded to 1/2" plywood, using heavy duty construction adhesive.
    - Wood-only cover/door
      - New 5/8" plywood without gypsum.
  - If any framing is required to complete the opening (e.g., a block between studs), it shall match dimensions of studs.
- **Installing Hinges**
  - Spring-loaded hinges shall be required when access penetrates a firewall.
  - Standard and spring-loaded hinges shall properly support the access door and make it self-closing, in accordance with the following guidelines:
    - One spring hinge for doors weighing up to 45 pounds
    - Two spring hinges for doors weighing up to 75 pounds
    - Three spring hinges for doors weighing up to 90 pounds
  - Hinges shall be attached to a stud and to plywood backing (not to gypsum).
  - Screws shall penetrate wood at least 1/2".
- **Installing Trim**
  - Trim/molding shall:
    - Be cut with mitered corners.
    - Positioned so nails will penetrate framing at least 5/8".
  - Trim/molding shall be secured with finish nails
    - Countersunk nails shall be at each corner, and spaced at intervals not exceeding 12".
    - Nail holes shall be filled with spackle or wood putty (not caulk).
- **Finishing and Latch**
  - Bare wood shall, at a minimum, be primed.
  - A latch shall be installed that pulls the door tightly against the frame and weatherstripping.
- **Weatherstripping and Insulation**
  - Required only when access is located in conditioned space.
  - The access shall be weatherstripped as prescribed in WIS Section 9 (Weatherstripping).
  - Flexible or rigid insulation, with an R-value equal to attic floor, shall be attached to the cover in accordance with WIS Section 20A (Ceiling Insulation for Conventional Homes).

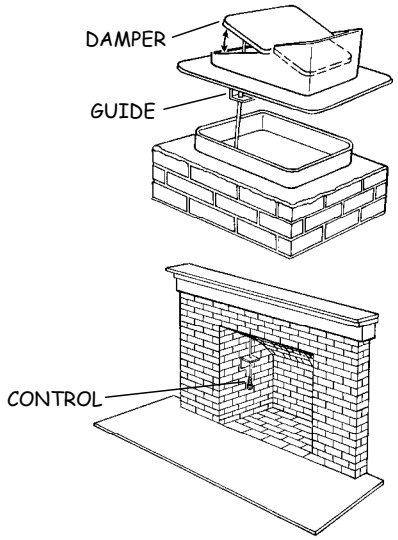
9. CRAWLSPACE ACCESS COVER REPLACEMENT—HORIZONTAL

- **Framed Opening**
  - Ends of the opening shall be framed with blocks that are perpendicular to the floor joists at the edges of the opening and fully extend from joist to joist.
  - Blocks shall be properly secured at each end to floor joists (e.g., with minimum 3" nails or comparable screws, minimum two anchors for 2" x 4", and three anchors for 2" x 6".
- **Access Cover**
  - Deteriorated/defective cover(s) shall be repaired with new materials comparable to those used for the existing cover and surrounding floor.
  - Installed hardwood, or other finish material, shall be attached with finish nails.
  - Finish nails shall be countersunk, and holes shall be filled with wood putty.
- **Finish Surface**
  - Top of access cover shall be flush with the floor, when the top surface is flooring, or it will be covered by carpet or other floor covering.
  - Top of access cover shall be recessed appropriately, if needed to accommodate future installation of finishing material (e.g., hardwood).
- **Weatherstripping and Insulation**
  - Required only when access is located in conditioned space.
  - The access shall be weatherstripped as prescribed in WIS Section 9 (Weatherstripping).
  - Flexible or rigid insulation, with an R-value equal to floor insulation, shall be attached to the cover in accordance with WIS Section 22A (Floor Insulation for Conventional Homes).

10. CRAWLSPACE ACCESS COVER—VERTICAL

- **Access Location**
  - Due to complexity of this work, shall require prior approval of installation from CSD.
  - Cuts/alterations in foundation wall shall not violate local code.
  - Best Practice
    - Minimum 16" x 24" opening (per code), or as wide as feasible.
    - Located where crawl clearance is 18" or more.
- **Access Cover**
  - Shall be metal or wood framed, or unframed metal material in conformance with the specifications listed below.
- **Metal Framing or Unframed**
  - New corrosion-resistant screened metal or solid metal material shall be installed per manufacturer's instructions.
  - Metal framing shall be secured to:
    - Wood with corrosion-resistant screws that penetrate at least 1/2".
    - Concrete with corrosion-resistant screws and compression anchors.
- **Wood Framing (Box Frame)**
  - Framed wood (plywood or 1-by boards) shall be 1" x 2" redwood or pressure-treated fir at a minimum.
  - Attached to concrete with concrete nails or corrosion-resistant screws and compression anchors.
  - Attached to wood with nails or screws that penetrate solid wood at least 1/2".
- **Hinges and Latches**
  - Hinges and/or latches, when applicable, shall be installed with corrosion-resistant anchors.
- **Finishing**
  - Bare wood shall, at a minimum, be primed.
- **Weatherstripping and Insulation**
  - Not applicable (unconditioned space is on both sides of access cover).

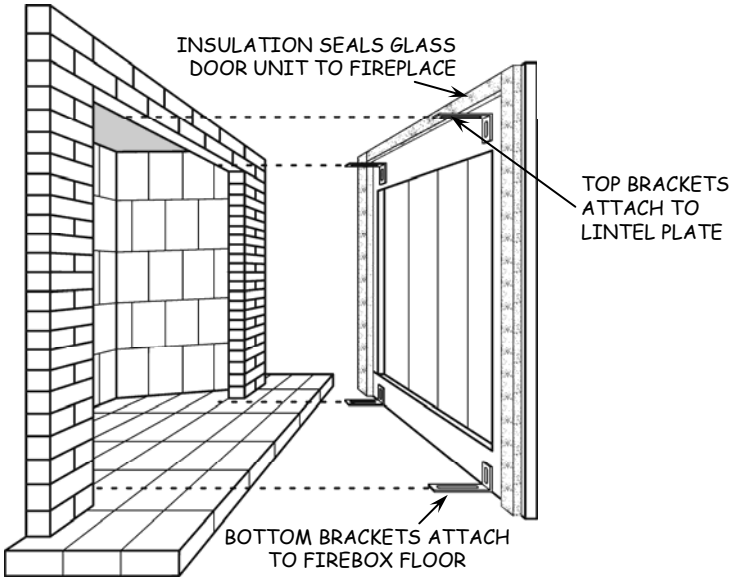
11. FIREPLACE CHIMNEY DAMPERS



- **Factory-Built ("Zero Clearance") Fireplaces**
  - Malfunctioning dampers shall be repaired or replaced with listed parts specified by the manufacturer.
- **Masonry Fireplaces**
  - Malfunctioning dampers shall be repaired.
  - A retrofit damper shall be installed when no damper is present or repair of a malfunctioning damper is not feasible.
  - Retrofit dampers
    - Only commercially available **top-sealing** dampers shall be used (see "Gas Log Present" section below).
    - Damper shall be properly sized to fit chimney termination.
    - Manufacturer's installation instructions shall be followed.
- **Gas Log Present**
  - A retrofit damper shall not be installed when a gas log is present unless it is blocked partially open by means of a permanently-installed damper clamp.
  - The California Mechanical Code sizing and clamp policies shall apply[i].
    - Fireplace shall have a permanent free opening, based on appliance input rating and chimney height.
    - Shell sealing is not feasible if the damper does not have a permanent free opening (provided by a damper clamp or other means).

12. FIREPLACE GLASS DOORS

- **All Fireplaces**
  - All pre-existing fireplace glass door units shall seal against the fireplace surround (the surface surrounding the fireplace opening).
- **Retrofit Glass Doors**
  - When a fireplace damper is not present or is not feasible to install, glass doors for fireplaces shall be selected and installed per fireplace manufacturer's instructions.
  - The glass door unit shall be designed and sized to fit:
    - The smallest dimensions of the firebox opening.
    - The surround size and surface (smooth or textured).
- **Attachment of the Glass Door Unit**
  - The top of the door unit shall be mechanically secured to the lintel bar (e.g., with a lintel clamp).



TASK 2: SEALING OF CEILING BYPASSES

13. CEILING BYPASSES

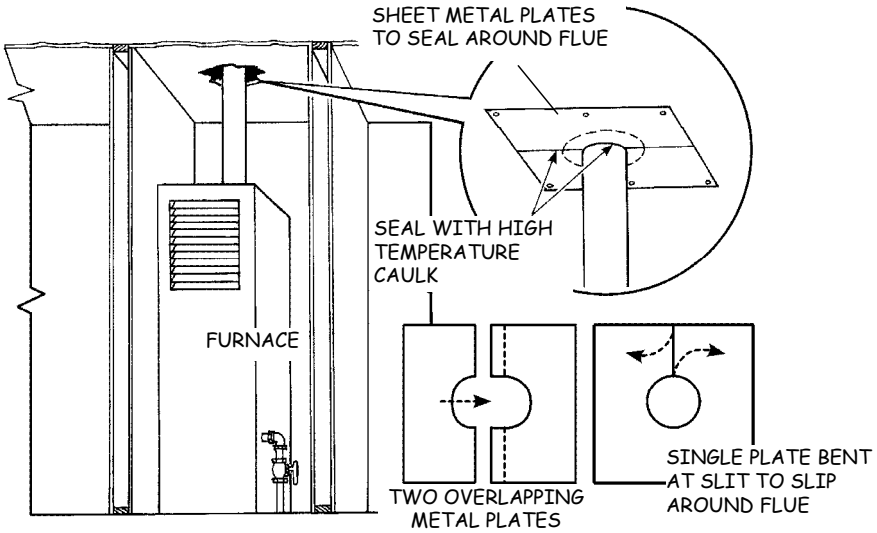
- **A ceiling bypass is a penetration from the living space into the attic (i.e., through the ceiling) that allows communication of conditioned air between the home and the attic.**

14. OPEN COMBUSTION FURNACE VENT

- **Ceiling bypasses at vent penetrations shall be sealed *only when*:**
  - Bypass is not required for combustion air.
  - Installation of a metal collar does not cover a vented thimble or support system, and does not violate local code.

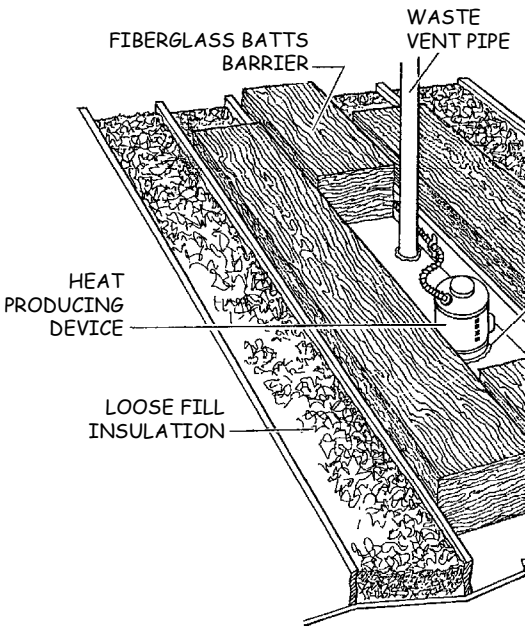
15. CLOSED COMBUSTION FURNACE VENT

- **Ceiling Collar**
  - A collar is not required for gaps less than 3/8" (gap may be sealed with high temperature caulk).
  - Loose-hanging and fallen collars shall be reinstalled as feasible.
  - When no collar is present or gaps at the existing collar are 3/8" or larger, a metal collar shall be provided.
  - The collar shall be sealed and mechanically secured against ceiling.
    - Elastomeric caulk (or duct mastic) shall be applied to back side of the collar (high temperature caulk within 3" of the flue pipe).
    - The collar shall be secured with at least 4 anchors (e.g., sheet metal screws) which penetrate solid wood when possible.
    - High temperature caulk shall be used to seal gaps 1/16" or greater between the pipe and collar.



16. HPD CEILING PENETRATIONS WITHIN THE ATTIC

- **Heat-Producing Devices (HPDs)**
  - High temperature caulk shall be used near heat-producing devices (HPDs).
- **Recessed Lights**
  - Holes or ventilation openings in recessed light canisters or other heat producing devices shall not be blocked.

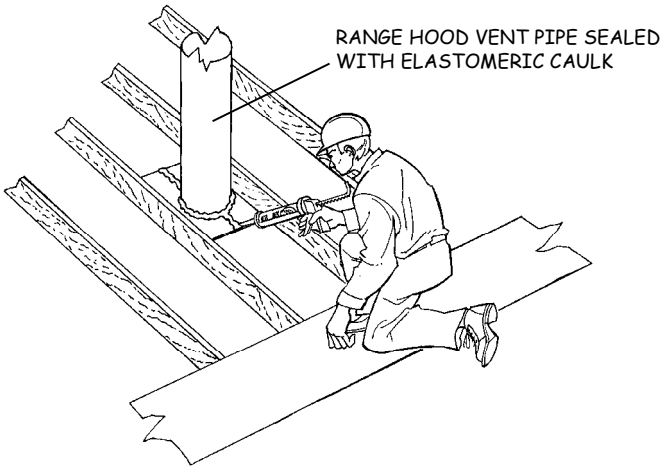


17. MASONRY CHIMNEYS

- **Attic Penetrations by Masonry Chimneys**
  - Seal penetrations with a non-combustible barrier and sealant.
    - Galvanized sheet metal or aluminum shall be a minimum of 0.007" thick.
    - Barrier shall be mechanically secured to ensure permanent installation.
    - Gaps shall be sealed with high temperature sealant.
  - Exclusions: The following shall not be sealed:
    - Wall furnace vent pipes and other gas vents located inside wall cavities.
    - Non-conforming single wall vent or flue pipes.
    - Ventilated thimbles and collars.

18. NON-HPD PENETRATIONS AND SIMILAR LEAKS

- **Non-HPDs**
  - High temperature caulk is not required for local or kitchen exhaust fan ducts, waste vent pipes, water pipes, and similar penetrations that are not heat-producing.
- **Gaps *less* than 3/8" shall be sealed with elastomeric caulk.**
- **Gaps 3/8" and *larger* shall be covered with a metal collar, and:**
  - Sealed to the mounting surface with elastomeric caulk, and
  - Sealed at penetration with elastomeric caulk.



19. CHASES & OPENINGS TO THE ATTIC ABOVE DROPPED CEILING OR SOFFITS

- **Pre-Installation**
  - Inspect for mold, water leaks, and/or water damage.
  - Repair of minor leaks shall be completed prior to sealing.
- **Chases/Openings/Soffits**
  - Entire opening shall be spanned with rigid material.
  - Material shall be cut to fit and fastened as required.
  - Rigid material shall meet fire code flame and smoke spread requirements.
  - Support material, if span is wider than 24 inches.
  - Fasten filler material.
- **Tongue-and-Groove Ceilings**
  - Backing shall be installed behind tongue-and-groove ceilings.
  - Sealants shall be compatible with their intended surfaces.
  - Sealants shall be continuous and meet fire barrier specifications, according to authority having jurisdiction.
  - No sealant shall be allowed to be visible in the living space.
- **Light Boxes and Fixtures in Dropped Ceilings (with non-Intact Fixed Ceilings) or Soffits**
  - An airtight seal shall be provided around perimeter between light box enclosure and interior ceiling.
  - All seams and penetrations of the enclosure shall be sealed.
  - Insulation shall be kept at least 3” away from the top and side of any fixtures
  - If dropped ceiling is to be filled with insulation, then a sealed rigid barrier enclosure shall be installed to maintain a 3” clearance on all sides and at least ½” from combustible materials
  - Top of rigid barrier enclosure shall be sealed with non-insulating rigid material (e.g., gypsum or equivalent perm rating and R-value).
- **Sealing of Chases and Openings**
  - Continuous seal shall be installed around seams, cracks, joints, edges, penetrations, and connections
  - All remaining gaps at the top of the chase shall be sealed
  - Sealants shall be used that prevent visible air movement using chemical smoke at 50 Pascals of pressure difference.

TASK 3: SEALING OF CRAWLSPACE BYPASSES

20. PRE-INSTALLATION TO SHELL SEALING—PREPARATION OF CRAWLSPACE

- **The following crawlspace conditions shall be corrected (by client, or by contractor when within the program scope) before the installation of shell sealing is allowed:**
  - Fuel leaks
  - Electrical hazards
  - Mold issues
  - Plumbing leaks, both supply and waste lines
  - Pest and termite infestation
  - Structural defects
  - Repair or replacement of HVAC appliance systems located in the crawlspace, when applicable. Note: Crawlspace repairs (sealing and installation of insulation) shall only be performed after HVAC work has been completed and inspected by the local jurisdiction.
  - Correctable standing water: passive drains or sump pumps will be used to remove standing water
  - Non-correctable standing water: Installation of floor insulation is not feasible.
  - Note: If materials suspected to contain asbestos or lead content are present, dwelling shall be assessed in accordance with the CSD Asbestos Policy. If client arranges for hazardous

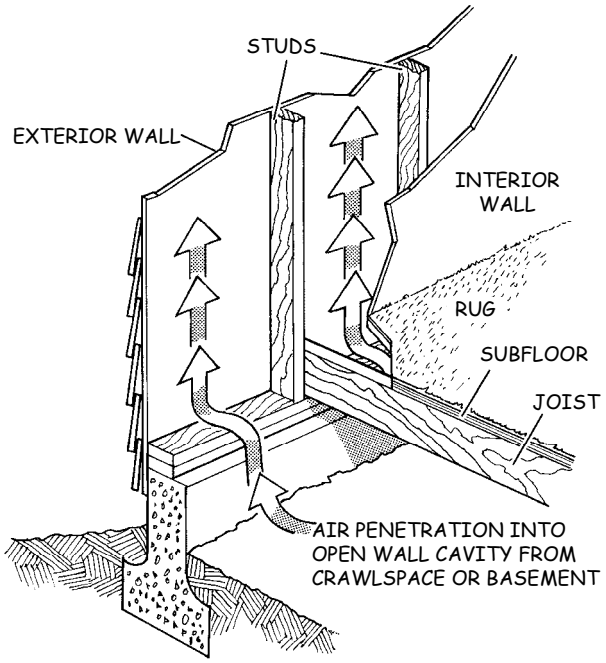
material to be removed by a licensed abatement contractor in accordance with EPA regulations, installation of shell sealing measures may be feasible.

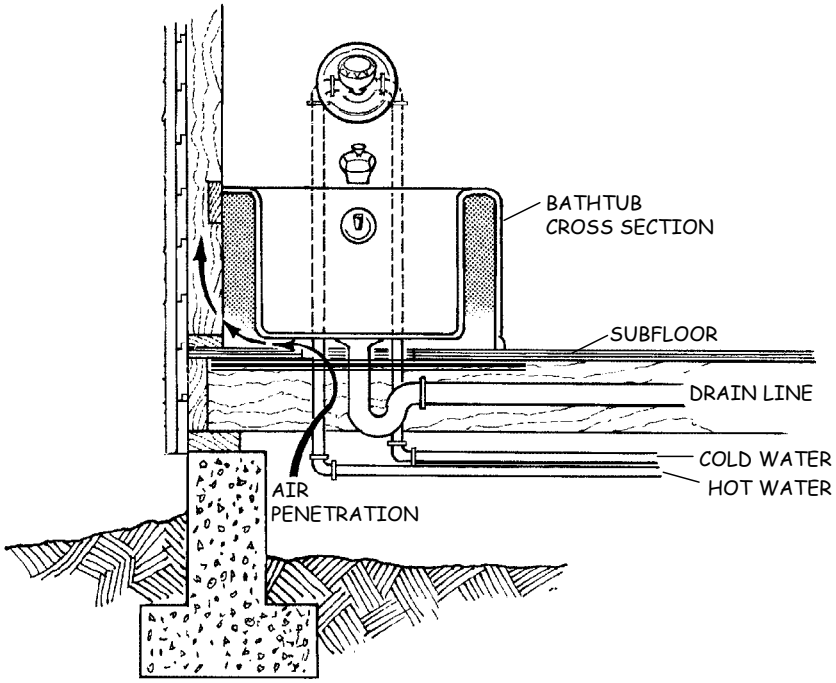
21. SEALING

- **Sealing of floor thermal bypasses shall be performed before shell sealing is installed.**

22. CRAWLSPACE BYPASSES

- **A crawlspace bypass is a penetration from the living space into the crawlspace (i.e., through the flooring) that allows communication of air from the crawlspace into the home.**
- **Bathtub Holes**
  - Floor opening under bathtubs shall be sealed with filler board and sealant.
    - Radiant barrier, foam board, duct board, or other approved barrier material may be used for filler board.
    - Silicone, acoustical caulk, or foam sealant may be used to seal filler board.
    - Filler board shall be secured, as needed, with mechanical fasteners (screws, staples, or nails) to ensure a complete and permanent seal.
- **Other Floor Bypasses (Plumbing Penetrations)**
  - Typically created by drain lines and hot / cold water lines through the floor.
  - Seal with caulk, foam, or other appropriate, approved material. (Also see CSD WIS Section 8, Caulking.)

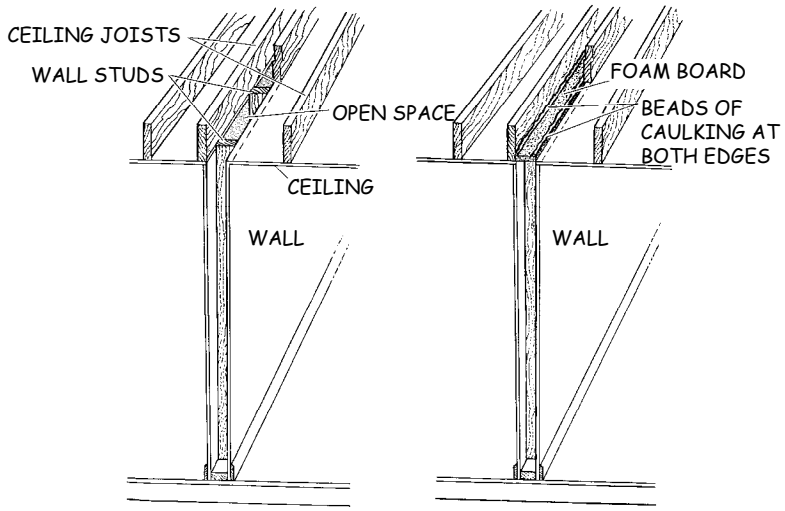




TASK 4: SEALING OF WALL BYPASSES

23. WALL BYPASSES

- **A wall bypass is a penetration from the living space into the wall cavity that allows communication of conditioned air between the home and the building envelope.**
- **Interior Wall Openings**
  - Cavities shall be sealed with filler board and sealant.
    - Foam board, duct board, radiant barrier, or other approved rigid barrier materials are acceptable to use for filler board.
  - Silicone or acoustical caulk, or foam sealant shall be used to seal the filler board.
  - Sealants shall be used that prevent visible air movement using chemical smoke at 50 Pascals of pressure difference.
  - Continuous seal shall be installed around seams, cracks, joints, edges, penetrations, and connections.
  - Filler board shall be secured, as needed, with mechanical fasteners (screws, staples, or nails) to ensure a complete and permanent seal.



- **Exterior Wall Openings**
  - Cavities shall be sealed with filler board and sealant.
    - Foam board, duct board, radiant barrier, or other approved barrier material may be used for filler board.
  - Silicone or acoustical caulk, or foam sealant shall be used to seal the filler board.
  - Filler board shall be secured, as needed, with mechanical fasteners (screws, staples, or nails) to ensure a complete and permanent seal.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes (access cover items do not apply).

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

24. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: TASK-SPECIFIC POST-INSTALLATION REQUIREMENTS

25. WORKMANSHIP

- **General**
  - Gaps shall be filled with appropriate material as described in this standard.
  - Finishing materials shall:
    - Be installed in conformance with manufacturer's instructions.
    - Completely cover gap and be sealed onto wall.
  - No restricted sealing materials shall be used where prohibited by manufacturer or WIS Appendix A.
  - Sealing work shall not create a fire hazard or other dangerous condition.
- **Finishing**
  - Gaps between patches and wallboard shall be filled (e.g., with drywall mesh and mud).
  - Patches shall be finished to match the surrounding wall surface (e.g., with drywall mesh covered by at least two coats of drywall mud sanded between coats).
  - Patches in exposed locations (not inside a cabinet) shall be sealed with primer and/or paint to prevent moisture intrusion.
  - Caulking shall be evenly tooled, with excess material removed, to ensure a clean appearance and adequate seal.

REFERENCED STANDARDS

[i] CMC Section 907.2(3) and Table 9-2

CAULKING

Lead Paint Risk Factor
LOW

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CAULKING

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

CAULKING REPAIR

Not applicable to this measure.

CAULKING INSTALLATION

1. SURFACE PREPARATION

- **Surface shall be free of:**
  - Loose or cracked caulking.
  - Dirt, debris, and oily substances.
  - Moisture, *unless* allowed by manufacturer's specifications.

2. SEALING PRIORITY

- **See "Prescriptive Shell Sealing Priority List" in the CSD 704 form for prioritization of all shell sealing (infiltration-reduction) activities.**
  - General caulking priority is:
    - First—largest leaks.
    - Second—cracks located near or in the floor and ceiling area.
    - Last—mid-height (neutral pressure zone).
    - Note: Exterior caulking is not required above the first floor.

3. MATERIAL USAGE

- **Sealing Requirements**
  - Like material and/or compatible materials shall be used.
  - Sealants shall be used to fill holes no larger than recommended by manufacturer specifications.
  - Sealants shall be compatible with all adjoining surfaces.
  - Sealants will allow for differential expansion and contraction between dissimilar materials.
  - Sealants shall be applied in a continuous bead and meet fire barrier specifications, when foam is required between common walls in multi-family units.
  - Only noncombustible materials will be used in contact with chimneys, combustion exhaust vents, and flues.
  - Caulking materials will be selected to comply with manufactured housing rules and regulations (e.g., Manufactured Housing Institute).
  - Materials used for air sealing will be used or installed in accordance with product manufacturer specifications.
  - Ensure resulting closure is permanent and supports expected wind and mechanical pressure loads. Sealing shall be effective and durable.
  - Injected foam is allowed only if intended for that purpose and installed strictly in conformance with manufacturer instructions. Overfilling the cavity in a manner that warps a sliding glass door or window frame shall not be allowed. Workmanship corrections will be the sole responsibility of the agency and not reimbursable by CSD.

4. VISIBLE LOCATIONS (INTERIOR)

- **Caulk shall be:**
  - Clear when dry, or color coordinated with surrounding material and existing caulk.
  - Paintable, with the following *exceptions:*

- Polyurethane (paintable) caulk is required to be used in visible locations where elastomeric sealant is required.
- Silicone shall be applied neatly to a joint between dissimilar materials when that is the best option (e.g., sealing around the perimeter of a window-mount air conditioner).

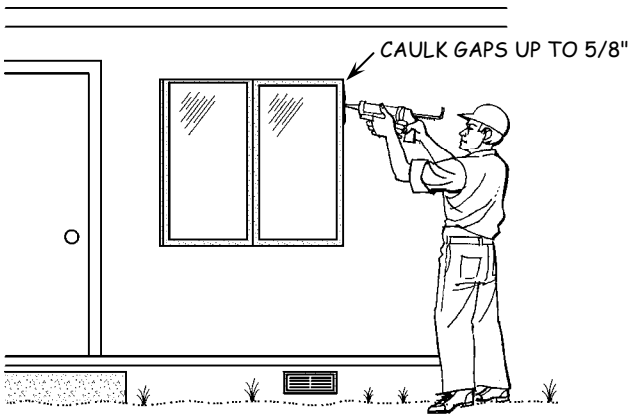
- **Foam Sealant**
  - Foam sealant shall be used to seal gaps in penetrations (e.g. plumbing and electrical), subject to the following limitations:
    - Gap size, location, and use shall be in conformance with foam manufacturer's specifications and local code.
    - Fire-resistant foam (e.g., orange or red) shall be used to seal penetrations in common walls/floors/ceilings between adjacent residences (e.g., MUD units).
  - Finished Foam
    - The foam surface shall be even with the surrounding surface.
    - When an escutcheon is present, it shall be placed over the finished foam sealant.
    - Foam installations larger than gap sealant (e.g., insulation board) shall not be installed to patch the interior of a dwelling (including attached room or garage).

5. NON-VISIBLE LOCATIONS (INTERIOR)

- **Pipe Penetrations Under Sinks**
  - Pipes shall be sealed behind escutcheons where possible.
  - Escutcheon shall be sealed to wall only if necessary.
  - In inaccessible, non-visible locations, where installation of caulking and metal escutcheon is impossible, sealing shall be performed using UL 181 butyl tape. Use of tape is restricted to this specific circumstance only.
- **Appliance Enclosure Walls and Exhaust Duct Penetrations**
  - Cracks and holes shall be caulked as feasible or shall be repaired/patched:
    - From the living space-side, whenever feasible.
    - If not feasible, from inside furnace and water heater enclosures where products of combustion could leak into the living space.
    - Around penetration of exhaust fan duct (e.g., range hood duct through the ceiling).
    - Removal of the appliance to seal is the last possible option.

6. EXTERIOR CAULKING

- **Lap-Sided Homes**
  - Large gaps are common between siding and door or window casings.
  - Caulk:
    - At door thresholds.
    - All three door stops.
    - Junction of the door jamb and casing.
    - Any gaps that exist between two differing materials, such as metal windows on wooden sills.
- **For Masonry, Metal Joints and Joints Between Two Different Materials use:**
  - Elastomeric caulk with an elongation rating of at least 200%.
  - Masonry caulk shall be neutral cure (e.g., oxime cure) or paintable silicone.
- **Attic and Crawl Space**
  - Foam sealant shall be used in accordance with manufacturer's specifications, *unless* prohibited by local code.

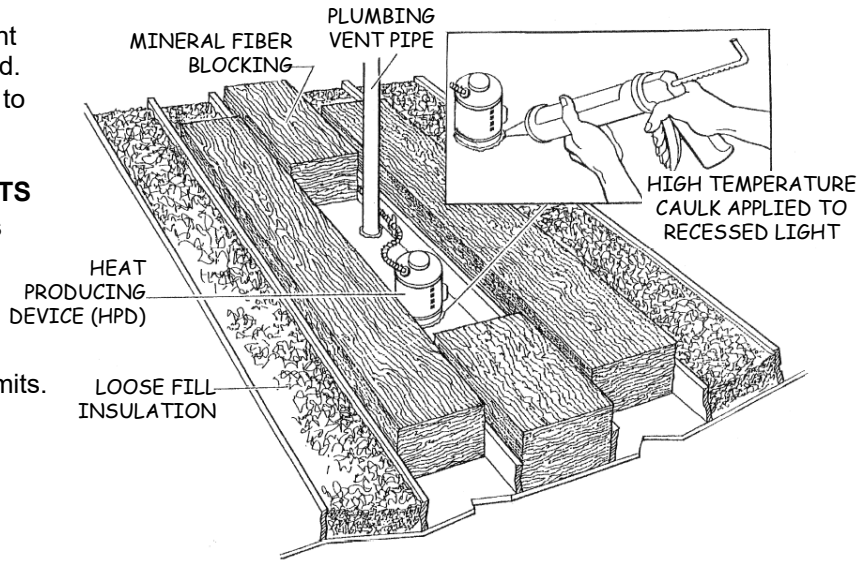


ELASTOMERIC CAULK FOR MASONRY, METAL, AND DISSIMILAR JOINTS

- **Wood Joints**
  - Elastomeric caulk or butyl caulk.
- **Mobile Home Marriage Line**
  - Elastomeric caulk
  - Non-expanding foam (it is acceptable to leave foam exposed in the undercarriage area).

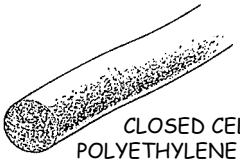
7. HEAT-PRODUCING DEVICES

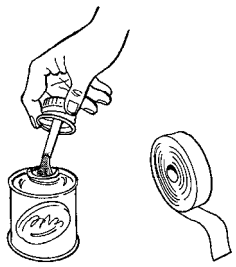
- **All Heat Producing Devices**
  - High temperature sealant shall be used.
- **Recessed Lights**
  - Vent holes in recessed light canister shall not be sealed.
  - Caulk shall not be applied to decorative trim.

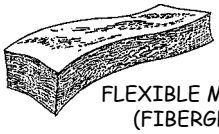


8. INSTALLATION REQUIREMENTS

- **Manufacturer's instructions shall be followed in all applications, with careful attention to:**
  - Surface preparation.
  - Application temperature limits.
  - Primer requirements (especially for metal and masonry surfaces).
  - Use of filler material (e.g., backer rod) and/or bond breaker tape.
  - Width and depth of bead.
  - Tooling recommendations.
- **Filler Material**
  - Acceptable filler materials include:
    - Closed-cell polyethylene backer rod.
    - Flexible fiberglass.
    - Rope caulk.
- **Bond Breaker Tape**
  - Bond breaker shall be polyethylene or TFE-fluorocarbon self-adhesive tape.
- **Backing and Filler**
  - Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration.
  - The backing or infill will not bend, sag, or move once installed.

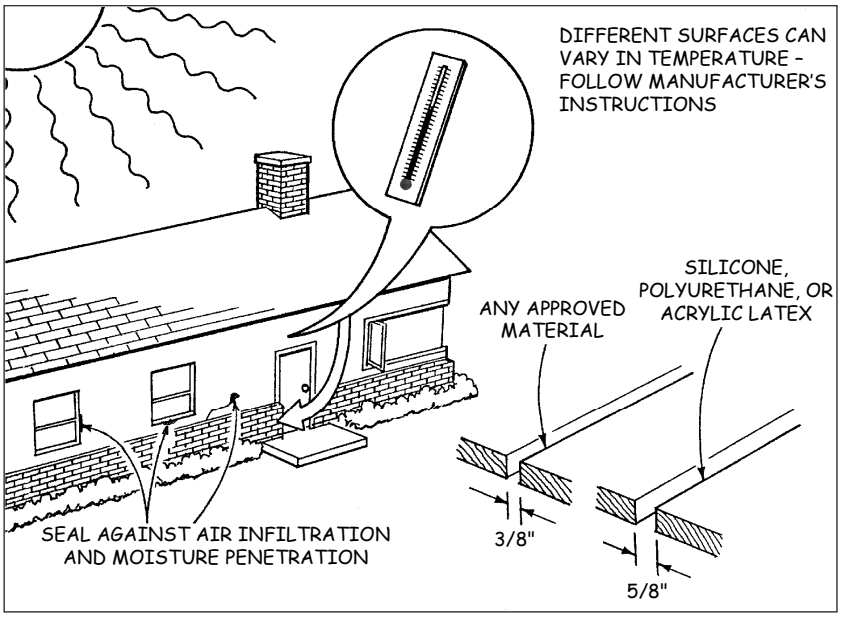






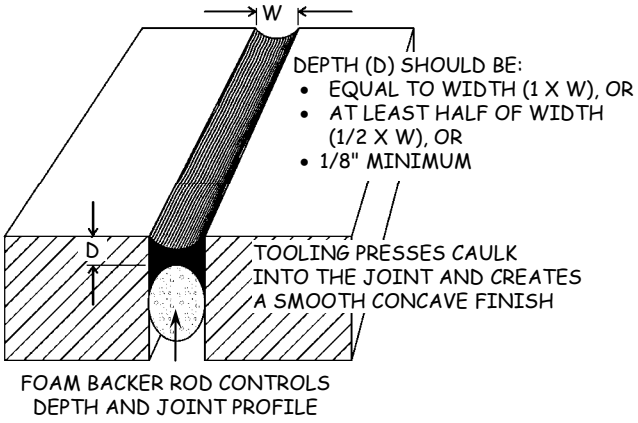
9. WIDTH OF GAP

- **Crack Widths to Be Caulked**
  - Minimum crack width, 1/16".
  - Maximum crack width, 5/8".
- **Sealant by Gap Size**
  - Gaps up to 3/8"—shall be caulked with any material approved for the location and type of joint.
  - Gaps 7/16" to 5/8"—shall be caulked with silicone, polyurethane, or acrylic latex.
- **Additional Requirements for Larger Gaps**
  - Gaps 3/8" to 5/8"—shall be filled with backer material to within 1/2" of the surface before caulking.
- **Gaps Over 5/8"**
  - Wall Patching of gaps over 5/8" shall be performed in accordance with CSD WIS Section 7 (Minor Envelope Repair).
  - Foam sealant shall be used in accordance with manufacturer's instructions regarding gap size and code requirements regarding type (e.g., high temperature near heat sources and in apartment common walls).



10. QUALITY OF FINISHED BEAD

- **All Joints**
  - Bead shall be minimum size required to achieve a permanent seal, and excess caulk shall be removed.
  - Bead shall be continuous and free of voids and bubbles.
  - All excess caulk shall be removed (e.g., by tooling).
  - Sealants shall be applied/tooled with sufficient pressure to fill the joint completely.
- **Butt Joints**
  - Bead shall be at least 1/8" deep—but no deeper than it is wide.
  - Depth shall be controlled by filler material (e.g., foam backer rod).
  - Gaps wider than 5/8" shall <u>not</u> be caulked: Wall patching required.
  - Bead shall be tooled to:
    - Compress sealant against filler material and sides of the joint.
    - Remove excess caulk.
    - Form a concave surface (e.g., create an "hourglass" profile when backer rod is used).



  - When filler material is not used and a bond breaker is recommended by sealant manufacturer:
    - Bond breaker tape shall be installed to prevent sealant adhesion to bottom of the joint.
    - Bond breaker shall be polyethylene or TFE-fluorocarbon self-adhesive tape.

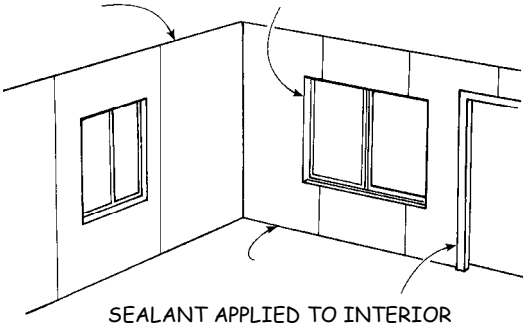
PART 2: MOBILE HOME CRITERIA

11. MOBILE HOME CAULKING PRIORITY

- **See "Prescriptive Shell Sealing Priority List" in the CSD 704 form.**

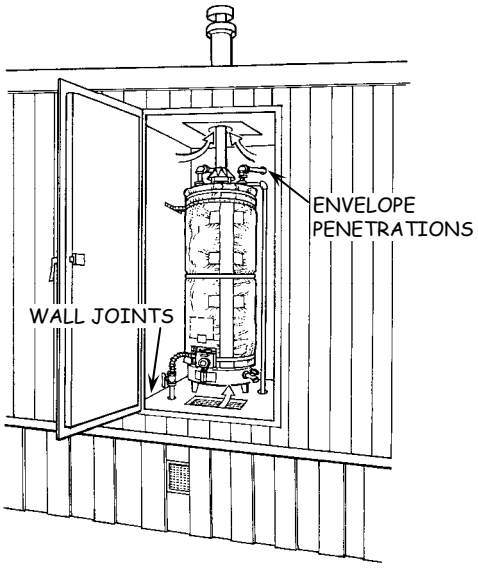
12. CAULKING LOCATIONS IN MOBILE HOMES

- **Work assessment**
  - The assessment of the unit will determine the structural integrity, size of wall studs, insect infestations, accessibility, and the number, type, size, and location of penetrations.
- **Interior Envelope Leaks 1/16" and Wider**
  - All leaks to the exterior shall be sealed, as feasible.
  - Gaps under 3/8" shall be caulked without filler material.
  - Gaps 3/8" to 5/8" shall be caulked *only if* filler material (e.g., foam backer rod) can be properly installed/secured and covered with at least 1/8" of caulk.



SEALANT APPLIED TO INTERIOR SEAMS AND JOINTS WHERE GAP IS 1/16" OR GREATER

- **Interior Seams and Joints**
  - Gaps 1/16" to 5/8" shall be caulked, including:
    - Trim around windows and doors, room corners, and ceiling perimeters.
    - Accessible baseboards (i.e., not covered with carpeting or obstructed by heavy furniture).
    - Trim down the center of a double-wide unit (i.e., along the marriage line).
  - Both edges of trim shall be caulked as feasible.
- **Appliance Enclosure Walls and Exhaust Duct Penetrations**
  - Gaps and wall joints up to 5/8" wide shall be:
    - Caulked in conformance with Item 5.
    - Repaired/patched in conformance with the descriptions below.
- **Exterior Envelope Holes and Penetrations**
  - All exterior leaks and penetrations shall be sealed, as feasible.
  - Exterior Wall Air Sealing:
    - Intentionally ventilated walls shall not be sealed at vent locations (e.g., weep holes).
    - Backing or infill will be provided as needed to meet the specific characteristics of the selected sealant and the characteristics of the penetration.



SEAL LEAKS FROM APPLIANCE ENCLOSURE INTO THE LIVING SPACE

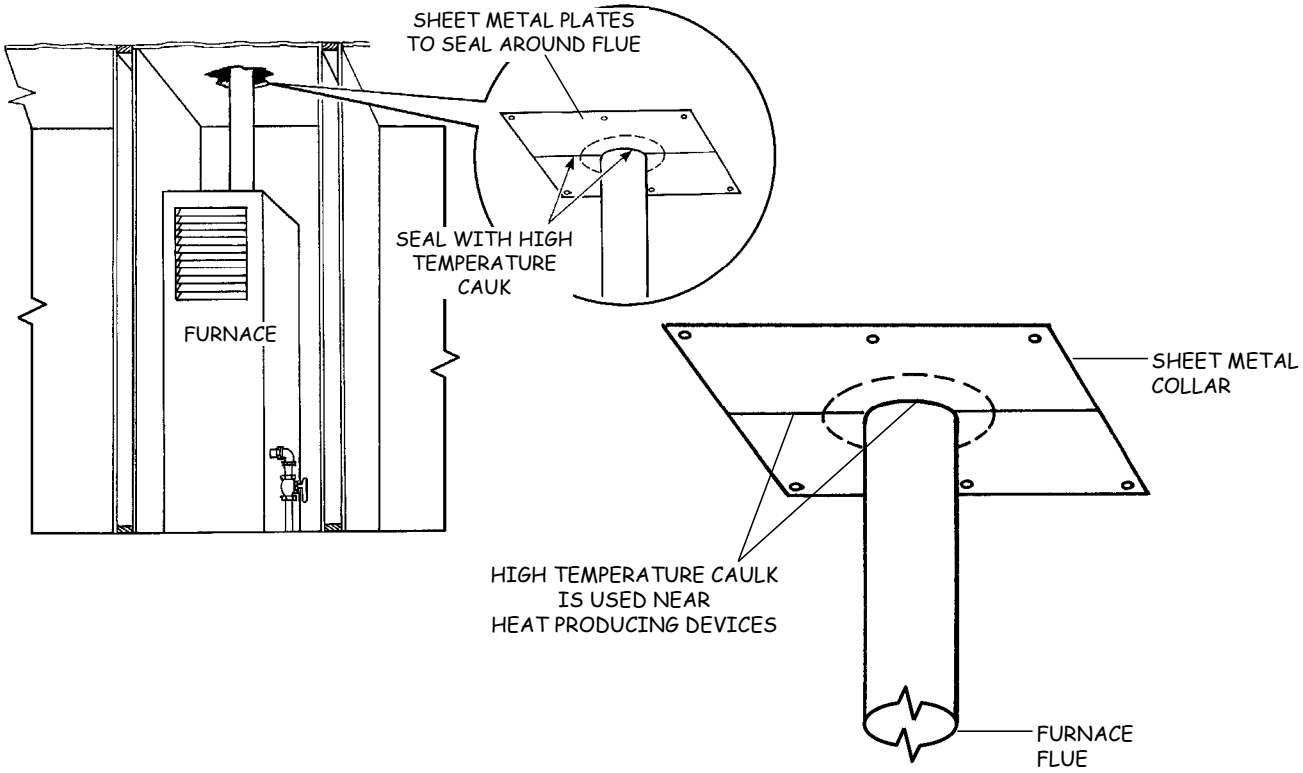
- **Marriage Line**
  - All accessible holes and penetrations at marriage lines will be sealed continuously at end walls, floors, and ceiling.
  - Backing or infill will be provided at the marriage line as needed.
  - All remaining gaps will be sealed with an approved material.
- **Ceilings**
  - Ceiling repair material must meet or exceed strength of existing ceiling material,
  - Ceiling repair must span from truss to truss or add blocking as needed for support,

12. CAULKING LOCATIONS IN MOBILE HOMES (cont.)

- **All accessible damaged**
  - Vapor barriers will be repaired.
  - Penetrations through the ceiling air barrier must be repaired.
- **Floors**
  - Floor repair material will meet or exceed strength of existing floor material.
  - Repair will span from joist to joist and blocking added as needed to support floor.
  - Patches smaller than 144 square inches will not require repairs from joist to joist.
  - Floor repair material will be glued, fastened, and air sealed.
- **Bellyboard**
  - Patching material will be provided as needed to meet the specific characteristics of the bottom board material and the characteristics of the hole.
  - Patch will be permanent and have a service life of a minimum of 20 years.
  - Patch will not bend, sag, or move once installed.
  - Bottom board penetrations
    - Combustion air supplies will be labeled for identification and will not be blocked or sealed.
    - Penetrations will be sealed to meet both the specific characteristics of the bottom board material and the characteristics (hole size and type) of the penetrations (e.g., electrical, PVC, gas line, dryer vent).

13. HEAT PRODUCING DEVICES IN MOBILE HOMES

- **Sealant**
  - High temperature sealant shall be used.
- **Flue Pipe Ceiling Penetrations**
  - Gaps up to 1/4" wide shall be:
    - Sealed with high temperature caulk, or
    - Repaired/patched.
  - Gaps over 1/4" shall be repaired/patched as prescribed in CSD WIS Section 7 (Minor Envelope Repair).



PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

14. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

15. WORKMANSHIP

- **General**
  - Gaps shall be filled with appropriate material as described in this standard, and completely cover gap.
  - Material shall be installed in conformance with manufacturer's instructions.
  - No restricted sealing materials shall be used where prohibited by manufacturer or WIS Appendix A.
  - Sealing work shall not create a fire hazard or other dangerous condition.
- **Finishing**
  - Caulking shall be evenly tooled, with excess material removed, to ensure a clean appearance and adequate seal.
  - Where required by this standard, caulking shall be painted or primed to prevent moisture intrusion.

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NOTES

WEATHERSTRIPPING

Lead Paint Risk Factor
LOW

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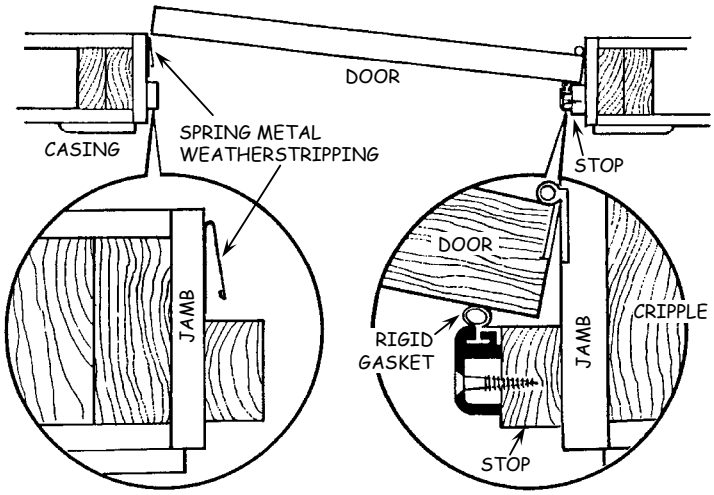
WEATHERSTRIPPING

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

WEATHERSTRIPPING REPAIR

Not applicable to this measure.

WEATHERSTRIPPING INSTALLATION



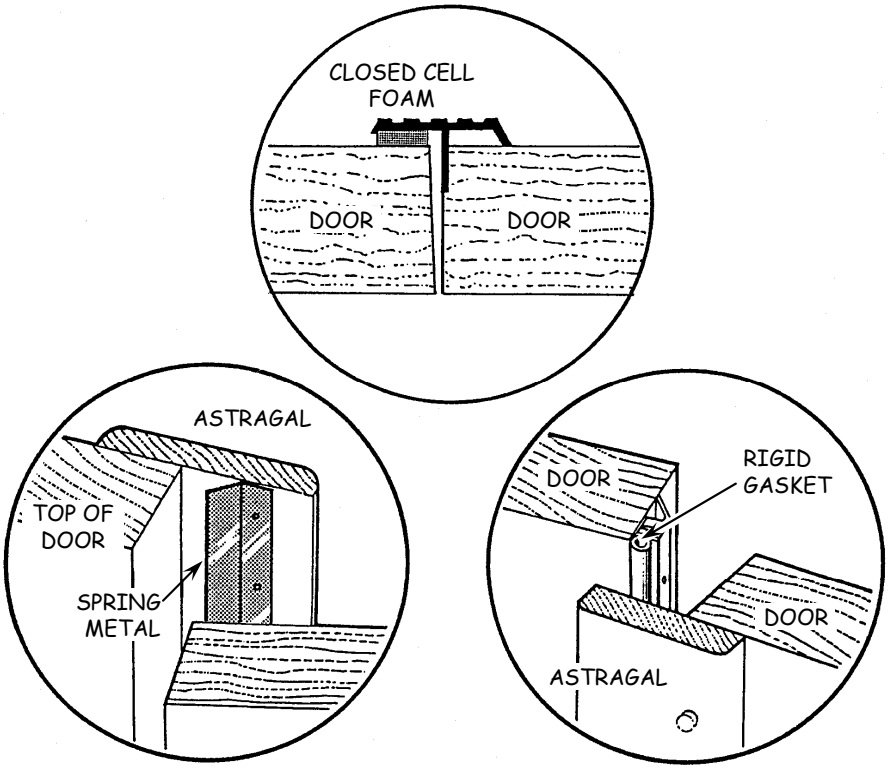
1. **GENERAL REQUIREMENTS**
   - **Weatherstripping shall effectively reduce air leakage without hampering window, door, or access cover operation.**
   - **Material Usage**
     - Products for jambs, door bottoms, and thresholds shall be installed full-length; splicing not allowed.
     - To the extent feasible, color must be compatible for surrounding surfaces:
       - Light-colored carrier (e.g., mill finish) and foam tape (e.g., white/off-white/light gray) in light-colored locations.
       - Darker carrier (e.g., bronze) and foam tape (e.g., dark brown or gray) in dark-colored locations.

BY TYPE	GENERAL REQUIREMENTS
Rigid Gasket Jamb Materials	• Solid extruded aluminum carrier products shall have a pliable gasket that effectively covers the gap between the door and jamb. • A complete seal shall be achieved, with maximum tolerance for seasonal changes (e.g., with a kerf or flap type gasket).
Vinyl V-Strip	• Shall be used only when no other material (including cushion synthetic) can feasibly be installed. • Shall be additionally secured with staples placed within 1" of each end and at intervals not exceeding 12".
Foam Tape and Round Tube	• Shall be used only in compression applications; not allowed where shear/friction movement occurs. • Closed cell foam tape: o Acceptable for sealing entrance doors with metal jambs. o Exposure to sunlight is acceptable. • Open cell foam tape o Acceptable for cooler vent covers, appliance enclosure door, and attic access only. o Shall not be used where exposed to sunlight.
Door Shoes	• Rain drip required on shoes in exterior locations exposed to precipitation.
Thresholds	• Shall be solid aluminum or hardwood; vinyl-top thresholds not allowed

2. DOOR JAMBS

- **Allowable materials include those listed below by location:**

BY LOCATION	ACCEPTABLE TYPES
Wooden Door Jambs	• Rigid gasket. • Spring or Cushion Metal • Replacement Kerf-in Bulb and Foam
Metal Door Jambs	• Rigid Gasket • Cushion Synthetic • Flanged Bulb • Closed Cell Foam
Astragals on Double Doors	• Rigid Gasket • Spring or Cushion Metal • Cushion Synthetic • Flanged Bulb • Replacement Kerf-in Bulb and Foam • Closed Cell Foam and Compression Bulb (in compression only)
Threshold Elevators/Shims	• Non-Wood: Aluminum and Plastic (e.g., Vinyl) • Solid Wood: Redwood, Cedar, Pressure-treated Fir, or Solid Hardwood (i.e., must be degradation-resistant and exterior grade).



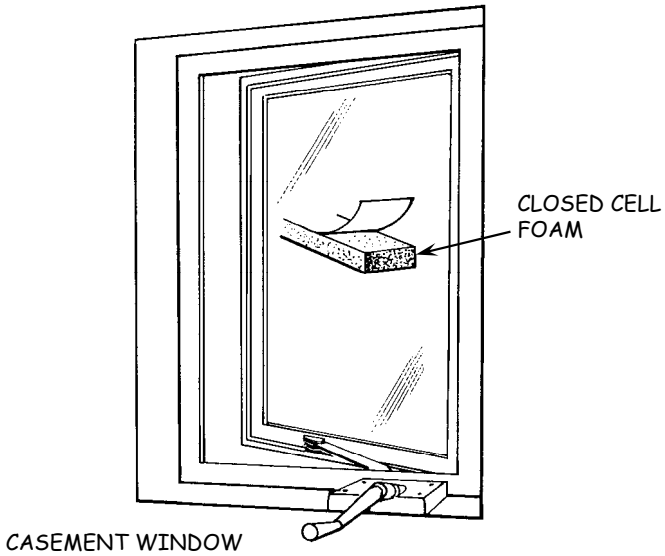
3. WINDOW WEATHERSTRIPPING

- **Materials**
  - Allowable materials include those listed below by window type.
- **Installation**
  - Existing weatherstripping and sash sealant shall be removed.
  - Surfaces where the sill meets the sash shall be cleaned.
  - Seal between the fixed components of the window (e.g., jambs, sill) shall be continuous and complete while maintaining the operability of the window.

3. WINDOW WEATHERSTRIPPING (cont.)

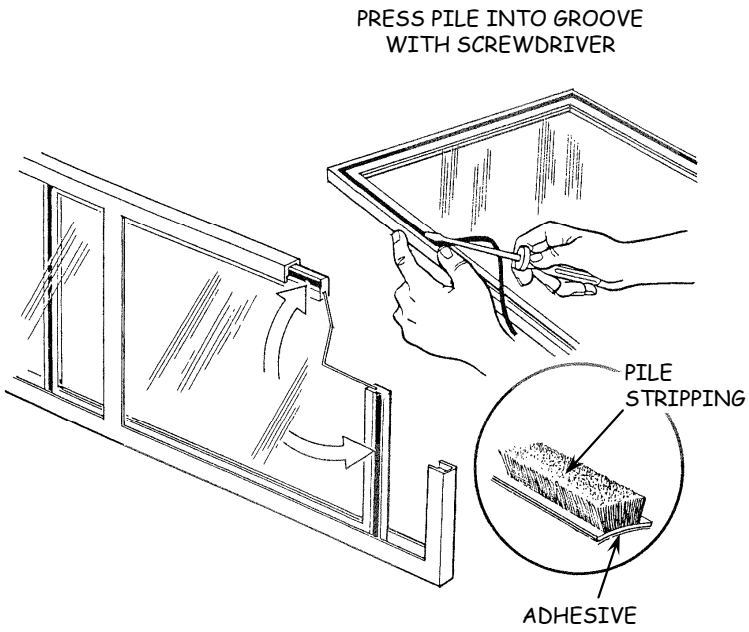
- **Installation (cont.)**
  - Continuous and complete weatherstripping will be installed on the bottom of the lower sash where it makes contact with the sill; and at the top of the upper sash, where it makes contact with the upper part of the window frame.
  - Sill will be water-sealed and primed.
  - Stops will be adjusted to eliminate visible gaps between the stops and the jamb while maintaining operability of the window.
  - Stops will be installed to keep the window securely in place.
- **Sash Locks**
  - Locks will be installed to prevent catastrophic leakage (i.e., so that rails of the upper and lower sashes are flush and in full contact).
  - No gaps shall be visible between the two sashes.
- **Operable Windows**
  - All egress windows shall be operable when required by local code.
  - Items that reduce air infiltration will be repaired, replaced, sealed, or installed to prevent catastrophic leakage infiltration (e.g., new latch for meeting rail connection, pulley seals, rope caulking for other cracks, interior storm windows).
- **Water Infiltration**
  - Details that reduce water infiltration will be repaired, replaced, or installed (e.g., replace missing glazing compound on sash, exterior caulking, and exterior storm windows).

BY WINDOW TYPE	ACCEPTABLE TYPES	
Metal Casements	• Cushion Synthetic • Closed Cell Foam	• Rigid Gasket
Wooden Casements	• Cushion Synthetic • Spring or Cushion Metal	• Closed Cell Foam • Rigid Gasket
Wooden Double-Hung	• Rigid Gasket • Spring or Cushion Metal • Flanged Bulb	• Closed Cell Foam • Vinyl or Metal Jamb Liner



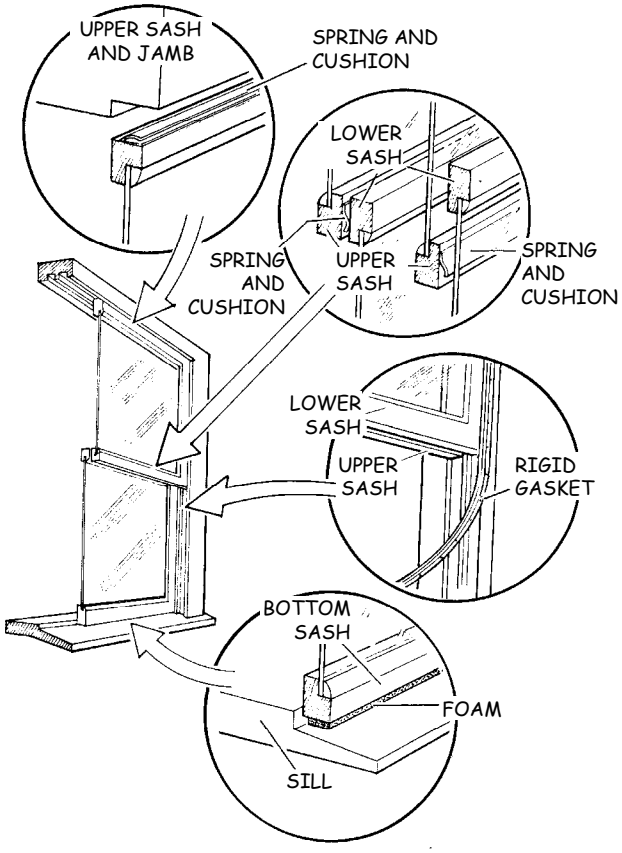
3. WINDOW WEATHERSTRIPPING (cont.)

BY WINDOW TYPE	ACCEPTABLE TYPES
Metal and Plastic Vertical Sliders	• Cushion Synthetic • Flanged Bulb • Closed Cell Foam • Vinyl Jamb Liner
Horizontal Sliding Aluminum Windows and Glass Doors	• Replacement Pile • Cushion Synthetic • Flanged Bulb • Closed Cell Foam
Awning and Jalousie Windows	• Commercially available specialty materials may be installed on windows with functional operating mechanism. • Weatherstripping shall effectively reduce air leakage without hampering window operation.



4. PLACEMENT

- **All Units**
  - Weatherstripping shall be placed only at moveable joints on windows and doors between conditioned and unconditioned space.
  - Weatherstripping shall be installed and adjusted to provide a continuous barrier to infiltration along its entire length.

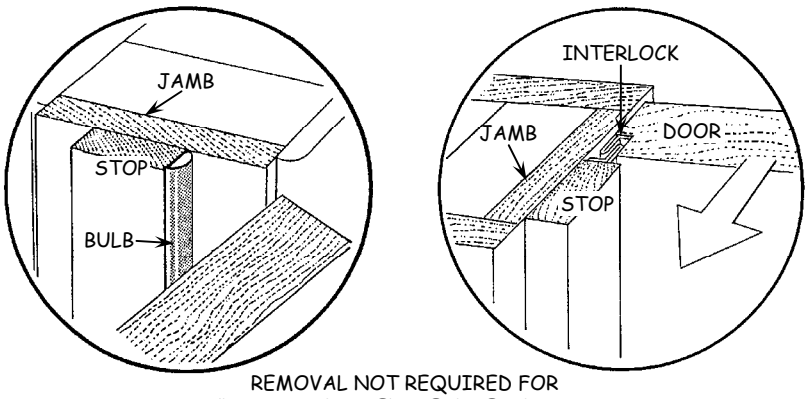


5. SAFETY PRACTICES

- **When metal stock is cut or trimmed:**
  - Burs shall be removed.
  - Sharp edges and ends (e.g., on rain drips) shall be rounded and smoothed.

6. EXISTING WEATHERSTRIPPING

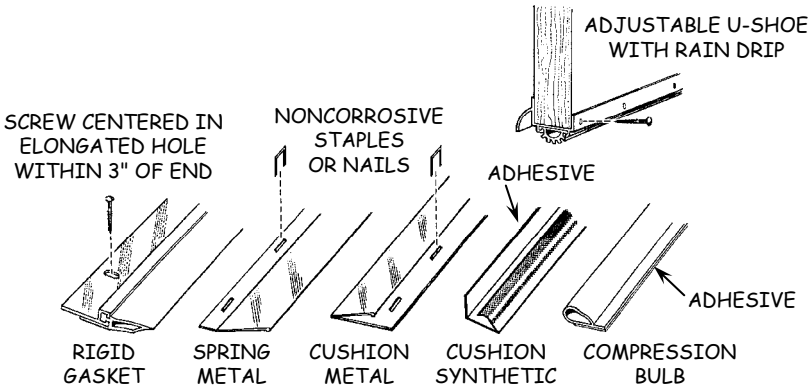
- **Doors with <u>Factory-Installed</u> Weather-stripping**
  - Includes interlock and kerf-in bulb and magnetic types.
  - Removal of existing weatherstripping not required <u>if</u> existing material does <u>not</u> interfere with proper operation of the door and the new weatherstripping, <u>and</u> if the CSD Field Guide does not specify removal of such material.
  - Retrofit weatherstripping shall be installed on all three sides of the jamb.
- **All Other Doors**
  - Retrofit weatherstripping shall <u>not</u> be added until faulty weather-stripping is removed.



REMOVAL NOT REQUIRED FOR FACTORY-INSTALLED WEATHERSTRIPPING, SUCH AS INTERLOCK AND BULB TYPES

7. ATTACHMENT

- **All Types**
  - Manufacturer's instructions shall be followed.
- **Rigid Gasket, Shoes, and Sweeps**
  - Shall be adjustable and attached with screws located within 3" of each end and at intervals not exceeding 9".
- **Spring and Cushion Metal**
  - Mechanical attachments (e.g., 1/4" x 3/8" staples) shall be placed within 1" of each end and at intervals not exceeding 4".
- **Cushion Synthetic, Flanged Bulb, and Foam Tape**
  - Mounting surface shall be thoroughly cleaned.
  - Existing adhesive residue shall be removed with solvent.
- **Corner Pads**
  - Adhesive backing shall be supplemented with staples, tacks, etc. which penetrate wood 3/8" minimum.
- **Replacement Pile**
  - Shall fit snugly into retaining channel.



- **Mechanical Attachment**
  - Rigid gaskets, shoes and sweeps shall be attached with non-corrosive metal pan head Phillips screws.
    - Head diameter shall be no *larger* than 2 times the width of the elongated mounting hole.
    - Manufacturer-supplied Phillips-head screws shall be used.

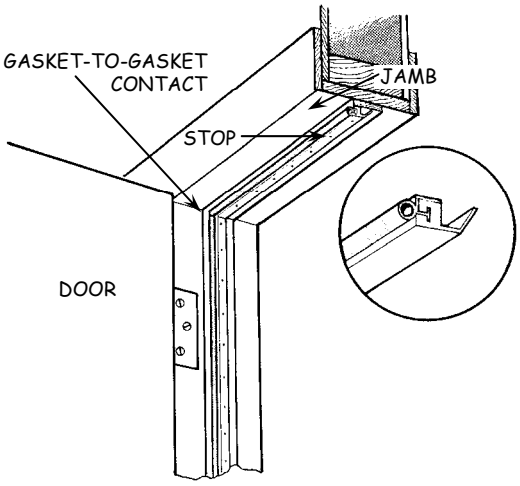
8. FIRE-RATED DOORS AND JAMBS

- **All Listed/Labeled Metal and Wooden Doors and Jambs with a Fire Rating of 20 Minutes and Greater**
  - Weatherstripping materials and installation shall meet specifications and listing requirements of the door and jamb manufacturer(s), with written documentation placed in client file.
  - Screws shall not be installed in the door or jamb, unless allowed by the door and jamb manufacturer(s), with written documentation placed in client file.

9. DOOR JAMB WEATHERSTRIPPING INSTALLATION

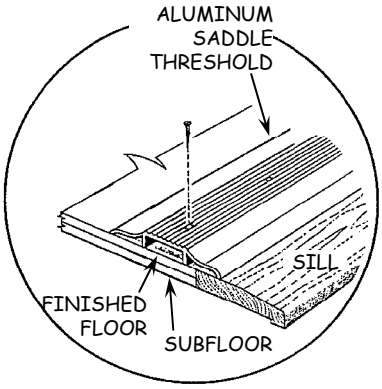
- **All Material Types**
  - Corners and joints shall be trimmed to provide a continuous barrier to infiltration without unnecessary gaps between adjoining legs.

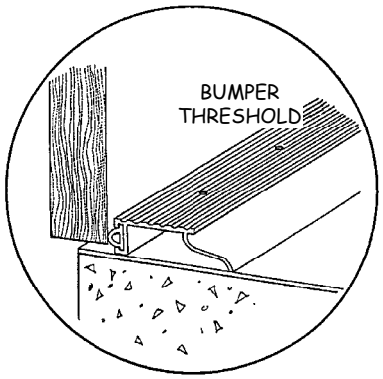
- **Rigid Gasket**
  - Screws shall be positioned to allow for adjustment of carrier.
  - Gasket Contact
    - Gasket-to-gasket contact required at corners.
    - Gasket-to-threshold contact required at bottom.
    - Seal shall not be achieved by the addition of caulk.
- **Spring and Cushion Metal, and Cushion Synthetic**
  - Sealing surfaces shall be mitered at the corners.
  - Ends shall be overlapped when possible to provide a seal when compressed.
- **Foam Tape and Flanged Bulb**
  - Material shall be joined at corners, and mitered as needed to seal joint.



10. THRESHOLD INSTALLATION

- **All Thresholds**
  - Shall extend above the interior finished floor a maximum of 1", or 1/2" if any occupant is physically handicapped (e.g., uses a wheelchair or walker).
  - Ends of threshold shall be cut to match the contour of the jamb (i.e., notched to fit snugly around jamb, stop, trim, etc.).
  - Threshold perimeter shall be sealed (e.g., by caulking the ends and, where applicable, the front and back edges).
  - Saddle threshold shall be installed where possible.
- **Metal Thresholds**
  - Saddle threshold shall have floor-sealer gaskets in place.
  - A bumper threshold may be used on out-swinging door for which a threshold-and-shoe combination cannot be feasibly installed (e.g., when bottom of closed door is not entirely above floor surface).
  - Threshold shall be permanently screwed in place.





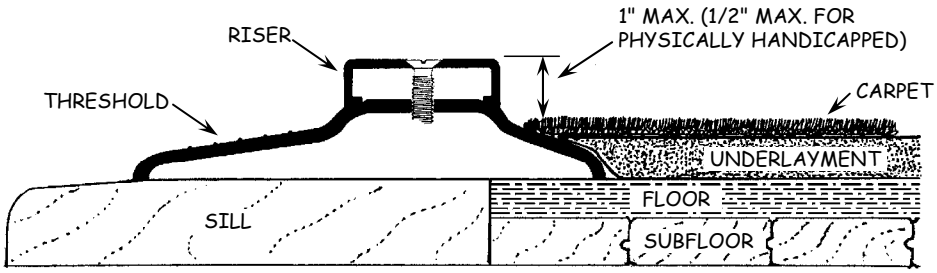
11. WOODEN SADDLE THRESHOLDS

- Threshold shall be sealed to the floor with glue, or elastomeric caulk, or floor-sealer gaskets.
- Threshold shall be mechanically secured with countersunk nails or screws.
- Nails shall be countersunk and holes shall be filled with exterior grade filler/putty.

- **Low-Profile Thresholds (Maximum 1/4" Height)**
  - Shall be installed when an interior door has no existing threshold, such as:
    - At a step-down from the living space to an unconditioned area (e.g., kitchen to garage).
    - On a floor continuing flat into an unconditioned area (e.g., from kitchen into utility room or, in an apartment complex, from the living area into an unheated common hallway).
  - Shall be installed when replacing an existing defective low-profile threshold.

12. THRESHOLD RISERS AND ELEVATORS/SHIMS

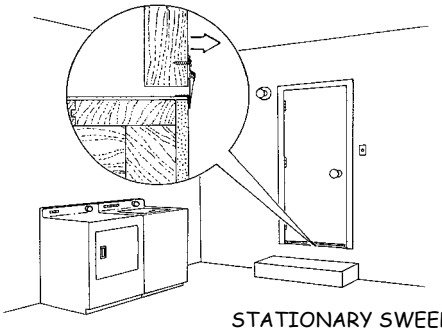
- **All Thresholds**
  - When a riser is installed on top of an existing threshold:
    - It shall be installed full length, *without* splices.
    - It shall be compatible with threshold.
    - Metal risers shall be used on metal thresholds, and hardwood risers shall be used on wooden thresholds.
    - Field-fabricated risers, when allowed, shall:
      - Be made of solid stock that: (a) equals threshold length, (b) is 80% to 100% of the width of the top surface, and (c) has evenly rounded or beveled top edges.
      - Have a minimum of 4 countersunk holes, located within 3" of each end and equally spaced in the field.
  - Top of riser shall extend above the interior finished floor a maximum of 1", or 1/2" if any occupant uses a wheelchair or walker.
  - Riser shall be securely attached with countersunk screws.
- **Threshold Elevators/Shims**
  - All Elevators/Shims shall be:
    - A solid block of decay resistant wood (e.g., cedar, redwood, white oak).
    - Installed securely under the threshold, and trimmed to conform to the footprint of the threshold.



13. ENTRANCE DOOR BOTTOM INSTALLATIONS

- **Shoes**
  - Solid aluminum carrier, except plastic units when aluminum will not fit and door cannot be cut, per the CSD Field Guide.
  - Tall (e.g. 3” high) U-Shoe may be used when door bottom is cut too short or is too worn/weak to accept a standard (1-1/2” high) U-shoe.
- **Shoe-and-Saddle Threshold Combination**
  - Shoe-and-saddle combination shall be used where possible.
  - L-shoe may be installed only where U-shoe cannot be installed (e.g., non-standard door thickness or metal-clad door).

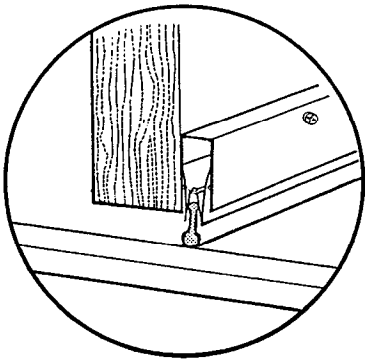
- **Stationary Sweeps**
  - Allowed only when no other door bottom treatment is feasible.
  - Sweep shall seal along the entire length of the gasket.
  - In-Swinging Doors
    - Sweeps shall be installed on the interior side of an exposed exterior door.
  - Out-Swinging Doors in Sheltered Locations (e.g., Inside Garage)
    - Sweeps shall seal against a threshold or a vertical surface (e.g., sill-nosing).
    - Sweep may be installed on the outward side of the door.



STATIONARY SWEEP SEALING AGAINST NOSING

- **Retractable Sweeps (Automatic Door Bottoms)**
  - An automatic door bottom shall be installed only when:
    - There is no threshold over the finished floor, and/or
    - A shoe-and-saddle combination is not feasible.
  - Sweep shall seal against floor or threshold along entire length of gasket.
    - *Exception*: 100% seal not required at ceramic tile grout lines.
  - Ends of gasket shall be trimmed long enough to extend from jamb to jamb when door is closed.
  - Door bottom shall be attached securely with screws which penetrate solid wood.

AUTOMATIC DOOR BOTTOM

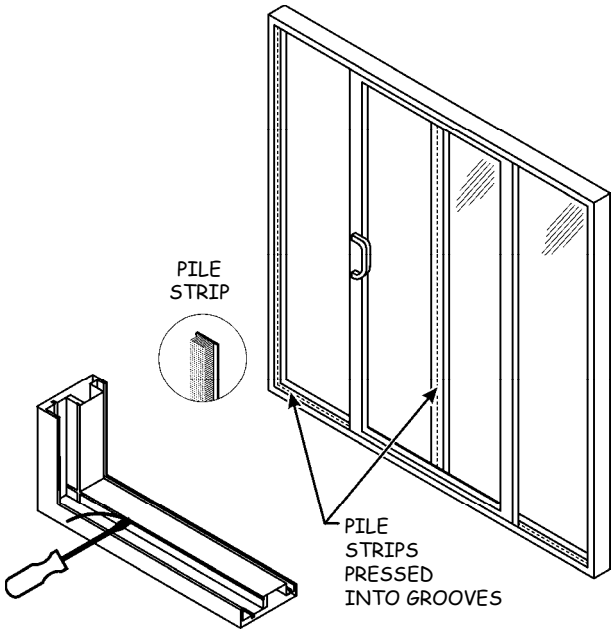


RETRACTABLE SWEEP GASKETS MUST SEAL ALONG ENTIRE WIDTH OF DOOR

- **All Door Bottoms**
  - Weatherstripping material shall not drag on the floor covering (wood, tile, carpet, etc.).

14. SLIDING GLASS DOORS AND WINDOWS

- **Pile**
  - Worn pile shall be replaced when feasible.
  - Replacement pile shall be installed in the retaining channels, after existing pile has been removed.
- **Self-adhesive Compression Material**
  - Cushion synthetic, flanged bulb, or closed cell foam tape shall be installed in compression location only (e.g., on the latch side of the jamb).
  - Existing material shall be removed and the surface cleaned prior to installing new material.
  - Following installation, the door or window shall close and latch properly.

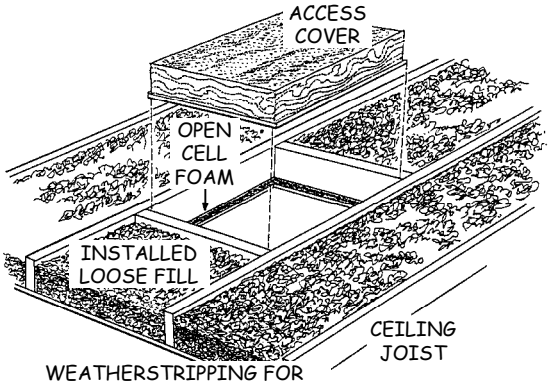


15. APPLIANCE ENCLOSURE DOORS

- **Weatherstripping shall be installed to seal appliance from living space in conformance with the CSD Field Guide Appendix A (CAS Protocol).**
- **Jamb Materials**
  - Rigid Gasket, Spring and Cushion Metal, Cushion Synthetic, Flanged Bulb, Open or Closed Cell Foam Tape (depending upon exposure to sunlight).
  - Vinyl V-Strip, per Item 1.
- **Door Bottom and Threshold Materials**
  - Materials approved for entrance doors shall be used (e.g., bumper threshold at bottom, and rigid gasket, spring metal or self-adhesive material on jamb).

16. ATTIC AND CRAWLSPACE ACCESS COVERS/DOORS

- **Location**
  - Only functional attic entry doors/covers accessed from conditioned space shall be weatherstripped.
  - Damaged/missing covers shall be replaced.
- **Materials**
  - Horizontal Access Doors/Covers
    - Weatherstripping material shall not create *more* than a 3/16" gap between door and retaining surface.
    - Visible material, when possible, shall blend with paint color (i.e., light-colored gasket with light-colored ceiling/lid/trim).
    - Open cell foam is standard; however, closed cell foam, cushion synthetic, and flanged bulbs are acceptable if thickness is 3/16" or less after access door/cover is closed.
  - Vertical Access Doors (i.e., Knee Wall Door)
    - Materials approved for entrance doors shall be used.
- **Mounting Surface**
  - Weatherstripping shall be installed on surface providing best adhesion (i.e., smooth wood trim rather than textured drywall lid).
  - Mounting surface shall be free of dust, dirt, and debris.

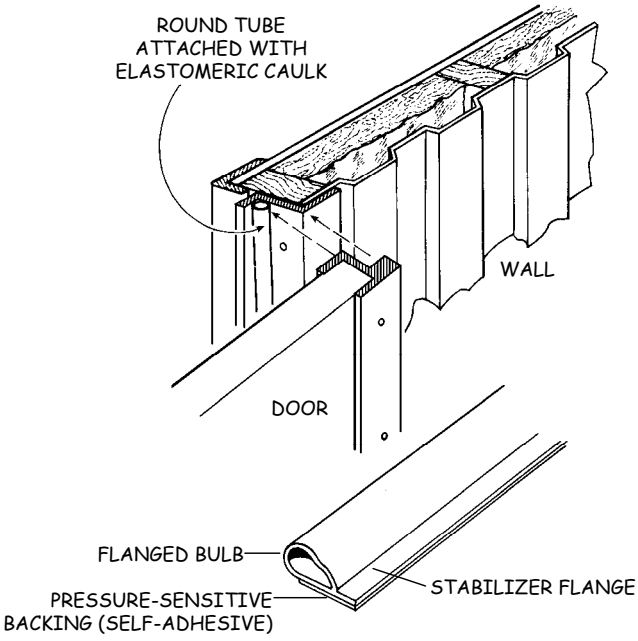


17. HOUSE TO GARAGE DOOR

- **Weatherstripping**
  - Weatherstripping, door sweep, and threshold will be installed to stop air leakage.
  - Broken glass panes in doors will be replaced, pointed, and glazed where allowed in accordance with Window Replacement policies in the CSD Field Guide.

PART 2: MOBILE HOME CRITERIA

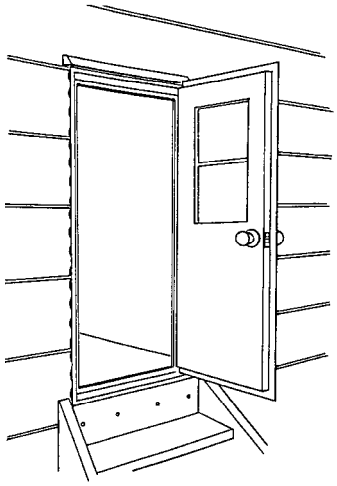
18. INSTALLATION AND ATTACHMENT



- **Replacement Pile**
  - Shall fit snugly into retaining channel.
- **Materials Attached with Adhesive**
  - Self-adhesive backing shall have a minimum adhesion strength of 65 oz./in.
  - Pre-existing weatherstripping materials and adhesive shall be removed to the extent feasible.
  - Mounting surface shall be thoroughly cleaned.
- **Flanged Bulb (i.e., Silicone or TPE Gasket with Stabilizer Flange)**
  - Material shall be installed as prescribed by manufacturer.
- **Round Tube Without Flange (e.g. Silicone or TPE Tube)**
  - Material shall be installed in compression application only.
  - Tube shall be attached with elastomeric sealant (e.g., silicone caulk) or other method specified by manufacturer.
  - Tube shall be placed only in a corner formed by two perpendicular surfaces.

19. FLUSH-MOUNT DOORS WITH EXTERNAL FLANGE/FIN

- **Door Bottom**
  - A door shoe or shoe-and-threshold combination shall be utilized.
  - If not feasible, a bumper threshold is allowed.
- **Jamb**
  - When mechanically-attached materials are not feasible, the most effective and durable of the following alternatives shall be used:
    - Cushion Synthetic.
    - Flanged Bulb.
    - Closed-Cell Foam Tape.
    - Round Tube.
    - Vinyl-V Strip.
  - Installation shall be in conformance with applicable criteria in Items 7 and 9.



FLUSH-MOUNT MOBILE HOME DOOR

20. WINDOWS IN EXTERIOR DOORS

- **Windows shall be weatherstripped in conformance with this section.**

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

21. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

22. OPERATION

- **After weatherstripping is installed:**
  - Doors and windows shall function properly and close without unusual force, and
  - All functioning locks shall latch properly.

23. CLIENT INSTRUCTIONS (DOORS & WINDOWS)

- **Windows and Doors**
  - Clients shall be notified of changes or repairs made, and will be educated on how to operate and maintain windows and doors.
  - Clients shall be notified of changes or repairs made and will be educated on how to operate and maintain weatherstripping and caulk around door and trim.
- **House to Garage Doors**
  - Client shall be educated on need to keep door from garage to house closed, and not to warm up vehicles or use any gas engine appliances or grills in the garage (even if the main door is left open).

24. WORKMANSHIP

- **General**
  - Weatherstripping shall form an effective infiltration barrier with appropriate material as described in this standard.
  - No restricted sealing materials shall be used where prohibited by manufacturer or WIS Appendix A.
  - Sealing work shall not create a fire hazard or other dangerous condition.
- **Finishing**
  - Metal corners shall be rounded gently to prevent client injury.
  - Weatherstripping material shall be evenly adjusted to ensure even sealing.
  - No corners shall be crimped, or material shall be damaged, creating infiltration potential.

VENT COVERS—INTERIOR

Lead Paint Risk Factor
NONE-LOW

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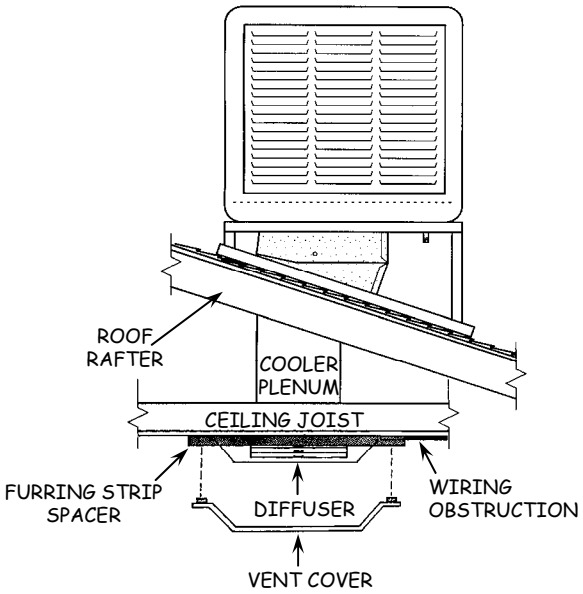
VENT COVERS—INTERIOR

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

VENT COVER REPAIR

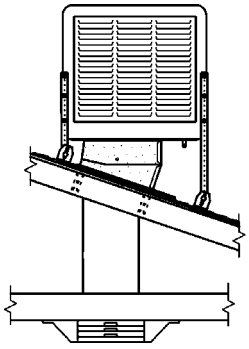
Not applicable to this measure.

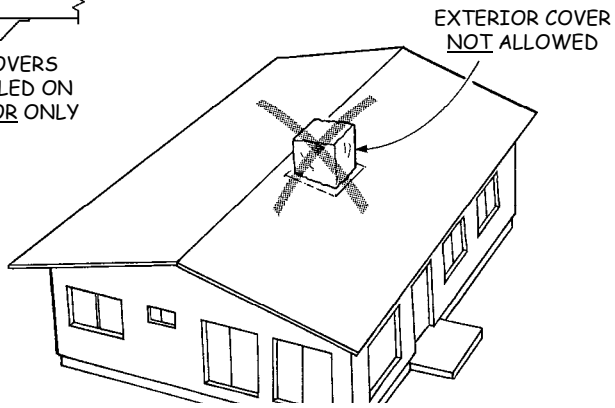
VENT COVER INSTALLATION



1. LOCATION

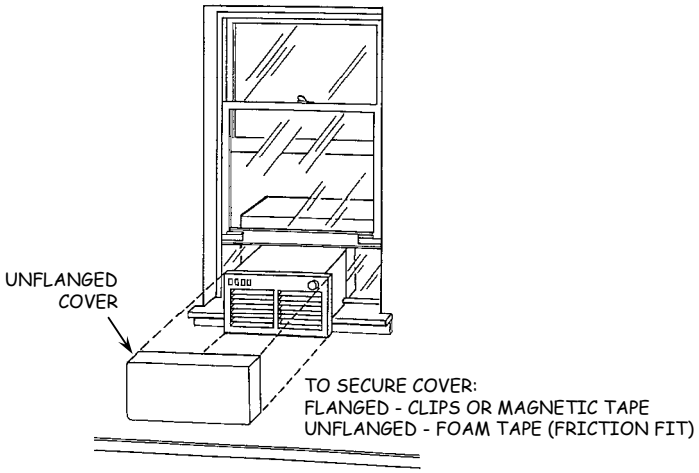
- **Placement**
  - Cover shall be placed to block infiltration at window/wall air conditioner vents and evaporative cooler interior vents.
  - Interior installations only; exterior covers not allowed.
    - *Exception:* Window/wall air conditioner may have an outdoor cover, when access to install and remove the cover is acceptable to the occupants.
  - Exterior covers for wall/window units allowed only in easily-accessible locations. The unit must be in a location that:
    - Is free of obstructions and reachable from ground level.
    - Allows easy removal and reinstallation of the cover.
  - All wall and ceiling vents must be covered.
- **Shared Ducts**
  - Cover shall not be installed when the cooler and a heating unit use a common duct system.
  - For ducted evaporative coolers that use ducts not shared with a FAU, preformed plastic vent covers are not feasible.
  - Cut and install vinyl-faced flexible magnetic sheets to size, and place over the flat surface of each register, when feasible.
- **Dedicated Ducts with Metal Supply Registers**
  - Registers shall be blocked with magnetic sheeting trimmed to cover the register surface.





2. EASY REMOVAL

- **All Units**
  - Cover shall be held securely in place, yet be easy to install and remove.
- **Flanged Covers**
  - Cover shall be secured with rotating clips or magnetic strips.
- **Covers Without Mounting Flange**
  - Cover may be held in place with weatherstripping (e.g., foam weatherstripping tape installed on interior for a friction fit).

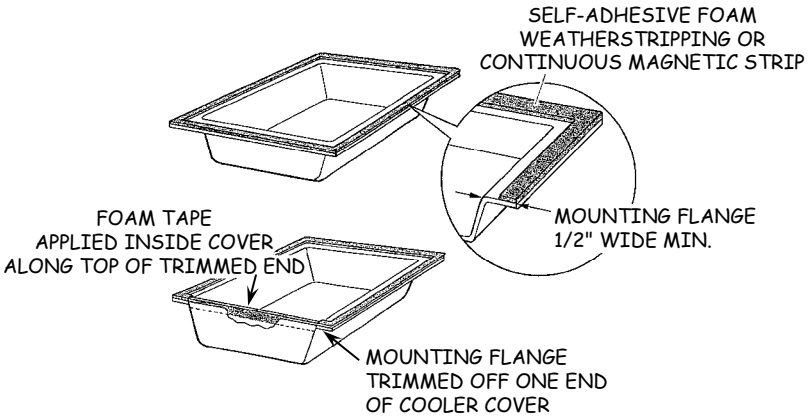


3. MOUNTING FLANGE

- **Unobstructed Locations**
  - Each edge of the cover shall be a minimum of 1/2" wide to accommodate attachment and weatherstripping.
- **Obstructed Locations**
  - Flange may be trimmed on one side to facilitate installation <u>if</u> cut side can be sealed against air leakage.

4. WEATHERSTRIPPING

- **All Covers**
  - Perimeter of cover shall be sealed against air leakage.
- **Weatherstripping Materials**
  - Open cell foam or hollow gasket weatherstripping.
  - Magnetic strip may be used in lieu of weatherstripping if an airtight seal is achieved (i.e., installed without gaps).



5. FURRING STRIPS

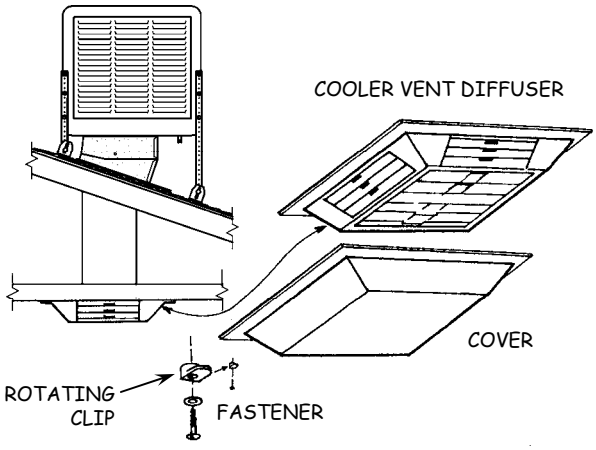
- **Obstructed Locations**
  - Furring strips may be installed as spacers that allow the cover to clear the obstruction (such as an electric wire).
  - Furring strips shall:
    - Be made of finished wood.

- Be securely attached to the structure.
- Create a continuous, smooth mounting surface for the cover.

- Gap/hole created by obstruction shall be sealed (e.g., with caulk).

6. ATTACHMENT

- **All Types**
  - Attachment shall be secure and permanent.
- **Screws**
  - Screws shall penetrate:
    - Solid wood at least 1/2", or
    - Sheet metal, or
    - An anchoring device (e.g., drive or expansion type anchor).
- **Rotating Clips**
  - Barrel of clip shall rest on mounting surface.
  - Clips shall be placed within 4" of each corner, minimum of two clips per side.
    - *Exception:* One clip centered along the side is acceptable on sides 14" or shorter.
  - Clip and cover shall be made of compatible materials.
    - Metal clips shall be used with metal and wood frames.



- **Magnetic Tape**
  - Tape shall be:
    - Permanently attached to mounting surface and cover.
    - Adequate to hold cover securely in place.
    - Continuous around the entire perimeter if weatherstripping is not used.
- **Magnetic Sheeting**
  - Magnetic strength shall be adequate to tightly secure the sheet to metal registers.
  - Sheet must be neatly, squarely cut to cover the flat surface of the register.
  - A small slot shall be cut for the damper control arm, with a slit cut from end of cover to arm slot, to enable installation of cover around the arm.
- **Multi-Piece Covers**
  - Pieces shall be bonded together per manufacturer's instructions and installed/secured as a one-piece rigid cover.
- **Anchors (Drive Anchors, Expansion Anchors, Molly Bolts, etc.)**
  - Mounting surface shall be appropriate and conform to manufacturer's installation specifications.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

7. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

8. CLIENT EDUCATION

- **Use of Vent Covers**
  - Occupants must be educated on the proper use of vent covers, including installation and removal.
  - When interior vent covers are not feasible, occupants shall be advised to close internal dampers (when present) during the heating season.
  - When a vent cover must be in place because a furnace vent terminates too close to the cooler intake, occupants must be advised to always keep the vent cover properly installed during the entire heating season.

9. WORKMANSHIP

- **General**
  - All installed vent covers shall be secure and seal smoothly in accordance with this standard to prevent infiltration.

COVER PLATE GASKETS

Lead Paint Risk Factor
NONE-LOW

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COVER PLATE GASKETS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

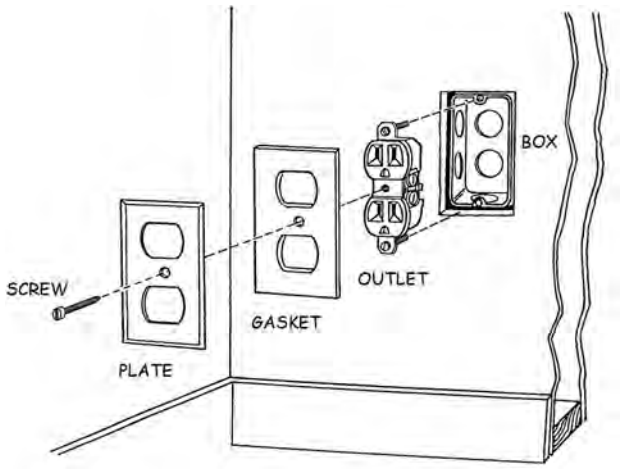
GASKET REPAIR

Not applicable to this measure.

GASKET INSTALLATION REQUIREMENTS

1. LOCATION

- **Gaskets shall be installed:**
  - Under cover plates located on the inside of walls between conditioned and unconditioned space, limited to:
    - Electrical switches and receptacles.
    - Telephone jacks and TV cable lines.
  - To remove a painted-on cover plate use a sharp utility knife blade to carefully cut the paint around the edges of the plate.



2. INSTALLATION

- **All Locations**
  - Gasket shall match switch/receptacle style.
  - Standard switches and receptacles:
    - Factory-made gaskets.
  - Rocker-style switches and rectangular receptacles (e.g., GFCI):
    - Factory-made, when available, or cut to fit.
  - Gasket shall cover the gap between the utility box and the surrounding wall material.
  - When utility box is an odd size and standard gaskets will not work, gap between box and wall shall be caulked when feasible.
  - Plate shall cover gasket completely.
  - Broken or missing cover plates shall be replaced.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

3. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

Not applicable to this measure.

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NOTES

GLASS REPLACEMENT AND WINDOW REPAIR

Lead Paint Risk Factor
LOW-HIGH

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GLASS REPLACEMENT AND WINDOW REPAIR

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

WINDOW REPAIR

1. WINDOW REPAIR LIMITATION

- **Window repairs are limited to repairs to make a window frame structurally sound and functional and eliminate catastrophic leaks, and as described in the CSD Field Guide.**

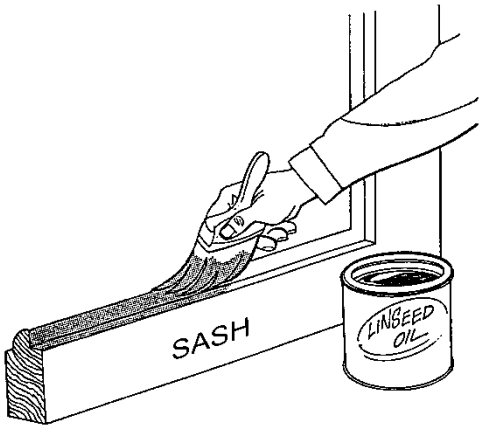
2. OPERABLE WINDOWS

- **Operable windows (movable sashes) shall not be converted to fixed panes.**

GLASS REPLACEMENT

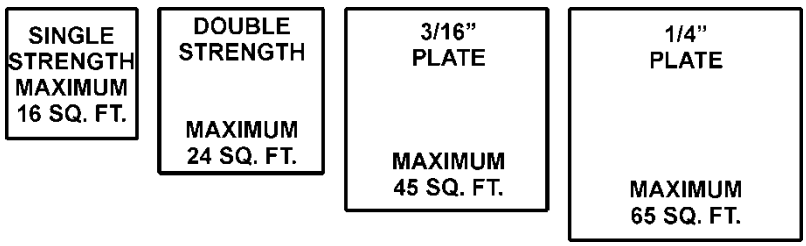
3. PRE-TREATMENT OF SASH

- **All Sashes**
  - Glass channel shall be clean and free of debris.
- **Wood Sashes**
  - Shall be treated with linseed oil before glazing compound is installed.
- **Metal Sashes**
  - Rust shall be removed from steel sashes, and a minimum of one coast of rust-inhibiting metal primer shall be applied.



4. MATERIAL REQUIREMENTS

- **Replacement Glass**
  - Replacement glass will be sized to original width, height, and depth.
- **Single Strength (SS)**
  - Allowed when double strength (DS) is too thick for the frame.
  - Maximum pane size: 16 sq. ft.
- **Double Strength (DS)**
  - Recommended to replace SS when frame thickness is adequate.
  - Maximum pane size: 24 sq. ft.
- **3/16" Plate Glass**
  - Maximum pane size: 45 sq. ft.
- **1/4" Plate Glass**
  - Maximum pane size: 65 sq. ft.
- **Fully Tempered Glass**
  - Multiply the above listed sizes by 4.
- **Heat Strengthened Glass**
  - Multiply the above listed sizes by 2.



- **Plastic Materials**
  - UV treated polycarbonate, minimum of 1/8" thick
  - All sheeting shall have sufficient rigidity to prevent bowing after installation.
  - Acrylic sheets and plastic film are not allowed.
- **Jalousie Windows**
  - Minimum 3/16" glass shall be installed.
  - Maximum pane length shall be 48".
  - All attachment clips must be present.
  - Regular, patterned, frosted, tempered, and heat strengthened glass allowed.
  - Wired, laminated, and sandblasted glass not allowed.
- **Safety Glazing**
  - Safety glazing shall be permanently labeled per the current California Residential Code (CRC)[1]. (See Item 5.)
- **Glass Quality**
  - Quality of the replacement glass shall equal or exceed that of the existing glass.


MINIMUM 3/16" PLATE GLASS IN JALOUSIE WINDOWS

5. SAFETY GLASS REQUIREMENT

- **Safety glass shall be installed per the current California Residential Code[2], *part of which* is summarized below.**

- **CRC Windows Requirements Summary**
  - Safety glass is required in any window adjacent to a door where:
    - The nearest vertical edge is within 24" of the door, and
    - The bottom edge is *less* than 60" above the floor.
    - *Exception:* Not required when there is an intervening wall or other permanent barrier between the door and the glazing.

  - Safety glass is required in panes *larger* than 9 sq. ft. where:
    - The bottom edge is *less* than 18" above the floor, and
    - The top edge is *more* than 36" above the floor, and
    - A walking surface is within 36" horizontally of the window.
    - *Exception:* As defined in in the CRC[3].
  - Safety glass is required when the bottom edge of the glazing is less than 36" above the walking surface of a stairway or landing shall be installed in accordance with the CRC requirements.
  - Safety glass is required in shower and bathtub enclosures for exterior windows *less* than 60" above the floor of the enclosure.
- **Entrance Doors with Glazing**
  - Safety glass is required in all doors with glazing.
  - *Exceptions:* (a) jalousie windows, and (b) windows with panes *less* than 3" in width or height.
- **Plastic Glazing**
  - Polycarbonate shall be used instead of safety glass when allowed by the local jurisdiction and approved by the client.

6. BATHROOM WINDOWS

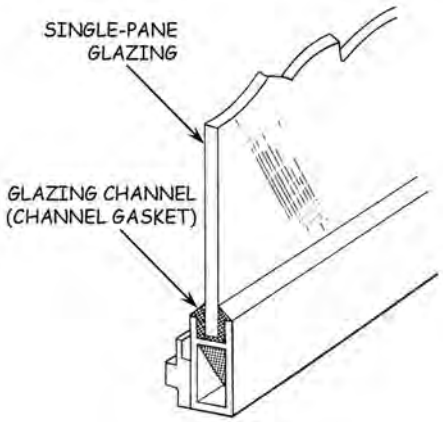
- **Obscure Glass**
  - Obscure glass on the ground floor shall be replaced with obscure glass, if bottom edge of window is *less* than 60" above finished floor.

7. GLAZING COMPOUND

- **Requirement**
  - Glazing compound shall be installed according to manufacturer specifications.
  - Shall be used in sashes designed to use glazing compound.
  - Caulk not allowed instead of glazing compound.

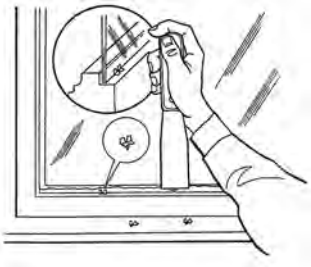
8. GLAZING CHANNEL

- **Metal and Vinyl Windows**
  - A watertight seal shall be present all around the sash.
  - Glazing shall be sealed/secured with glazing spline, glazing channel (channel gasket), or snap-in glazing bead.
- **New replacement gasket/spline shall be:**
  - Installed when feasible.
  - Proper size to form snug fit in channel.
- **Existing gasket/spline may be reused.**
  - Shall be in satisfactory condition to provide a complete seal.
  - Clear silicone caulk or equivalent may be added to fill in the gaps.
- **Where proper gasket/spline cannot be provided, glass shall be stabilized in clear silicone caulk or equivalent.**



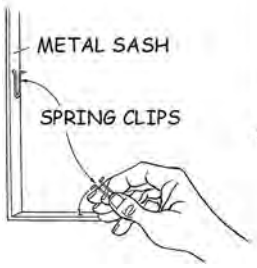
9. WOOD SASH

- **Push points shall be installed:**
  - A maximum of 8" apart.
  - Within 4" of each corner.
  - On each side to secure glass in frame.



10. METAL SASH

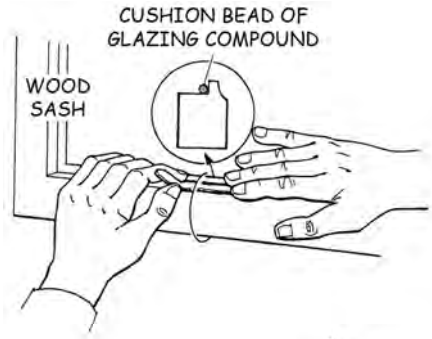
- **Spring Clips shall be reinstalled:**
  - A maximum of 12" apart, and
  - Within 4" of each corner).
- **Continuous Angles or Stops**
  - Shall be properly reinstalled (e.g., with screws or snap-in spring retainers) to keep glass securely in place.



- **Glazing Splines**
  - Spline cords shall be properly reinstalled to keep glass securely in place.
  - Replacement glazing splines (e.g., aluminum or vinyl) may be installed when the original splicing splines cannot be reused.

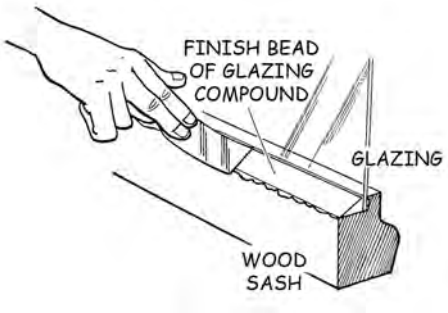
11. CUSHION BEAD

- **Wood and Metal Sash**
  - Cushion bead shall be continuous and free of voids.
- **Wood Sash**
  - Glazing compound shall be used.
  - Caulk shall not be used.



12. FINISH BEAD

- **Wood Sash**
  - Finish bead shall:
    - Be free of gaps.
    - Be tooled in place and uniform with existing beads (see CSD WIS Section 8, Caulking).
    - Not be visible from interior side.



PART 2: MOBILE HOME CRITERIA

13. APPROVED MATERIALS

- **Single Strength (SS) Glass**
  - Allowed when DS is too thick for the frame; maximum pane size: 11 sq. ft.
- **Double Strength (DS) Glass**
  - Used to replace SS when frame thickness is adequate; maximum pane size: 15 sq. ft.
- **3/16" Plate Glass**
  - Maximum pane size: 30 sq. ft.
- **1/4" Plate Glass**
  - Maximum pane size: 43 sq. ft.
- **Safety Glass and Plastic Materials**
  - Same requirements as for Conventional Homes

14. GLASS REPLACEMENT

- **General Requirement**
  - Stops shall be replaced or installed when needed to prevent catastrophic leakage.
  - Glass shall be sealed in accordance with original installation design.
  - Glass shall be selected with comparable tint and coating (standard color and look)
- **Glass Replacement in Awning Windows**
  - The sash shall be disassembled as needed to remove broken glass.
    - Care shall be taken to preserve the channel gasket.
    - Damaged gasket shall be replaced or repairs shall be made.
  - Glass thickness shall allow proper installation into the channel with gasket installed.
  - Reassembled sash shall be:
    - Reinstalled and secured properly.

- Opened and closed, and adjusted as needed, to operate smoothly and close properly.

- **Glass Replacement in Sliding Windows**
  - Applicable procedures prescribed above for awning windows shall be followed.
- **When flanged window frame is removed to facilitate glass replacement:**
  - Integrity of sealant on back side of flange shall be maintained.
  - Elastomeric caulk or non-hardening sealant/putty tape applied as needed for a complete seal.
  - Surfaces to which sealant is applied shall be clean.
- **When flanged frame is re-installed:**
  - Screws shall be reinstalled and fully tightened.
  - Stripped or damaged screws shall be replaced.

15. INFILTRATION-REDUCTION ITEMS

- **Air Infiltration**
  - Window Repair items that reduce air infiltration will be repaired, replaced, sealed, or installed (e.g., plastic gliders, weatherstripping, cranks, latches, locks, knobs, thresholds) to prevent catastrophic leakage.
- **Water**
  - Items that reduce water infiltration will be repaired, replaced, or installed (e.g., replace missing glazing on sash, exterior caulking, exterior storm windows, storm doors, drip cap, J-channel, flashing).

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

16. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

17. OPERATIONAL CHECK

- **Sliders/Latches**
  - Sliders and latches shall operate, close, and latch properly.
  - Replaced windows/glass shall be cleaned inside and out before leaving the job site.

18. CLIENT INSTRUCTIONS

- **Windows and Sliding Glass Doors**
  - Clients will be notified of changes or repairs made, and will be educated on how to operate and maintain windows and doors.

REFERENCED STANDARDS

[1] CRC, §R308.1

[2] CRC, §R308

[3] CRC, §R308.4

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NOTES

WINDOW AND SLIDING GLASS DOOR (SGD) REPLACEMENT

Lead Paint Risk Factor
HIGH

TABLE OF CONTENTS

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WINDOW AND SLIDING GLASS DOOR (SGD) REPLACEMENT

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

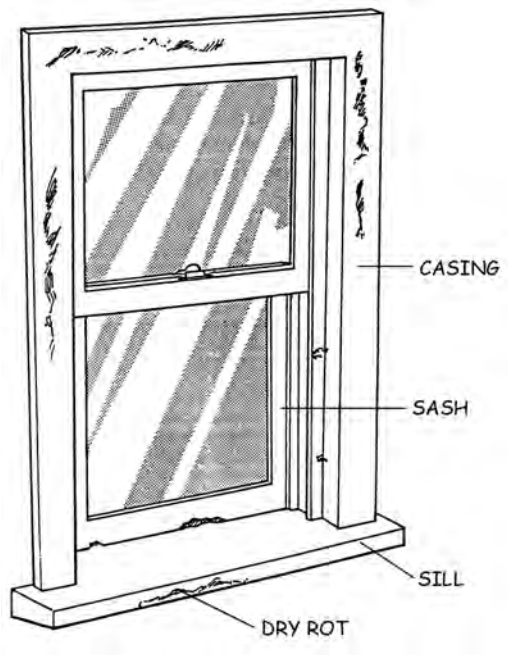
WINDOW/SGD REPAIR

See CSD WIS Section 12 (Glass Replacement and Window Repair).

WINDOW AND SGD INSTALLATIONS

1. GENERAL REQUIREMENTS

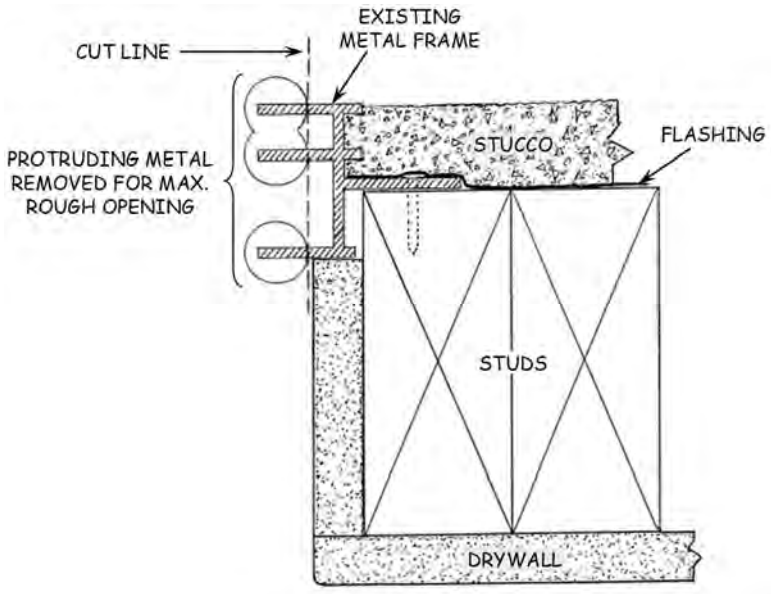
- **All Window Types**
  - Shall be installed:
    - In conformance with the current California Residential Code (CRC).
    - In conformance with manufacturer's instructions and accepted industry standards.
    - Plumb, level, and square with sash edge parallel to frame edge.
    - With interior and exterior fin/trim that provides barrier to water and air infiltration and a finished appearance.



2. PREPARATION OF OPENING

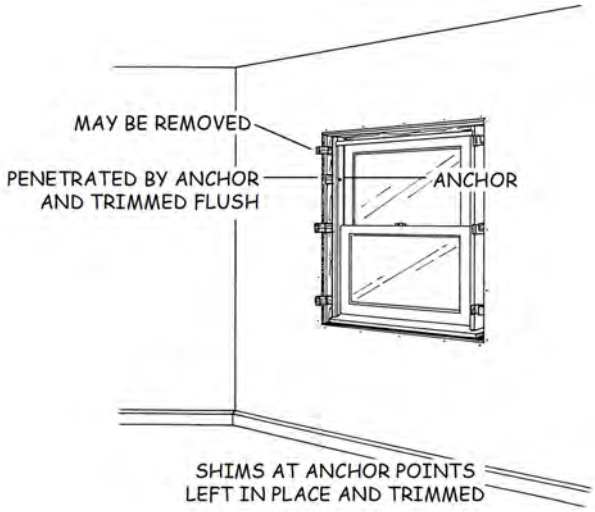
- **All existing components associated with the installation shall be structurally sound.**
  - All necessary repairs shall be made to facilitate a proper replacement unit installation.
  - Dry rot damage shall be repaired in wooden members.
  - Water penetration points shall be sealed.
  - All mounting surface contact areas shall be smooth, clean, and free of protrusions.
- **When Existing Frame Is Removed**
  - The old window frame shall be completely removed from rough opening.
  - Rough opening shall be free of all obstructions, such as nailing fins, nails and hardware.
  - Rough opening shall be solid, and decayed material shall be replaced.
  - Exterior trim will be removed or exterior siding will be cut back to fit new window with trim.
- **When Existing Frame Is Not Removed**
  - Wood Frames
    - The frame shall be free of all obstructions, with the sashes, hardware, stops and parting strips removed.
    - The existing frame shall be securely attached in the rough opening, and any decayed material shall be removed before the new window is installed.
- **Replacement Window**
  - Replacement window will be laid out with trim.
  - Mounting detail will be determined based on depth of window and location of window liner.
  - Replacement window or sliding glass door will be sized to original width, height, and depth.

- Metal Frame
  - Sashes, screens and hardware shall be removed from the frame.
  - The frame shall be free of protruding metal and all other obstructions.
  - Maximum rough opening should be maintained by cutting away metal frame as needed (e.g., on egress windows).



3. SHIMS

- **All Shims**
  - Shims shall be installed as required to:
    - Comply with manufacturer's instructions.
    - Ensure square installation and proper operation of sashes.
  - Tapered shims shall be doubled to:
    - Provide continuous contact and uniform support across frame.
    - Minimize distortion or rotation of the frame or sill.
- **Side Shims Used to Square and Plumb the Window**
  - Shims used to establish spacing at anchor points shall be:
    - Penetrated by the anchor.
    - Trimmed as needed but <u>not</u> removed.
  - Other shims may be removed after frame is securely anchored.



4. BOTTOM SUPPORT

- **All Window Types**
  - Tapered bottom shims used for permanent support shall be doubled to provide uniform support across the sill jamb.
- **All Vinyl Windows**
  - The sill jamb shall be supported along the entire bottom to ensure that the replacement window will operate without distortion (sagging or rotation).
  - The sill jamb of the replacement window shall <u>not</u> rest directly on anything which would cut or damage it (e.g., sharp edge of the original aluminum frame).

5. GENERAL INSTALLATION—SAFETY

- **Broken Glass**
  - When broken glass is present, be careful to avoid injury to worker and occupants.
  - All broken glass and glass particles must be removed from the work site.

- Masking tape or register film shall be applied to broken panes to stabilize broken pieces, and prevent them from falling out of the sash/frame (when feasible)

- **Hazards During Installation**
  - Burs, sharp corners and edges, and other such hazards shall be removed/corrected following installation.

WINDOW-SPECIFIC REQUIREMENTS

6. REPLACEMENT SELECTION

- **Replacement Window Type**
  - Shall be in accordance with Table 13-1.

TABLE 13-1: REPLACEMENT WINDOW TYPE

EXISTING WINDOW TYPE	REPLACEMENT WINDOW TYPE
Horizontal Slider	Horizontal Slider
Vertical Slider	Vertical or Horizontal Slider
Picture Window	Picture or Sliding Window
Jalousie Window	Vertical or Horizontal Slider

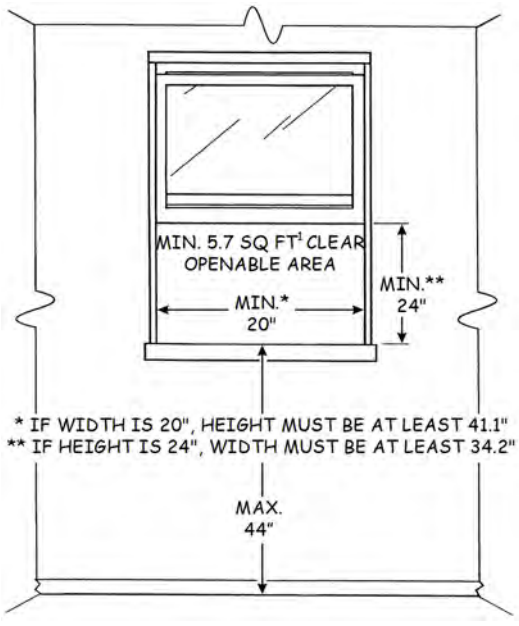
- **Replacement Energy Factor**
  - Shall be in accordance with Table 13-2.

TABLE 13-2: TITLE 24 ENERGY EFFICIENCY REQUIREMENTS

EFFICIENCY FACTOR	CEC CLIMATE ZONE	MAXIMUM VALUE
Maximum U-Factor	**All CZ**	**0.32**
Maximum Solar Heat Gain Coefficient (SHGC)	**1, 3, 5**	**No Requirement**
	2, 4, 6 – 16	**0.25**

7. EGRESS REQUIREMENT (CONVENTIONAL HOMES)

- **Windows in Bedrooms (Sleeping Rooms)**
  - Egress requirements apply to all rooms used for sleeping.
  - When a sleeping room has no operable exterior door, at least one window shall meet the egress requirements of:
    - Local code, or
    - California Residential Code (CRC)[1], which places the following requirements on egress windows:
      - Minimum net clear openable: (a) area of 5.7 sq. ft., (b) width of 20", (c) height of 24", and (d) maximum finished sill height of 44" above the floor.
      - *Exception:* Minimum net clear openable area of 5.0 sq. ft. is allowed on a "grade-floor" opening/window where the sill height is not more than 44" above the finished ground level adjacent to the opening.



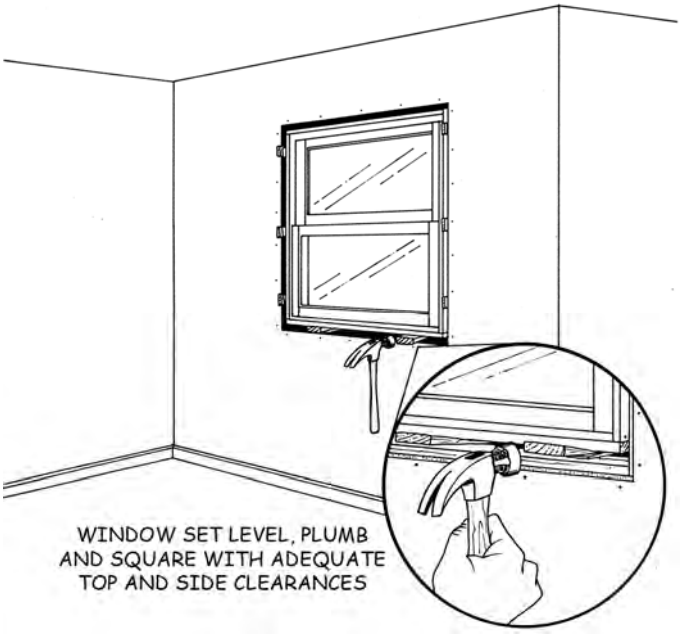
8. SAFETY GLASS

- **Labeling**
  - Safety glazing shall be permanently labeled and installed per the current CRC[2], *part of which* is summarized below:

- **CRC Summary of Requirements for Windows**
  - Safety glass is required in any window adjacent to a door where:
    - The nearest vertical edge is within 24" of the door, and
    - The bottom edge is *less* than 60" above the floor.
    - *Exception:* Not required when there is an intervening wall or other permanent barrier between the door and the glazing.
  - Safety glass is required in panes larger than 9 sq. ft. where:
    - The bottom edge is *less* than 18" above the floor, and
    - The top edge is *more* than 36" above the floor, and
    - A walking surface is within 36" horizontally of the window.
    - *Exceptions:* As defined in the CRC[3].
  - Safety glass is required when the bottom edge of the glazing is less than 36" above the walking surface of a stairway or landing shall be installed in accordance with the CRC requirements.
  - Safety glass is required in shower and bathtub enclosures for exterior windows *less* than 60" above the floor of the enclosure.
- **Entrance Doors with Glazing**
  - Safety glass is required in all doors with glazing.
  - *Exceptions:* (a) jalousie windows, and (b) windows with panes *less* than 3" in width or height.

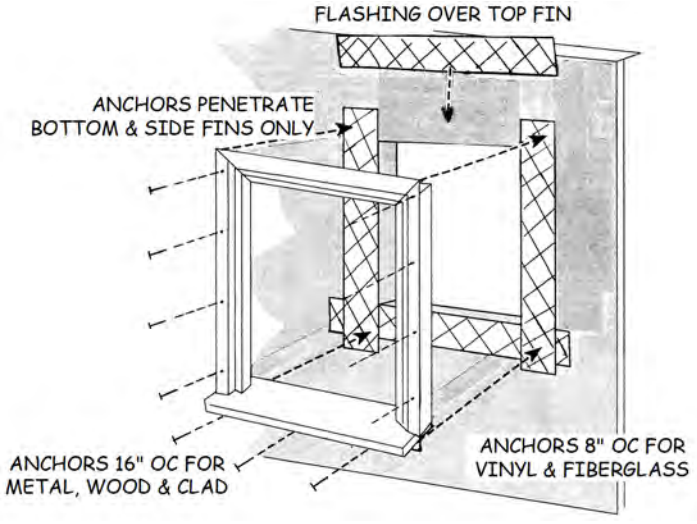
9. REQUIRED CLEARANCE

- **Between Window and Rough Opening**
  - Adequate side and top clearances are required to allow for expansion and contraction.
  - Clearances shall conform to the manufacturer's specifications.
- **Between Exterior of Window and Siding**
  - Clearances shall be provided as specified by the manufacturer.
  - Space shall be filled with caulk.



10. ATTACHMENT

- **All Window Types**
  - Shall be attached per manufacturer's instructions.
  - Top shall not be anchored to header *unless* prescribed in manufacturer's instructions.
  - When large windows must be secured at top, allowance shall be made for header flexing and sagging.
- **Nail/Screw Types**
  - All Window Types
    - Anchors shall be corrosion-resistant and compatible with the materials contacted/penetrated.
  - Wooden Windows
    - Casing or finishing nails or screws shall be used.
    - Nails shall be set and holes filled.
    - Nails shall penetrate framing or solid sheathing at least 3/4".
    - Screws shall penetrate framing or solid sheathing at least 5/8".
  - Vinyl Windows with Nailing Fins
    - Eight penny common nails, roofing nails, or number eight pan head screws shall be used.
  - Metal, Fiberglass, and Clad Windows
    - Attachment shall comply with manufacturer's instructions.

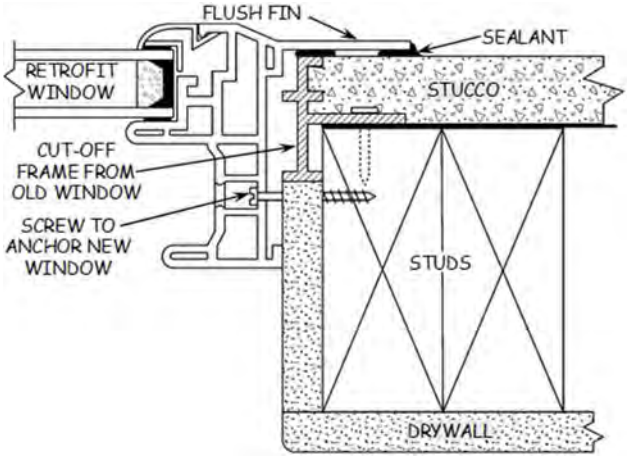


11. FLASHING AND DRIP CAP

- **Requirements**
  - Flashing shall be installed:
    - Per window manufacturer's instructions.
    - When the fins are attached directly to sheathing or framing.
    - When windows are not secured by fins but the existing flashing was damaged.

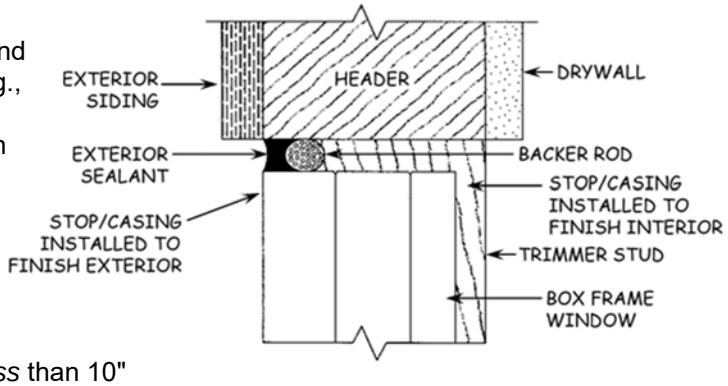
12. INSTALLING FLUSH FIN WINDOWS (RETROFITS)

- **Attachment**
  - Frame shall be anchored to structural framing with screws.
  - Screws shall be minimum #8 non-corrosive.
  - Screws shall not be placed in the fin.
  - Retrofit frame shall not be attached to old window frame.
  - Fin shall not be installed over lap siding.
- **Perimeter Sealing**
  - Exterior: Per Item 16.
  - Interior: Per Item 17.
- **Dissimilar Materials**
  - Unlike metals shall be separated from each other with a non-conductive tape, coating, or sealant material.

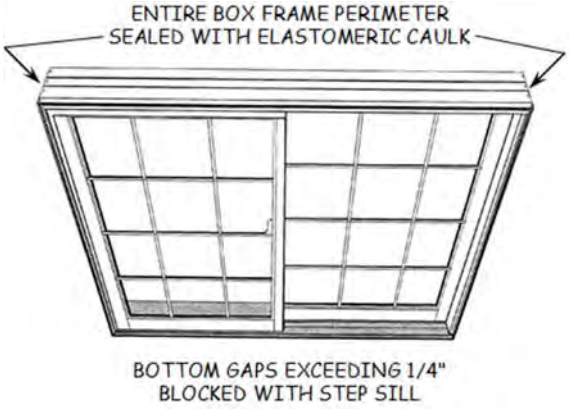


13. INSTALLING BOX FRAME WINDOWS (NO FINS)

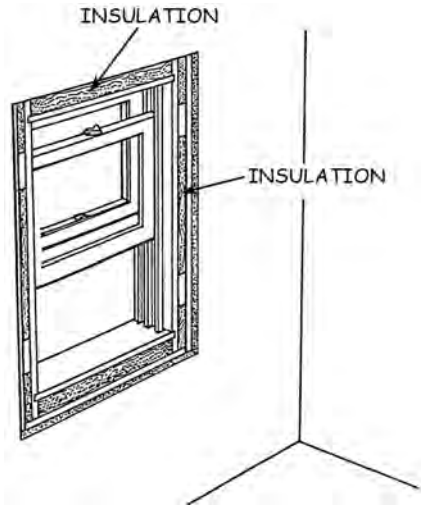
- **Installed in Existing Frames**
  - All sashes, strips, hardware, and other obstructions shall be removed.
  - Existing frames shall be structurally sound and free of damage or deterioration (e.g., dry rot).
- **Installed in Rough Opening**
  - The existing frame and all other obstructions shall be removed.
- **All Openings**
  - Rough framing shall be structurally sound and free of damage or deterioration (e.g., dry rot).
  - New unit shall be sealed in position with elastomeric caulk.
  - Backer rod required when gap exceeds 1/4".
- **Anchoring**
  - The unit must be anchored per manufacturer's recommendation.
  - Vinyl windows shall not be anchored *less* than 10" from corners.



- **Stop and Casing**
  - Exterior wooden stop and casing materials shall be exterior grade.
- **Closure at Bottom**
  - Step sill, step extender, or equivalent shall be installed when gap between existing sill and new sill jamb exceeds 1/4".
  - Bottom of unit shall be sealed except for small gap(s) near the center (for drainage).



- **Buildout (Jamb Extension)**
  - The window frame must be extended (built out) when it is narrower than the wall thickness.
- **Material**
  - Buildout material shall be compatible with the frame material.
  - Wooden buildout shall be finished to match the frame.
- **Perimeter Sealing**
  - Exterior: Per Item 16.
  - Interior: Per Item 17.



14. SASH

- **Wood**
  - Decayed or deteriorated sashes shall be replaced, if complete replacement window is not installed.
  - Springs and sash weight systems shall operate properly after sash replacement.
  - Lower sash will have the same bevel on the bottom rail as the sill.
  - Sash will be water-sealed and primed to prevent moisture intrusion.

15. CAVITY INSULATION

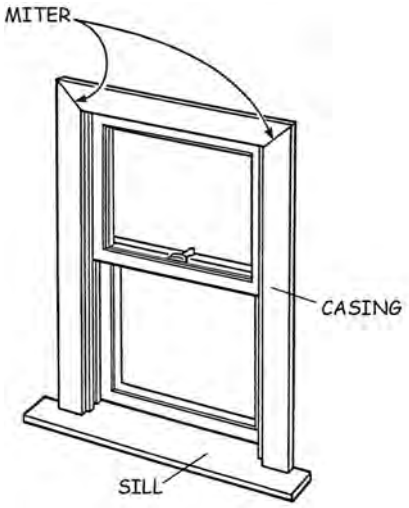
- **Wood Framing**
  - Open cavities between rough framing and window jamb shall be insulated.
  - *Exception:* Cavities where window weights are being utilized.

16. EXTERIOR SEALING

- **All Windows**
  - Elastomeric caulk shall be used.
- **Flanged Windows**
  - Entire window flange shall be caulked prior to installation to ensure watertight seal around perimeter.
- **Block Frame Windows**
  - Entire exterior perimeter shall be caulked to ensure watertight seal.
- **Under Fins**
  - A generous bead of caulk shall be placed between the fins and the mounting surface.
  - The sealant bead shall be continuous *except* for small gap(s) near center of bottom fin (for drainage).
- **Around Casing Perimeter**
  - Joint (gap) where the casing and siding meet shall be caulked *except* for small gap(s) near center of bottom trim (for drainage).
- **Between Window Frame and Siding (No Casing)**
  - The seam (gap) between the frame and siding shall be sealed with elastomeric caulk.
- **Size of Cracks**
  - Before caulking, cracks 3/8" to 5/8" wide shall be filled to within 1/2" of the surface with:
    - Closed cell polyethylene rod, or
    - Mineral fiber insulation.
  - Cracks wider than 5/8" shall be repaired, not caulked.

17. INTERIOR SEALING

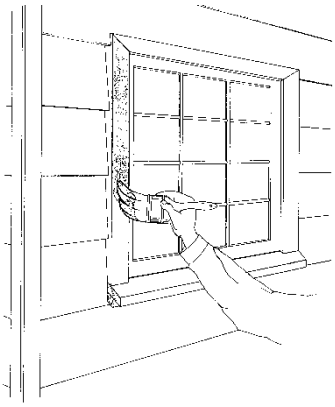
- **All units**
  - Gap between window frame and rough opening shall be sealed with elastomeric caulk.
  - Sealant must be applied before casing/trim is installed, and it may also be applied around outside of casing/trim.



18. CASING/TRIM

- **All Units**
  - Shall be installed on interior, and on exterior (except on flush fin retrofit windows).
- **Wood**
  - Paint grade acceptable *unless* existing jamb has natural finish.
  - Exterior grade required in all exterior locations.
  - Existing casing shall be matched.
  - Existing miters shall be matched.
- **Nails**
  - Finishing or casing nails required for interior applications.
  - Galvanized casing nails required for exterior applications.

19. WOOD FRAME SEALING MATERIALS



- **Painting of wood is to protect bare wood only, and is <u>not</u> provided for cosmetic reasons.**
- **General requirements for all window sashes, frames, and trim**
  - All bare wood on the exterior shall be painted and/or primed per manufacturer's instructions and industry standards to prevent moisture damage.
  - Finish coat shall lap 1/16" onto glass for proper moisture seal.
  - *Caution:* Paint shall <u>not</u> be applied to weatherstripping, vinyl, plastic, and other non-wood parts *unless* specifically allowed by the manufacturer.
  - Frame shall be painted with sashes open or removed.
  - Acceptable sealers are paint, urethane, and varnish.
- **Exterior**
  - Primer coat required to protect the wood.
  - Exterior grade material (e.g., high quality oil base or latex paint) shall be used in exterior locations.
- **Interior**
  - Interior surfaces shall, at a minimum, be primed or stained.
  - Paint or stain shall be applied in conformance with manufacturer's instructions.

SLIDING GLASS DOOR (SGD)–SPECIFIC REQUIREMENTS

20. APPROVED MATERIALS—SGD

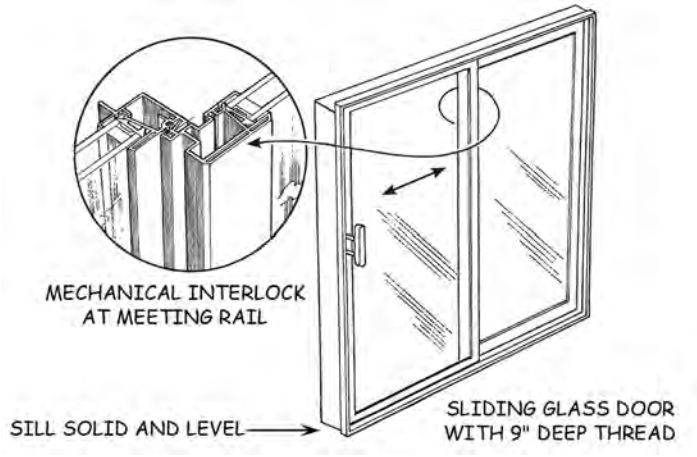
- **All Sliding Glass Doors shall be installed with a(n):**
  - NFRC temporary energy performance label.
  - ENERGY STAR labeled and Energy Efficiency ratings in conformance with Table 13-2.
  - Mechanical interlock at meeting rail.
  - Safety glazing with permanent marking.
  - Insect screen for sliding panel.

21. PRE-INSTALLATION REQUIREMENTS—SGD

- **Preparation of Opening**
  - When diagonal measurements differ by *more* than 1/8":
    - Rough opening shall be adjusted/shimmed to provide satisfactory mounting surfaces for the replacement frame.
  - Opening shall be structurally sound, square, plumb and level in conformance with manufacturer's recommendations.
    - Water penetration points shall be sealed.
    - Sound anchorage shall be provided for replacement unit.
    - Floor shall be structurally adequate to properly support replacement sill in a level condition.
  - Existing door frame, anchors and sealant shall be removed.
  - All mounting surfaces shall be smooth and clean.

22. INSTALLATION REQUIREMENTS—SGD

- **All Sliding Glass Doors**
  - Threshold shall have solid, level sill support from inside to outside and end to end.
  - Tread under the door or landing surface shall be no *less* than 9" in depth.
  - Frame shall be square, level, and plumb in the opening.
  - Gaps between door frame and rough opening shall be insulated (e.g., with mineral fiber or backer rod. Injected foam shall only be allowed when:
    - Injected foam is intended for that purpose and installed strictly in conformance with manufacturer instructions. Overfilling the cavity in a manner that warps the SGD or window frame shall not be allowed. Workmanship corrections will be the sole responsibility of the agency and not reimbursable by CSD.
  - Threshold shall extend above the interior finished floor surface a maximum of 1", or 1/2" if any occupant is physically handicapped.



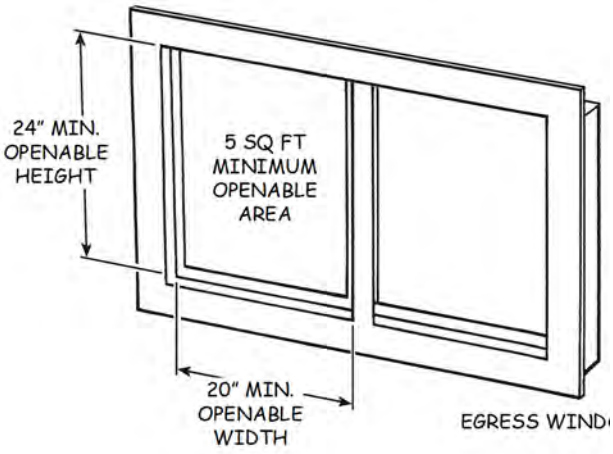
22. INSTALLATION REQUIREMENTS—SGD (cont.)

- **Jambs and Header**
  - Jambs and header shall be flashed and sealed as prescribed for windows in a like installation (e.g., nailing fin, flush fin, box frame).
- **Sill**
  - Aluminum sills shall be protected from contact with corrosives such as concrete, stucco, and steel (e.g., with sill pan or wood).
  - Sill shall be supported adequately (e.g., with shims or solid wood) to prevent sagging or twisting during door operation.
  - Apply two continuous, parallel 3/8" nominal beads of elastomeric sealant the entire length of the rough sill and 6" up each jamb, into which the door sill, or the sill pan (when used) is set.
  - When door is set into a sill pan, apply a continuous sealant bead along the up-turned leg of the sill pan, and a discontinuous bead near the front of the pan where the door sill makes contact.
- **Attachment**
  - Door shall be installed square, level, and plumb, and
  - Secured through pre-drilled holes placed 3 to 10 inches from each corner and 16" OC, or as prescribed by manufacturer.
- **Finishing Requirements for Sliding Glass Doors**
  - Exterior sealing for sliding glass doors shall comply with Item 16.
  - Interior sealing shall comply with Item 17.
  - All bare wood, whether exposed or added, shall be sealed to preserve integrity of the wood.
    - Exterior surfaces shall be primed or painted with high quality exterior products.
    - Interior surfaces shall, at a minimum, be primed or stained.
  - All exterior gaps and cracks exposed to the elements shall be sealed with elastomeric caulk.
  - Interior gaps shall be caulked in conformance with CSD WIS Section 8 (Caulking).
- **Flanged Sliding Glass Doors**
  - Replacement mounting flange shall be positioned to cover holes left by removal of pre-existing door.
  - Elastomeric caulk or non-hardening sealant/putty tape shall be applied to the back of the mounting flange.
  - Sill shall rest on the floor, or it shall have solid support from jamb to jamb.
  - Unit shall be centered side-to-side in the opening, with:
    - Sides plumb, and
    - Frame square.
  - The flange shall be securely anchored with screws spaced in accordance with manufacturer's instructions.
  - Lock shall be installed as instructed.

23. PAINTING AND STAINING WOOD MATERIALS—SGD

- **General requirements for all sliding glass doors**
  - All bare wood shall be painted and/or primed per manufacturer’s instructions, industry standards, and Item 19.

PART 2: MOBILE HOME CRITERIA



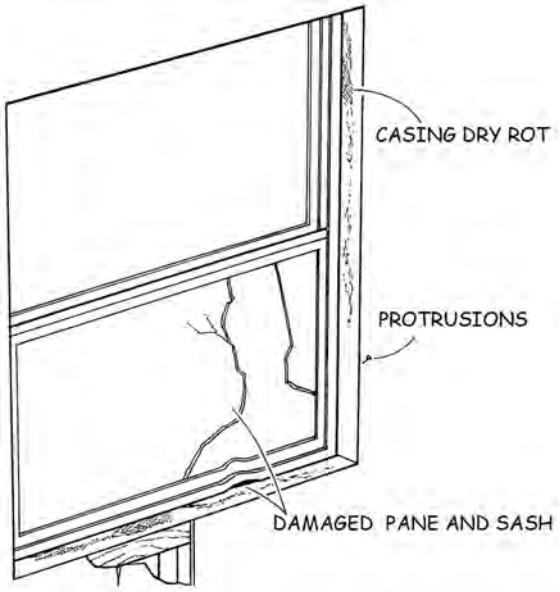
24. GENERAL REQUIREMENTS

- **All Windows**
  - Window or door units will be installed in accordance with manufacturer specifications.
  - Window or door units will be designed for manufactured home use and will be ENERGY STAR certified.
  - Rough opening will be measured before ordering replacements.

25. REPLACEMENT EGRESS WINDOWS

- **Egress Windows**
  - Access to emergency egress points, such as primary windows or exit doors, will be considered during the selection of retrofit window or door units.
  - Egress windows will only be replaced with egress windows.
- **Bedroom Windows**
  - Windows placed in emergency egress locations shall meet current AMMA requirements.[4]
  - Egress windows shall meet the following opening requirements:
    - Minimum clear openable area:
      5.0 sq. ft. clear openable area must be achieved. Thus, if height is 24", width must be 30", and so forth.
    - Minimum clear openable horizontal dimension: 20".
    - Minimum clear openable vertical dimension: 24".

26. PRE-INSTALLATION REQUIREMENTS



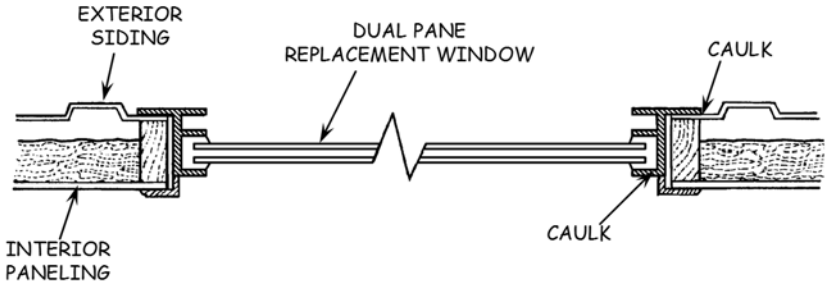
- **Replacement Windows and Doors**
  - All existing components associated with the installation shall be structurally sound.
    - All necessary repairs shall be made to facilitate a proper replacement unit installation.
    - Dry rot damage shall be repaired in wooden members.
    - Water penetration points shall be sealed.
  - Existing units will be removed and all mounting surface contact areas shall be smooth, clean, and free of protrusions.

27. REPLACEMENT WINDOW INSTALLATION

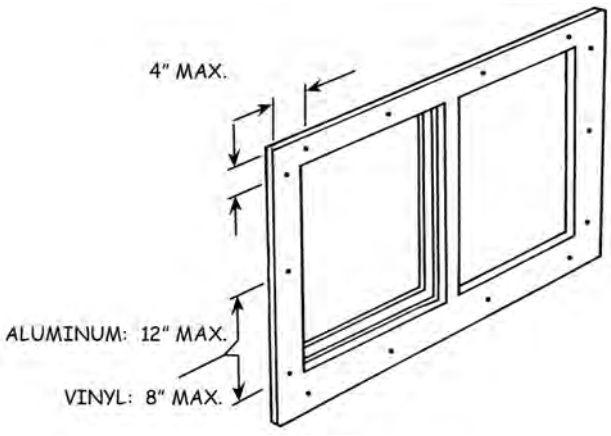
- **All Windows**
  - Insulation shall be installed in gaps between replacement frame and rough opening:
    - Flexible mineral fiber or non-expanding foam (e.g., backer rod) is acceptable.
    - Expanding foam is not allowed.
  - Clearances between window frame and rough opening shall conform to manufacturer's instructions.
  - Shims and bottom support shall be in conformance with Items 3 and 4, as applicable.

27. REPLACEMENT WINDOW INSTALLATION (cont.)

- **All Windows (cont.)**
  - The interior edge of the replacement window frame shall be:
    - Sealed around the entire perimeter with caulk.
    - Trimmed with molding as needed for a finished appearance.
  - All installed unfinished wood shall be sealed to preserve the integrity of the wood.
    - Exterior surfaces shall be primed and painted with high quality exterior products.
    - Interior surfaces shall, at a minimum, be primed or stained.



- **Flanged Windows**
  - Existing flanged windows shall be replaced with flanged windows.
  - A continuous bead of caulk, extending completely around the window, shall be placed between flange and mounting surface to achieve a permanent, water-tight seal.
    - Elastomeric sealant shall be used.
    - Finished bead shall be installed to direct water away from the window.
- **Attachment General Requirements**
  - Windows shall be secured in conformance with manufacturer's instructions or the following guidelines.
  - Screws shall be non-corrosive, #8 or larger.
  - Screws anchoring into the framing structure of the mobile home shall penetrate the wood at least 3/4".
- **Attachment of Box Frame Windows (No Flange)**
  - Window shall be held securely in place with screws and/or stops fastened to the rough opening.
  - Screws shall be installed perpendicular to the window frame; angling screws to pull the window into the rough opening is <u>not</u> allowed.
  - Flashing shall be installed at top of window.
  - Drip cap shall be installed in all locations <u>not</u> protected by awning or porch.
- **Attachment of Flanged Windows**
  - Screws shall be placed within 4" of each corner.
  - For metal frames:
    - Additional screws shall be placed a maximum of 12" apart.
    - Minimum 3 screws on each side exceeding 18" in length.
  - For vinyl frames:
    - Additional screws shall be placed a maximum of 8" apart.
    - Minimum 3 screws on each side exceeding 14" in length.



PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

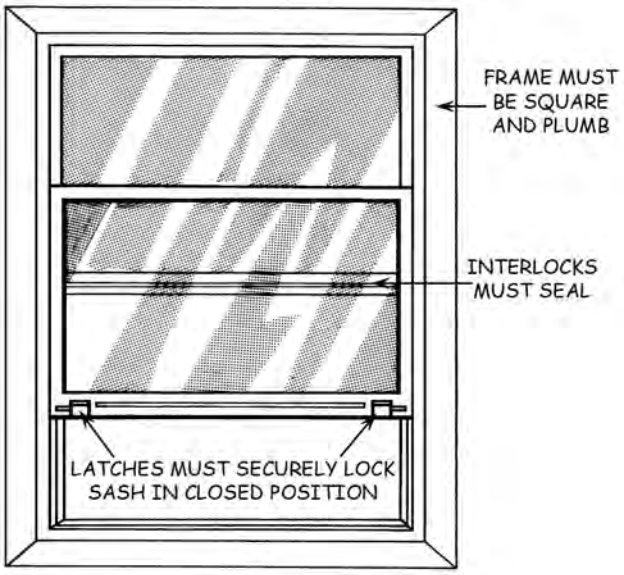
28. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

29. WORKMANSHIP/OPERATION

- **Windows and Sliding Glass Doors**
  - Units shall operate smoothly.
  - Frame shall be square, so sashes/panels close properly at all corners and edges.
  - Interlocks and latches shall function properly.
  - All replacement window and/or sliding glass door glass shall be cleaned inside and out before leaving the job site.



30. CLIENT INSTRUCTIONS

- **Windows and Sliding Glass Doors**
  - Clients will be notified of changes or repairs made, and will be educated on how to operate and maintain windows and sliding glass doors.
  - Clients shall be notified of changes or repairs made and will be educated on how to operate and maintain weatherstripping and caulk around door and trim.

REFERENCED STANDARDS

[1] CRC §R310.1

[2] CRC §R308.1

[3] CRC §R308.4

[4] AAMA 1701.2 and 1704

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NOTES

DOOR REPAIR/REPLACEMENT

Lead Paint Risk Factor
HIGH

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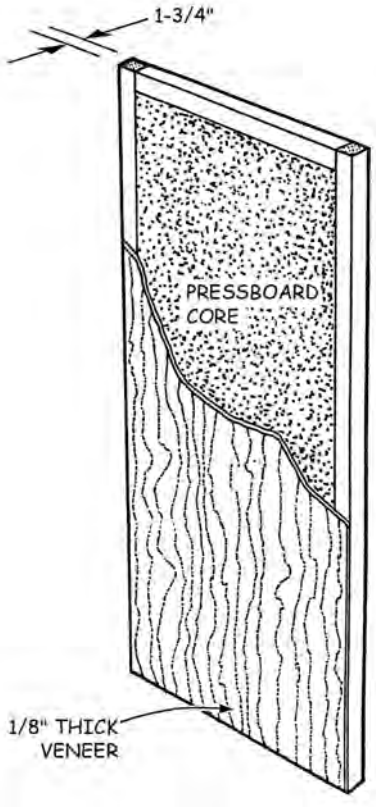
DOOR REPAIR/REPLACEMENT

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

DOOR REPAIRS



1. GENERAL REPAIR REQUIREMENTS

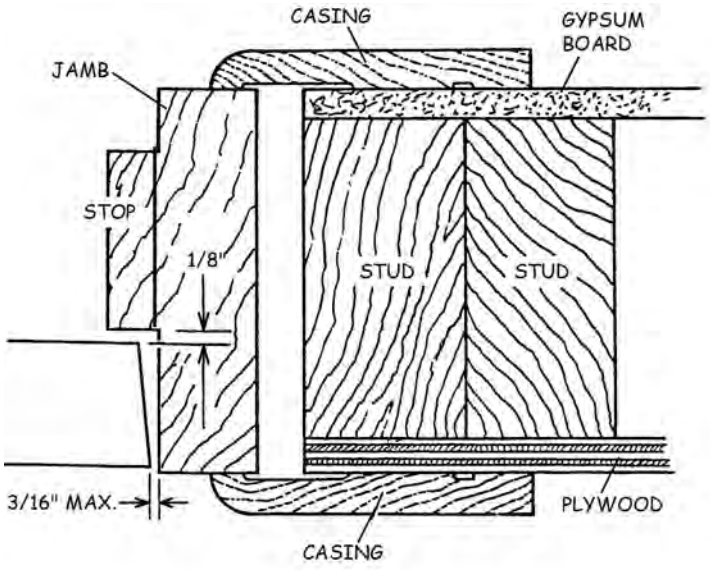
- **All Units**
  - Doors shall be repaired to correct infiltration or to support the installation of weatherstripping, safety glass replacement, etc.
  - Repairs requiring installation of wood components shall be sealed on both sides and four edges with exterior grade material.
  - Acceptable exterior grade sealers are:
    - Paint, urethane, and varnish.
  - Clear “water seal” products shall not be allowed.

2. SAFETY GLASS REPAIR

- **Labeling**
  - Safety glazing shall be permanently labeled and installed in conformance with the CRC[1].
- **Doors with Glazing**
  - Safety glass is required, *except* in jalousie windows, and windows with panes *less than* 3" in width or height.
  - Replacement of existing in-door glazing with a “like” specialty glass (e.g., stained glass or special design glass) shall not be allowed.
- **Polycarbonate**
  - When allowed by local code and with permission of the client, shall be used instead of glass.

3. DOOR STOP REPAIR

- **Wood Jambs**
  - Stop shall be made of wood.
  - 5/16" x 1-1/4" minimum dimensions.
- **Doubled Stops**
  - Stops shall not be doubled (one on top of another) for added thickness on the latch side.



4. CASING/TRIM REPAIR

- **Wood**
  - Exterior grade required in all exterior locations.
  - Partial or total replacement of casing/trim:
    - New casing/trim size/shape and miters shall be compatible with existing casing/trim visible from location of the replaced door.
  - Sealer or primer shall be installed to prevent moisture damage to unfinished wood.

- **Nails**
  - Finishing or casing nails required for interior applications.
  - Galvanized nails required for exterior applications.
- **Perimeter Seal**
  - Exterior casing/trim shall be caulked to provide a watertight seal around entire perimeter.

5. DOOR JAMB REPAIR

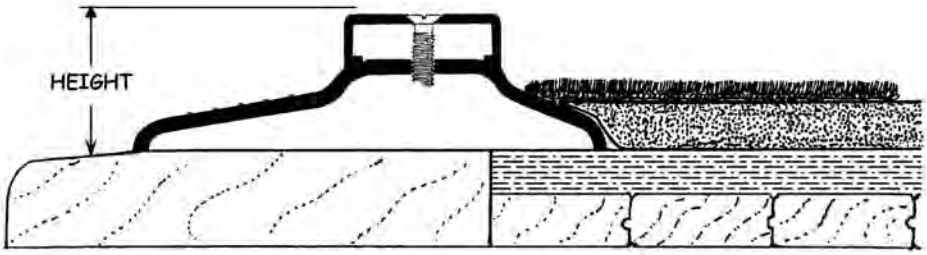
- **Repair Material**
  - Exterior grade only.
  - 5/4" thick stock standard; 3/4" minimum.
  - Top shall be secured to sides with dado or rabbet joints.
  - Width shall be within 1/4" of the finished wall thickness.

6. DOOR FIT REPAIR

- **Existing Doors**
  - When door does not close properly due to incorrect sizing, door shall be planed or trimmed to improve closure and reduce infiltration opportunity.

7. THRESHOLD REPAIR

- **All Doors**
  - Threshold height shall extend above finished floor a maximum of 1", or 1/2" if any occupant uses a wheelchair or walker.



MAXIMUM HEIGHT OF THRESHOLD AND RISER IS 1", OR 1/2" FOR HANDICAPPED

- **Proper door shoe and threshold installation:**
  - Requires using a saddle threshold and gasketed door shoe.
  - It is acceptable to install a gasketed door shoe without a new threshold if the shoe is compatible with the existing threshold.
  - An L-shoe shall not be installed, unless a U-shoe is not feasible (due to non-standard door thickness).
  - It is acceptable to replace an existing vinyl/plastic door shoe with a non-metal door shoe of equal or greater quality, when the door cannot feasibly be cut (such as a metal-clad door with cladding wrapped onto the door bottom), and the non-metal door shoe is the best available option (e.g., installation of a sweep is not feasible).

DOOR REPLACEMENT

8. GENERAL REQUIREMENTS

- **All Replacement Doors shall be:**
  - Limited to Entrance Door, Interior Enclosure Door, or Exterior Appliance Enclosure Door type.
  - Sized to fit properly into the opening with clearances that meet door manufacturer's specifications.
  - Frame shall be square, level, and plumb in the opening.
  - Installed in conformance with manufacturer's instructions and applicable codes, with a frame that is square, level, and plumb in the opening.

- Not be equipped with safety glass unless required by the local jurisdiction for the specific installation location.
- Replacement doors shall be limited to standard solid core slab or panel doors (no ornate design, stained glass, decorative windows, etc., unless required by SHPO and approved by weatherization waiver). Door "like for like" replacement shall not be allowed. .
- Equipped with a keyed locking mechanism when allowed by the CSD Field Guide.

9. OCCUPANT AND WORKER SAFETY

- **All Doors**
  - If the defective door has a broken window, workers shall be careful to avoid injury to self and occupants.
    - All broken glass and glass particles must be removed from the work site.
  - Burs, sharp corners and edges, and other such hazards shall be removed.

ENTRANCE DOORS

10. ENTRANCE DOOR INSTALLATION REQUIREMENTS

- **All Doors**
  - Entrance doors shall be replaced at locations between conditioned and unconditioned space.
  - Hinge side shall be securely attached to structural framing.
  - Insulation shall be installed in gaps between door frame and rough opening:
    - Mineral fiber or backer rod; injected foam not allowed.
  - Threshold shims/elevators shall be in compliance with Item 13.
  - Exterior casing/trim shall be caulked to provide a watertight seal around entire perimeter.
  - Weatherstripping (integral or applied) is required.

11. ENTRANCE DOOR COMPOSITION AND FIRE RATING

- **Replacement doors shall be:**
  - A minimum 1-3/8" thick solid core wood door; or
  - Metal door, with a minimum R-6 insulated core; or
  - Any type of door, with a **Fire Resistance Rating** of at least 20 minutes.
    - Replacement doors shall be fire-rated in conformance with local code (e.g., for doors transferring from kitchen to garage in homes with attached garage, and in multi-family units).
    - Doors labeled to have a fire rating of at least 20 minutes shall not be modified or weatherstripped, except as prescribed by the manufacturer and local code. If allowed by these sources, manufacturer or code documentation shall be kept in the client file.

12. ENTRANCE DOOR DIMENSIONS

- **Door and Jamb Replacement**
  - 1-3/4" door shall be installed.
- **Door Blank Replacement (Existing Jamb Not Replaced)**
  - 1-3/4" door shall be installed, when feasible.
  - 1-3/8" door allowed when 1-3/4" will not fit existing jambs.

13. ENTRANCE DOOR THRESHOLD SHIMS/ELEVATORS

- **Materials allowed include:**
  - Non-wood: aluminum and plastic (e.g., vinyl).
  - Solid Wood: redwood, cedar, pressure-treated fir, or solid hardwood (i.e., must be degradation-resistant and exterior grade).
- **Shim Thickness**
  - Shim shall not extend top of threshold above the finished floor more than 1", or 1/2" if any occupant is physically handicapped.

14. ENTRANCE DOOR FINISH/SEALER

- **Bare wood**
  - All bare wood shall be sealed.
- **Wood Door**
  - Shall be sealed on both sides and four edges with exterior grade material.
  - Acceptable exterior grade sealers are:
    - Paint, urethane, and varnish.
    - Clear "water seal" products not allowed.
- **Metal Door**
  - Shall be painted or primed.
  - Oil base or epoxy paint only.
- **Jamb and Casing/Trim**
  - Acceptable sealers are:
    - Paint, urethane, and varnish.
    - Clear "water seal" products not allowed.
  - Exterior grade material shall be used in exterior locations.

15. ENTRANCE DOOR TRIMMING/MODIFICATIONS

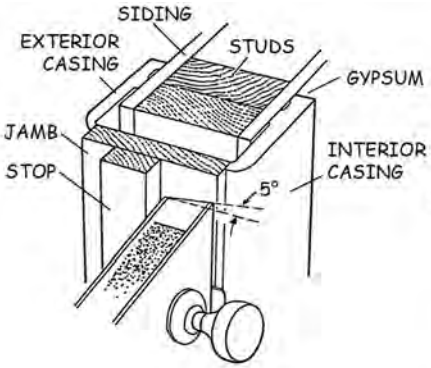
- **Veneer Type Replacement Doors**
  - A maximum of 1" may be cut from sides and top, and 2" from bottom, unless the door has expanded rails and stiles, and/or deeper cutting is approved by door manufacturer.
- **All Types**
  - 3 to 5 degree bevel required on lockset edge.
  - It is prohibited to trim or weatherstrip a **Fire Rated Door,** *unless* specifically allowed by the manufacturer and performed with approved methods and materials. Documentation of these manufacturer specifications shall be kept in the client file.

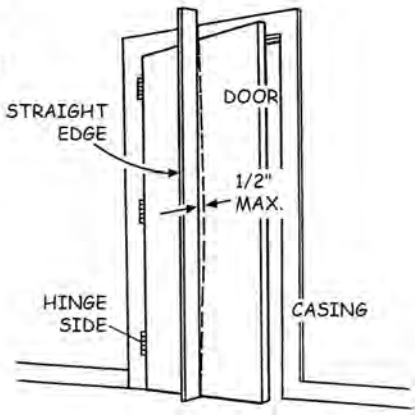
16. ENTRANCE DOOR WARPAGE

- **All Doors**
  - Warpage shall not exceed 1/2" from end to end, to facilitate proper weatherization.

17. ENTRANCE DOOR HINGE REQUIREMENTS

- **All Entrance Doors**
  - Minimum of 3 hinges per door.
  - Hinges shall:
    - Be loose-pin type, *unless* mounted toward exterior (fixed-pin not required on middle hinge).
  - At least one spring-loaded hinge required on door between attached garage and living area.
- **1-3/8" Doors**
  - Minimum hinge size 3-1/2" x 3-1/2".
- **1-3/4" Doors**
  - Minimum hinge size 4" x 4".

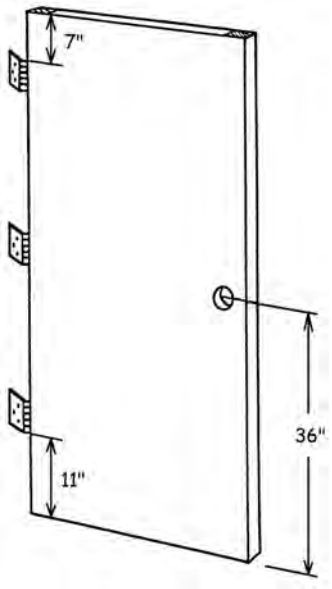




18. ENTRANCE DOOR SCREWS FOR HINGES

- **Wood and Metal Jambs**
  - Brass or stainless steel flathead screws shall be used, or as specified/supplied by manufacturer.
- **Pre-hung Units and Replacement Jambs**
  - Jamb screws shall be installed.
  - Screws shall penetrate trimmer stud at least 5/8".
- **Use of Existing Screw Holes**
  - Existing screw holes shall be filled with plugs or wooden golf tees and glued before reuse, unless larger/longer screws that tighten securely are installed.

19. ENTRANCE DOOR HINGE LOCATION



- **Jamb Replaced**
  - Lower hinge located 11" from floor.
  - Upper hinge located 7" from upper jamb.
  - Middle-hinge between upper and lower hinges, centered.
- **Jamb Not Replaced**
  - Existing hinge spacing is acceptable.
  - Mortise holes abandoned due to hinge relocation shall be patched.
- **Hinge Mortise**
  - Hinge relief mortise and flush mounting required for all hinges.

20. ENTRANCE DOOR CLEARANCES

- **Door Face to Door Stop**
  - 1/8" maximum distance between door face and door stop, when latch tongue and strike plate are engaged.
- **Door Edge to Door Jamb**
  - Distance between door edge and jamb (when door is closed) shall be:
    - 1/8" minimum, and
    - 3/16" maximum.

21. ENTRANCE DOOR CLOSURE SYSTEMS

- **All Components**
  - All door closure system components shall be base models. Ornate or complex lockset materials shall not be allowed.
- **Self-Closing Hinge**
  - At least one spring-loaded hinge shall be required on door between attached garage and living area when the door is replaced.
- **Entrance Lockset Height**
  - When both door and jamb are replaced: lock shall be installed 36" from floor.
  - When only the door blank is replaced: Existing height may be utilized.
- **Deadbolt**
  - Deadbolt shall turn freely.
  - Deadbolt shall engage when door is closed and latch tongue is inside strike plate.
  - Knob is required on the interior side (key instead of a knob is not allowed).
  - Existing deadbolt with key closure on the interior side shall not be reinstalled when a door is replaced. Lockset shall be replaced (for door replacement only. Lockset replacements shall not apply to Door Repairs).

- **Strike Plate**
  - Jamb strike plate required.
  - Latch tongue shall engage properly when door is closed with normal force.
  - Multiple strike plates for added thickness not allowed.
    - Jamb shall be repaired when latch will not function properly with one strike plate.
  - When existing holes will *not* properly secure a standard strike plate:
    - Jamb shall be repaired, or
    - A longer, heavy duty strike plate shall be installed.

INTERIOR DOORS

22. INTERIOR DOOR COMPOSITION

- **All Interior Doors**
  - Only interior grade hollow-core and louvered doors are allowed (e.g., for appliance enclosures and communication between rooms for combustion air). Doors may be solid-core by approved programmatic waiver only.
  - Hinged doors only.
- **Thickness**
  - 1-3/8" or 1-3/4" thick.
- **Veneer**
  - Minimum 1/8" thick.
- **Hinges**
  - 2 or 3 hinges (3 hinges for solid wood or solid core).
  - Hinges shall be constructed of brass or stainless steel.
  - Minimum hinge size: 3-1/2" x 3-1/2" and 0.120" thick.
- **Screws for Hinges**
  - Brass or stainless steel flathead screws shall be used, or as specified by manufacturer.

23. INTERIOR DOOR FINISH

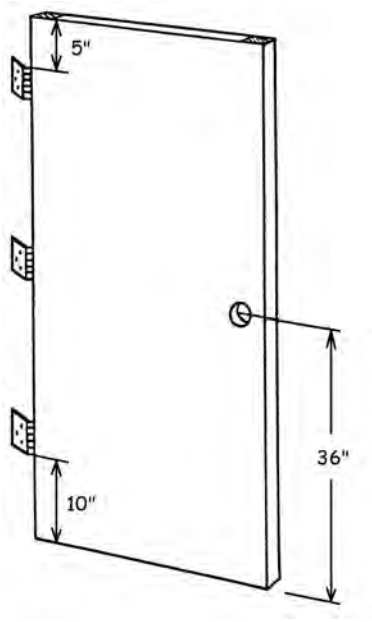
- **Interior Wooden Doors**
  - Shall be sealed on both sides and four edges to prevent moisture damage.
  - Interior grade primer, paint, urethane, or varnish shall be used.
  - Clear “water seal” products not allowed.

24. INTERIOR DOOR LOCK/LATCH

- **Shall be installed in conformance with entrance door closure system requirements in Item 21.**

25. INTERIOR DOOR HINGE LOCATION

- **Jamb Replaced**
  - Lower hinge located 10" from floor.
  - Upper hinge located 5" from upper jamb.
  - Middle-hinge, if installed, centered between upper and lower hinges.
- **Jamb Not Replaced**
  - Existing hinge spacing is acceptable.
  - Mortise holes abandoned due to hinge relocation shall be patched.
- **Hinge Mortise**
  - Hinge relief mortise and flush mounting required for all hinges.



26. INTERIOR DOOR HINGE SCREWS

- **Pre-Hung Units and Replacement Jambs**
  - Jamb screws shall be installed.
  - Screws shall penetrate trimmer stud at least 5/8".
- **Use of Existing Screw Holes**
  - Existing screw holes shall be filled with plugs or wooden golf tees and glued before reuse, unless larger/longer screws that tighten securely are installed.

EXTERIOR APPLIANCE ENCLOSURE DOORS

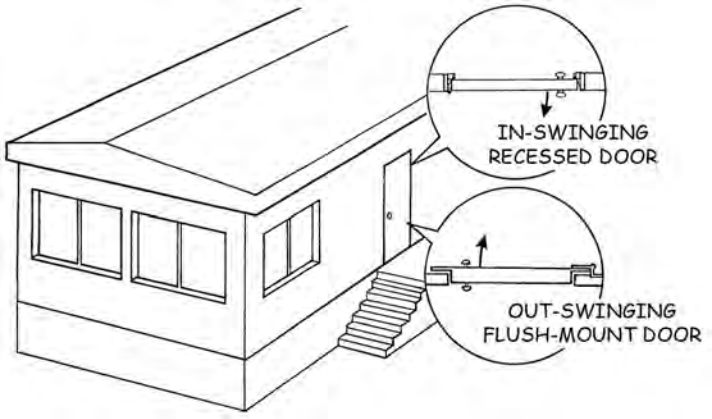
27. EXTERIOR APPLIANCE ENCLOSURE DOOR COMPOSITION

- **See Entrance Door requirements.**
- **Shall be an exterior-grade, solid-slab door only**

PART 2: MOBILE HOME CRITERIA

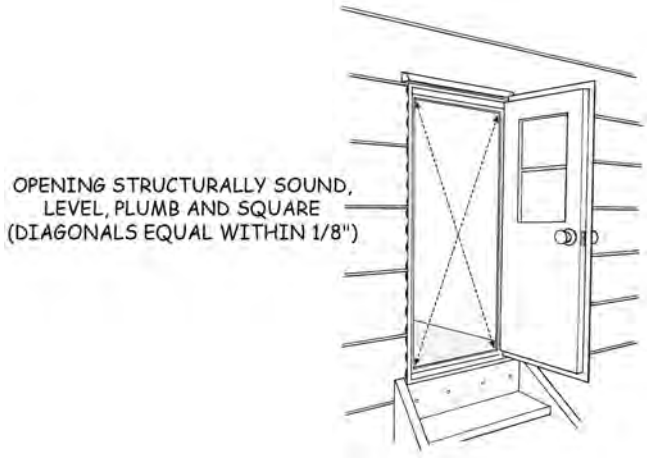
28. MOBILE HOME REPLACEMENT DOORS

- **Out-Swinging Replacement Door Material Limitations**
  - Pre-hung entrance door manufactured for mobile homes.
  - Permanently-finished skin (e.g., fiberglass or vinyl-clad metal).
- **In-Swinging "House Type" Door Material Limitations**
  - Material and installation criteria for conventional entrance doors apply to house type doors installed in mobile homes.
  - Door blank shall be replaced independently if feasible; installation of a pre-hung unit not required.



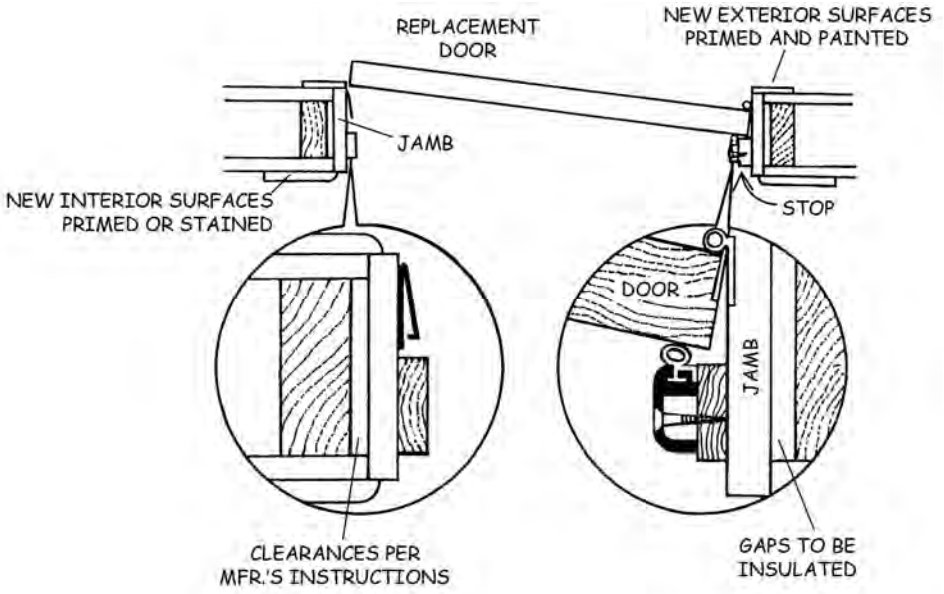
29. MOBILE HOME DOOR INSTALLATION REQUIREMENTS

- **All Doors**
  - Preparation of Opening
    - When diagonal measurements differ by *more* than 1/8":
      - Chassis should be checked and leveled as feasible, or
      - Rough opening shall be adjusted/shimmed to provide satisfactory mounting surfaces for the replacement frame.
    - Opening shall be structurally sound, square, plumb and level in conformance with manufacturer's recommendations.
      - Water penetration points shall be sealed.
      - Sound anchorage shall be provided for replacement unit.
      - Floor shall be structurally adequate to properly support replacement sill in a level condition.

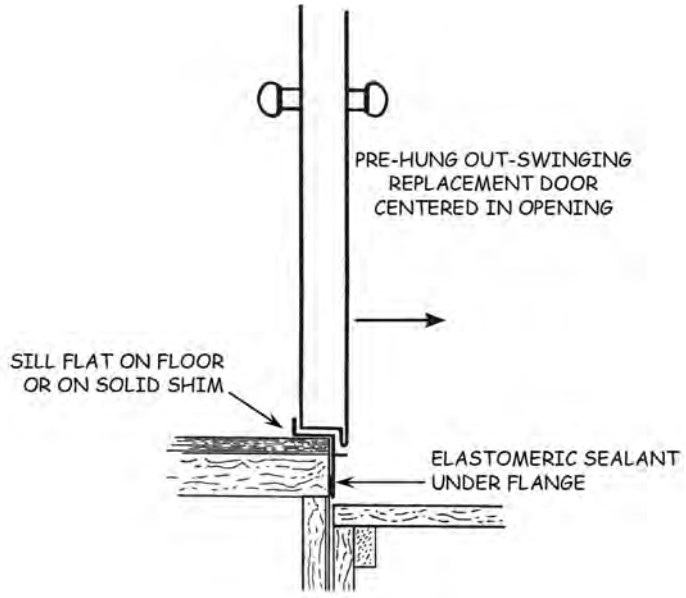


29. MOBILE HOME DOOR INSTALLATION REQUIREMENTS (cont.)

- **All Doors (cont.)**
  - Preparation of Opening (cont.)
    - Existing door frame, anchors and sealant shall be removed.
    - All mounting surfaces shall be smooth and clean.
  - Insulation shall be installed in gaps between door frame and rough opening (e.g., mineral fiber or backer rod; injected foam not allowed).
  - All exterior gaps and cracks exposed to the elements shall be sealed with elastomeric caulk.
  - Interior gaps shall be caulked in conformance with CSD WIS Section 8 (Caulking).
- **Installation Requirements for All Swinging Replacement Doors**
  - Sill shall be installed level over a solid surface/support.
  - Hinge side shall be securely supported and plumb.



- **Installation Requirements for In-Swinging "House Type" Doors**
  - For installation of door blank only, applicable requirements in this section for conventional home hinged doors apply to like doors installed in mobile homes.
  - Pre-hung doors with wooden box frame shall be installed in conformance with Item 28.
  - For installation of pre-hung door with flanged metal frame, applicable procedures below for positioning, sealing and attaching out-swinging flanged units apply.
- **Installation Requirements for Out-Swinging Replacement Doors**
  - Replacement mounting flange shall be positioned to cover holes left by removal of pre-existing door.
  - Elastomeric caulk or non-hardening sealant/putty tape shall be applied to the back of the mounting flange.
  - Sill shall rest on the floor, or it shall have solid support from jamb to jamb.
  - Unit shall be centered side-to-side in the opening, with:
    - Sides plumb, and
    - Frame square.



- The flange shall be securely anchored with screws spaced in accordance with manufacturer's instructions.
- Hardware shall be installed per manufacturer's instructions (i.e., lockset, door chain, pneumatic closer, etc.).

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

30. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.
- **Dwelling Unit Door to Hallway/Common-Area Doors**
  - Multi-Family Door Requirements
    - Confirm required door fire rating(s) with Fire Marshall having local jurisdiction.
    - All other installation requirements shall comply with this standard.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

31. WORKMANSHIP/OPERATION

- **All Doors**
  - Door shall seat properly when closed with no gaps or openings around the perimeter.
  - Door panel(s), and screened panel on sliding glass door, shall operate smoothly and freely without binding or scraping.
  - Hardware, lock assemblies, and weatherstripping shall function properly.
- **Attachments and Accessories**
  - Address numbers present on the existing door or trim shall be reinstalled.
  - Address numbers shall be positioned so they are clearly visible from the street.
  - Peephole, mechanical doorbell, mail slot, and other accessories shall also be reinstalled, when present on the existing door/trim.

32. CLIENT INSTRUCTIONS (DOORS)

- **All Doors**
  - Clients will be notified of changes or repairs made, and will be educated on how to operate and maintain doors.
  - Clients shall be notified of changes or repairs made and will be educated on how to operate and maintain weatherstripping and caulk around door and trim.
- **House to Garage Doors**
  - Client shall be educated on need to keep door from garage to house closed, and not to warm up vehicles or use any gas engine appliances or grills in the garage (even if the main door is left open).

REFERENCED STANDARDS

[1] CRC, §R308.4.

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NOTES

STORM WINDOWS

Lead Paint Risk Factor
HIGH

TABLE OF CONTENTS

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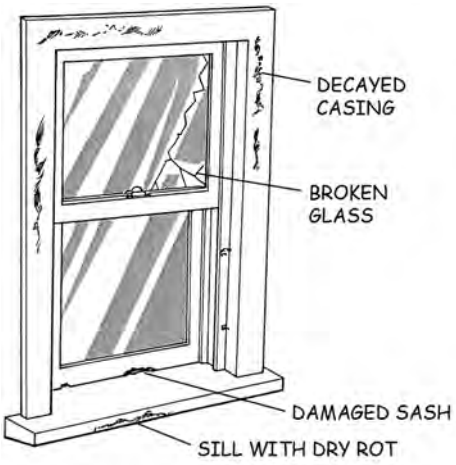
STORM WINDOWS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

STORM WINDOW REPAIR

See CSD WIS Section 12 (Glass Replacement and Window Repair).

STORM WINDOW INSTALLATION



1. PRIMARY WINDOWS

- **All existing components associated with the installation of the primary or main window shall be structurally sound.**
  - All necessary repairs shall be made to facilitate a proper storm unit installation.
  - Dry rot damage shall be repaired in wooden members.
  - Water penetration points shall be sealed.
- **All mounting surface contact areas shall be smooth, clean, and free of protrusions.**
- **Glass repairs shall be made as needed.**
  - Cracked and broken panes shall be replaced.
  - Small holes 1/4" or less in diameter shall be sealed with clear silicone caulk or clear glass repair tape.
- **Loose and missing glazing compound shall be replaced.**
- **Bare Wood**
  - Sealer is required on all bare wood, *except* redwood, before installing storm unit.
- **Air/Moisture Sealing**
  - Bypasses shall be repaired to prevent moisture accumulation between the primary and storm windows.

2. GLASS THICKNESS

- **Glass shall be selected in conformance with the currently-adopted California Residential Code (CRC[1]).**
- **The maximum pane size for each frame type and thickness of glass shall be as specified in Table 15-1, unless location-specific requirements of the CRC are more restrictive.**

TABLE 15-1: GLASS THICKNESS—CONVENTIONAL HOMES

Glass Thickness	Maximum Glass Size	
	Aluminum or Wood Frame	Rigid Vinyl Frame
Single Strength (SS)	16 sq. ft.	Not allowed
Double Strength (DS)	24 sq. ft.	17 sq. ft.[1]
3/16" Plate	45 sq. ft.	25 sq. ft.[2]
1/4" Plate	65 sq. ft.	Not allowed

[1] Maximum vertical measurement shall be 4' with vinyl frame, and glass shall be double-strength.
[2] No vinyl-framed single lite shall exceed 25 sq. ft.

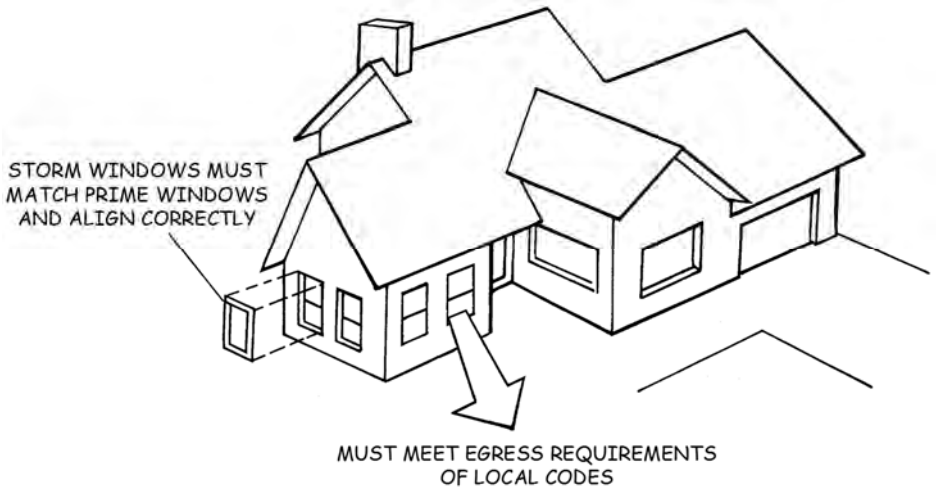
3. SAFETY GLASS

- **Windows**
  - If a primary window is required to be constructed of safety glass, the storm window shall conform to the same safety glass requirements, including material type(s) as specified in WIS Appendix A (Material Specifications).
  - Safety glazing shall be permanently labeled and installed in accordance with the CRC, part of which is summarized below:

- **Safety glass is required in any window adjacent to a door where:**
  - The nearest vertical edge is within 24" of the door, and
  - The bottom edge is *less* than 60" above the floor.
  - *Exception:* Not required when there is an intervening wall or other permanent barrier between the door and the glazing.
- **Safety glass is required in panes *larger* than 9 sq. ft. where:**
  - The bottom edge is *less* than 18" above the floor, and
  - The top edge is *more* than 36" above the floor, and
  - A walking surface is within 36" horizontally of the window.
  - *Exception:* As stipulated in the CRC.
- **Stairs and Landings**
  - Safety glass is required when the bottom edge of the glazing is less than 36" above the walking surface of a stairway or landing shall be installed in accordance with the CRC requirements.
- **Safety glass is required in shower and bathtub enclosures for exterior windows *less* than 60" above the floor of the enclosure.**
- **Plastic Glazing**
  - Polycarbonate may be used in lieu of safety glass where allowed by the local jurisdiction.

4. STORM WINDOW TYPE, SIZE, AND SHAPE

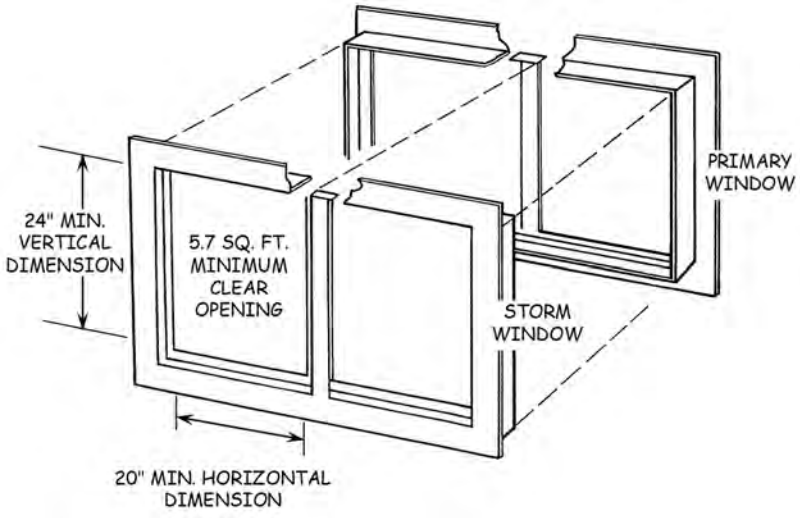
- **All Units**
  - Type, size, and shape of the storm window shall match the primary window.
  - Storm window frames, mullions, and meeting rails shall align with those of the primary window.
  - Egress windows shall conform to Item 5.
- **Interior Storm Windows**
  - Windows built for interior use shall be installed only on the interior.
  - Windows installed on the interior shall not contain solar control glazing or window film.



- **Exterior Storm Windows**
  - Windows built for exterior use shall be installed only on the exterior.
  - Clear glazed storm windows shall not be installed outside of primary windows with tinted glass or solar control film.

5. STORM WINDOW EGRESS

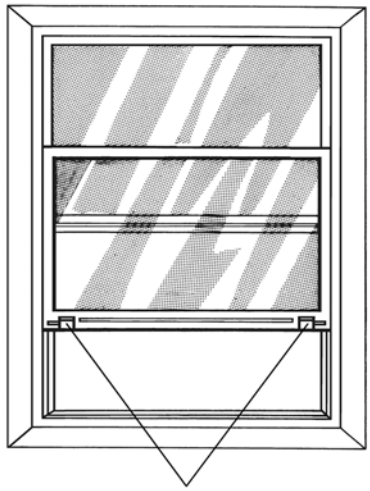
- **All Storm Windows**
  - Storm windows placed in emergency egress locations (bedrooms) shall be installed in conformance with the same egress requirements as for the primary window, and with local codes.
- **Opening Size**
  - Storm windows shall have a clear opening which is no smaller than that of the primary window and conforms to the following egress opening requirements:
    - Minimum clear opening area = 5.7 sq. ft.
    - Minimum clear horizontal dimension = 20".
    - Minimum clear vertical dimension = 24".



- **Non-conforming Primary Windows**
  - Operable storm windows shall not be installed in egress locations where the primary window clear opening is non-conforming.
- **Defective Primary Windows**
  - A primary egress window shall operate properly before a storm window shall be installed.

6. SASH REQUIREMENTS

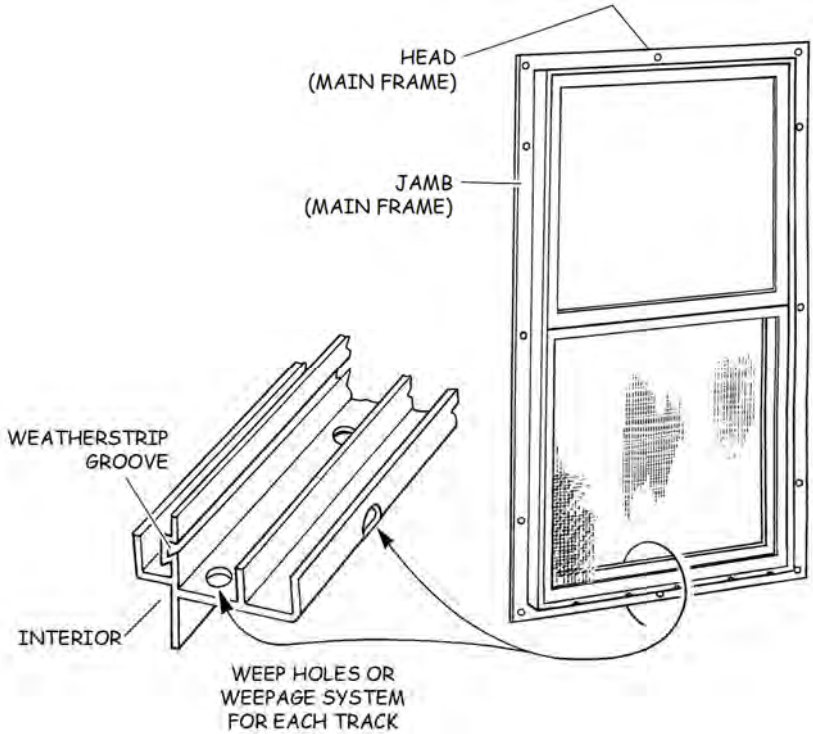
- **All Storm Windows**
  - Moveable Lites and Sash Panels
    - Windows shall be constructed to allow easy and accessible removal of moveable lites and fixed sash panels for cleaning, “set-aside” storage, and egress.
    - Such removal shall not require special tools.
  - Sash Operation
    - All operable windows shall be operable from inside the home.
    - All removable lites and sash panels shall be free of sharp edges or other conditions which could cause injury during normal use.
- **Vertical Sliders**
  - Sash travel shall be controlled to prevent “free fall”.
  - All vertical sliders shall be equipped with one of the following:
    - An automatic “sash lock” mechanism which stops at the next lower latch position when the sash is allowed to drop.
    - A pressure/friction system which will effectively prevent “free fall”.



AUTOMATIC LATCHES OR A FRICTION SYSTEM REQUIRED TO PREVENT "FREE FALL"

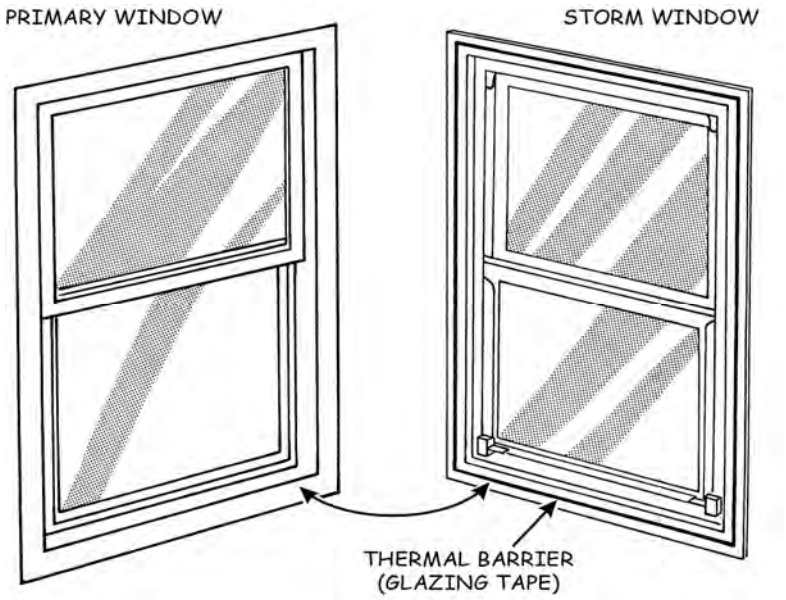
7. WEEPAGE SYSTEM

- **Exterior Storms**
  - A weepage system shall be provided.
    - Minimum 2 weep holes per track.
    - Holes shall be a minimum of 1/8" in diameter or equivalent.
- **Interior Storms**
  - A weepage system shall not be provided.



8. THERMAL BARRIER

- **Storm Windows**
  - A thermal barrier shall be installed to prevent metal-to-metal contact between primary and storm units.
  - Barrier shall be:
    - Glazing tape, gasket, or elastomeric material.
    - Minimum 1/8" thick.

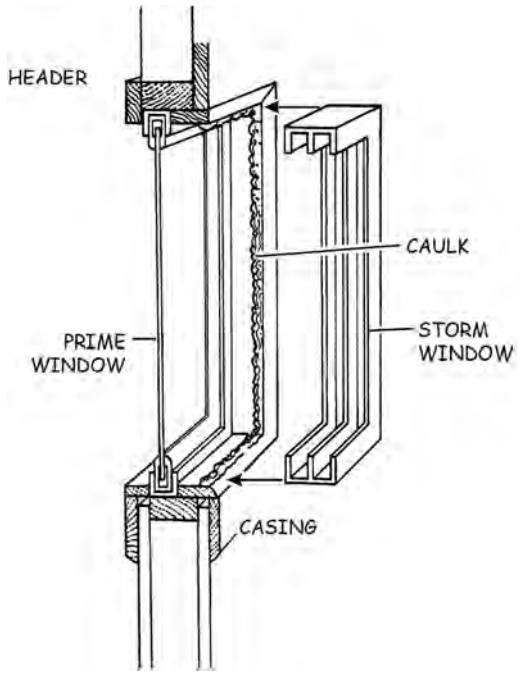


9. CORROSION PREVENTION

- **Storm Windows**
  - Dissimilar materials must be separated by a non-corrosive material, or unit shall fail quality control inspection.
  - Barrier shall be:
    - Glazing tape, gasket, or elastomeric material.
    - Minimum 1/8" thick.

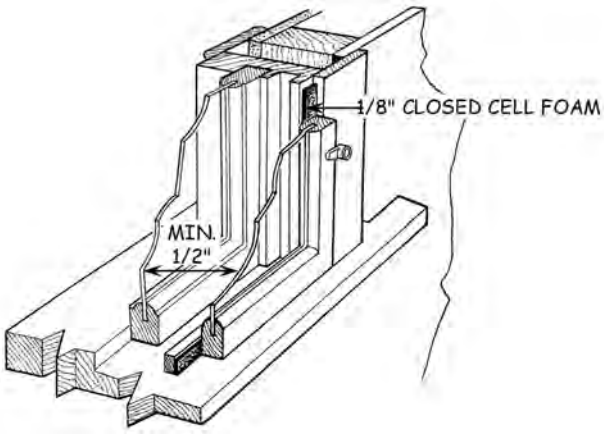
10. AIR SEALING

- **All Storm Windows**
  - Sealants shall be resilient, non-hardening, long-life materials.
  - All framed storm units shall be installed with a permanent airtight seal between the storm frame and the mounting surface.
  - All joints and gaps over 1/32" shall be sealed.
  - All exterior attachment penetrations shall be watertight.
  - Weep holes shall not be sealed.
- **All Interior Storm Windows**
  - The storm windows shall be sealed tighter than the exterior primary window.
- **Framed Interior Storm Window**
  - The frame shall be installed using glazing tape, caulking, or other effective sealant between the storm frame and the mounting surface so that a complete and permanent seal is provided around the entire perimeter of the storm window.



- **Unframed Interior Storm Window**
  - The mounting surface shall be sealed with a minimum 1/8" thick closed cell foam tape or equivalent.

- Panels attached with continuous magnetic strips require no additional gaskets if the attachment system provides an airtight seal.

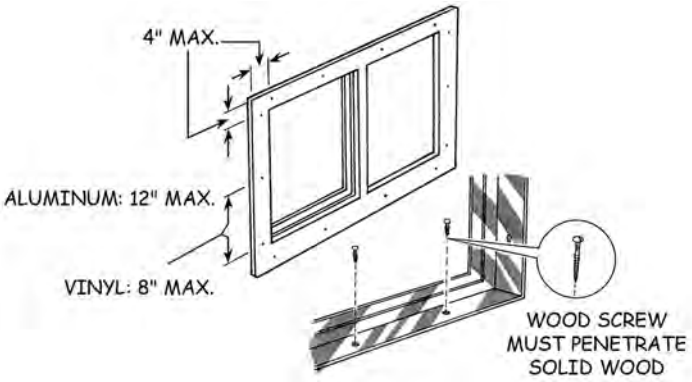


11. AIR SPACE

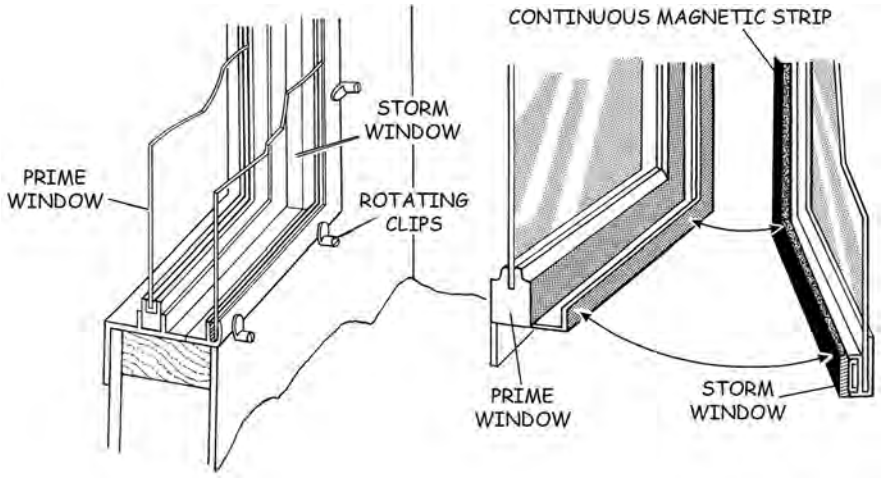
- **All Storm Windows**
  - The space between the storm and primary windows shall range between 1/2" and 4".

12. ATTACHMENT

- **All Storm Windows**
  - Installation of storm products shall conform to manufacturer's instructions and applicable code.
  - Attachment of the storm window shall in no way impede the proper operation of the primary window.
- **Exterior Storm Windows**
  - Frames shall be permanently anchored with corrosion-resistant screws per manufacturer's instructions of the following guidelines, whichever is more stringent.
    - Screws anchoring into solid wood shall penetrate the wood at least 3/4".
    - Screws shall be placed within 4" of each corner.
    - For metal frames:
      - Additional screws shall be placed 12" apart, maximum.
      - Minimum of 3 screws on each side exceeding 18" in length.
    - For vinyl frames:
      - Additional screws shall be placed 8" apart, maximum.
      - Minimum of 3 screws on each side exceeding 14" in length.



- **Framed Interior Storm Windows**
  - Windows with mounting fins shall be installed as prescribed above for Exterior Storm Windows.
  - Block frame windows (without fins):
    - Shall be securely attached within the prime window opening with screws.
      - Minimum 2 screws per jamb, for preassembled frames.
      - Minimum 2 screws per piece, when jambs, header, and sill are independent.
    - Shims shall be installed, as needed, to prevent torqueing or warping the frame.
- **Unframed Fixed Interior Storm Windows**
  - Applies to windows not in egress locations (see Item 5 for Egress Windows).
  - When secured with rotating clips,
    - Clips shall be located within 4" of each corner, and
    - Elsewhere, as needed, to provide a tight seal around the entire sash perimeter.
  - When secured with magnetic strips, attachments shall:
    - Be permanently bonded to the sash and mounting surface.
    - Have sufficient holding strength to retain the panel securely and maintain an airtight seal.



- **Sash Mount Storm Windows**
  - Storm sash shall be securely attached to prime sash with screws:
    - Within 4" of each corner, and
    - Elsewhere as required to create a complete seal.
  - Perimeter of storm sash shall be made airtight with sealant or weatherstripping.
  - Minimum 1/2" air space between storm and prime windows.

PART 2: MOBILE HOME CRITERIA

13. GLASS THICKNESS AND WEIGHT REQUIREMENTS

- **Panel Weight**
  - When installed in egress windows, removable panels requiring "set-aside" storage shall have a maximum weight of 20 lbs.
- **Pane Size**
  - The maximum pane size for each frame type and thickness of glass shall be as specified in Table 15-2.

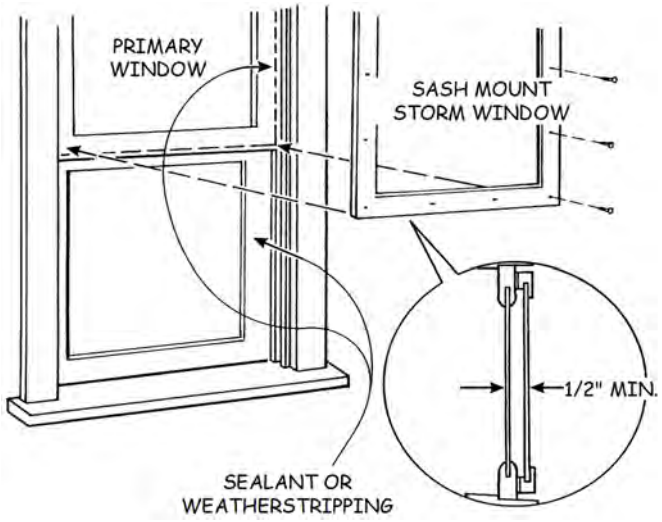


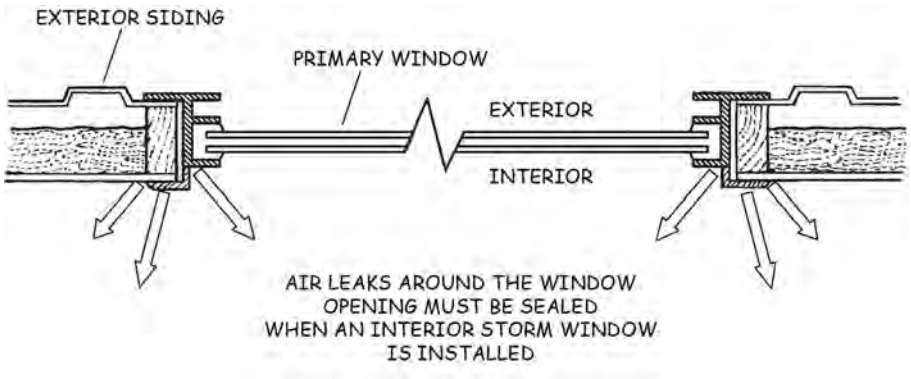
TABLE 15-2: GLASS THICKNESS—MOBILE HOMES

Glass Thickness	Maximum Glass Size	
	Aluminum or Wood Frame	Rigid Vinyl Frame
Single Strength (SS)	11 sq. ft.	Not allowed
Double Strength (DS)	15 sq. ft.	15 sq. ft. [1]
3/16" Plate	30 sq. ft.	25 sq. ft. [2]
1/4" Plate	43 sq. ft.	Not allowed

[1] Maximum vertical measurement shall be 4' with vinyl frame, and glass shall be Double Strength.
[2] No vinyl-framed single lite shall exceed 25 sq. ft.

14. MOBILE HOME INSTALLATION REQUIREMENTS

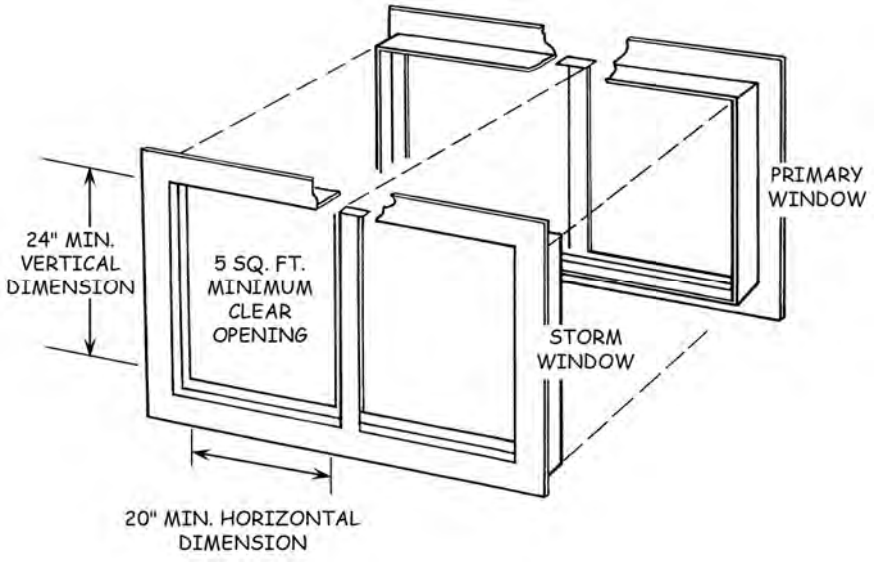
- **Primary Windows**
  - Significant bypasses shall be repaired to prevent moisture accumulation between the primary and storm windows.
    - Leakage at the glass perimeter shall be sealed by such means as:
      - Replacing missing or damaged gasket material when feasible.
      - Neatly sealing the perimeter with clear silicone or equivalent when gasket cannot be replaced.
    - Worn or damaged weatherstripping shall be replaced if possible.
    - All air infiltration bypasses to the wall cavity shall be repaired for interior storm window applications.



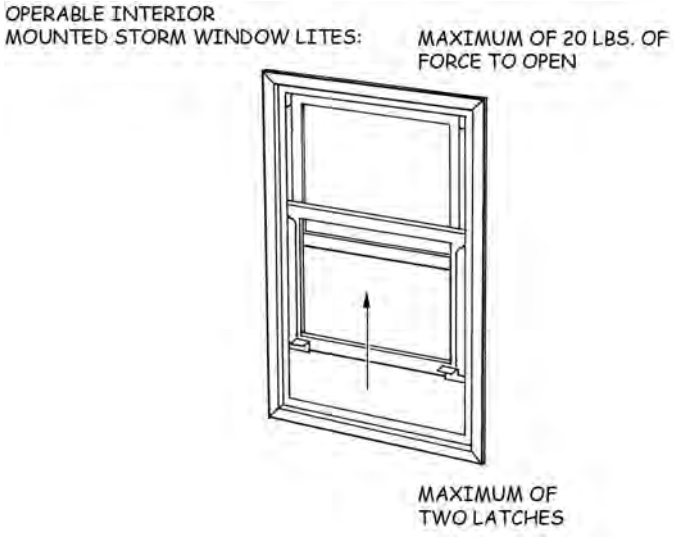
15. MOBILE HOME STORM WINDOW EGRESS REQUIREMENTS

- **All Storm Windows**
  - Windows placed in emergency egress locations (sleeping rooms) shall be installed in conformance with current AAMA standards[2].
- **Defective Primary Windows**
  - A storm window shall not be installed over a primary egress window that does not operate properly.
- **Opening Size**
  - Storm windows shall have a clear opening which is the greater of:
    - The primary window clear opening, or
    - The following egress opening requirements:
      - Minimum clear openable area = 5.0 sq. ft.
      - Minimum clear openable horizontal dimension = 20".
      - Minimum clear openable vertical dimension = 24".

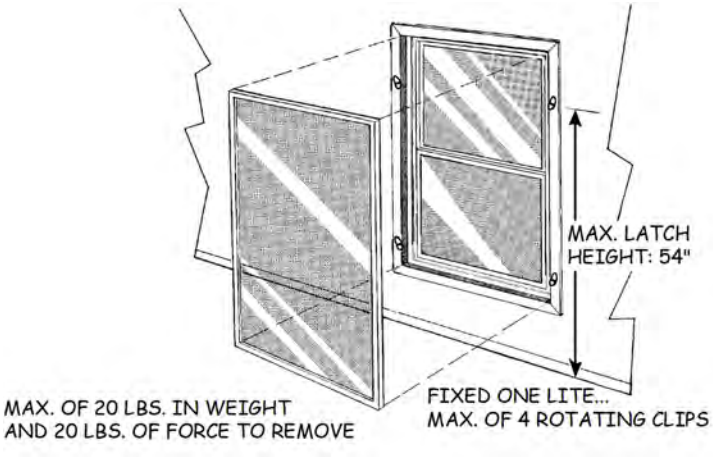
15. MOBILE HOME STORM WINDOW EGRESS REQUIREMENTS (cont.)



- **Operating Instructions**
  - The client shall be provided with both written and verbal instructions for the safe operation and/or removal of all storm windows installed in egress locations.
  - Instructions shall be in a durable form (e.g., permanent instruction label attached to the window, or an instruction card printed on card stock).
- **Operable Interior and Exterior Storm Windows**
  - The horizontal or vertical force required to open the window for egress shall not exceed 20 pounds.
  - Windows shall have no *more* than 2 locks or latches that require operation to achieve egress.



- **Fixed Storm Windows**
  - Shall be installed only on the interior.
  - Removable lites and panels (with or without sash) which require "set aside" for egress shall:
    - Have a maximum weight of 20 lbs.
    - Be removable by application of force not to exceed 20 lbs.
  - Storm windows that are held in place with pivot or swivel devices (rotating clips) shall have no *more* than 4 such devices requiring operation for egress.
    - Rotating clips shall be placed a maximum of 54" above the floor.
    - Rotating clips shall turn to open by application of force not exceeding 5 lbs.



16. MOBILE HOME LOCATION REQUIREMENTS

- **Interior Storm Windows**
  - Windows built for interior use shall be installed only on the interior.
  - Windows installed on the interior shall not contain solar control glazing or window film.
- **Exterior Storm Windows**
  - Windows built for exterior use shall be installed only on the exterior.
  - Clear glazed storm windows shall not be installed outside of primary windows with tinted glass or solar control film.
- **Operable Primary Windows**
  - Fixed storm windows shall be installed over operable primary windows:
    - Only on the interior, and
    - Only within the limitations set forth in Item 1.

17. MOBILE HOME SEALING

- **Storm Windows**
  - All joints and gaps over 1/32" shall be sealed.
  - All exterior attachment penetrations shall be water tight.
  - Weep holes shall not be sealed.
- **Unframed Interior Storm Windows**
  - The mounting surface shall be sealed with a minimum 1/8" thick closed cell foam tape or equivalent.
  - Panels attached with continuous magnetic strips require no additional gasket if the attachment system provides an airtight seal.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

18. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

19. PRIME WINDOW OPERATION

- **Permanently Mounted "Self-Storing" Operable Storm Windows**
  - Openable prime windows shall remain operable without removal of storm window sash or frame.
  - Interior access to prime window latches shall not be impaired.

20. CLIENT INSTRUCTIONS

- **Storm Windows**
  - Clients shall be notified of changes or repairs made, and will be educated on how to operate and maintain storm windows.
  - Clients shall be notified of changes or repairs made and will be educated on how to operate and maintain weatherstripping and caulk around windows and trim.

REFERENCED STANDARDS

[1] CRC

[2] AAMA 1704

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NOTES

WATER HEATER INSULATION

Lead Paint Risk Factor
NONE

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WATER HEATER INSULATION

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

WATER HEATER INSULATION REPAIR

1. WATER HEATER SEISMIC (EARTHQUAKE STRAPS)

- **General Application**
  - Straps shall be added when a water heater is not strapped, or was not strapped properly, AND:
    - The water heater is replaced or repaired.
    - It is required by the local jurisdiction (proof of requirement must be on file with the agency).
    - A water heater blanket is feasible and will be installed.
  - Strap kits must be selected in compliance with WIS Appendix A (Material Specifications) and installed in compliance with manufacturer's instructions.

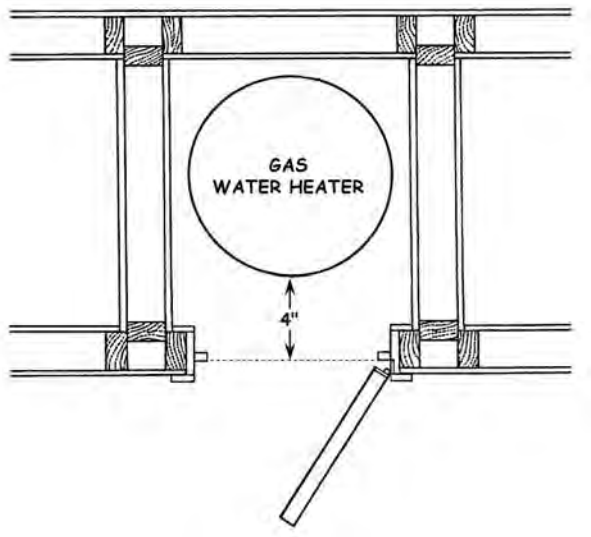
WATER HEATER INSULATION INSTALLATION

2. STORAGE WATER HEATERS ONLY

- **The section does not apply to Tankless Water Heaters.**

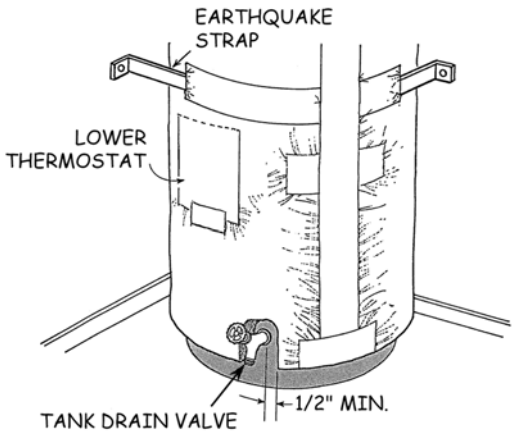
3. UNIT LOCATION—STORAGE WATER HEATERS

- **All Water Heaters**
  - Unit must be located inside a protected area which is not exposed to the weather.
  - Units in both conditioned and unconditioned space shall be insulated.
  - Unit shall not be insulated if *less* than 12" from a gas cook stove.
- **Gas Water Heaters—Open Combustion Natural Draft**
  - Clearance prior to blanket installation shall be:
    - Minimum 4" clearance in front.
- **Gas Water Heaters—Induced Draft and Sealed Combustion Chamber**
  - Sealed combustion chamber includes FVIR (Flammable Vapor Ignition Resistant) and Closed Combustion (Direct Vent) units.
  - 3" front clearance is acceptable, when allowed by the manufacturer, per the installation instructions or on the name/data plate.
- **Electric Water Heaters**
  - Clearance prior to blanket installation shall be:
    - Front clearance shall be sufficient to allow the enclosure door to close freely with blanket installed.



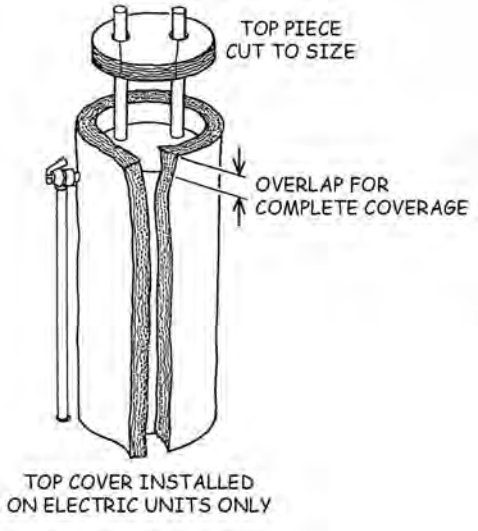
4. EARTHQUAKE (SEISMIC) STRAPS AND BRACES

- **Earthquake Straps and Bracing Devices**
  - Earthquake straps and bracing devices shall not be installed over insulation.
  - Bracing shall be fit tight to the body of the tank.
  - The blanket shall be slit to fit around straps and braces.
  - All slits shall be securely taped.



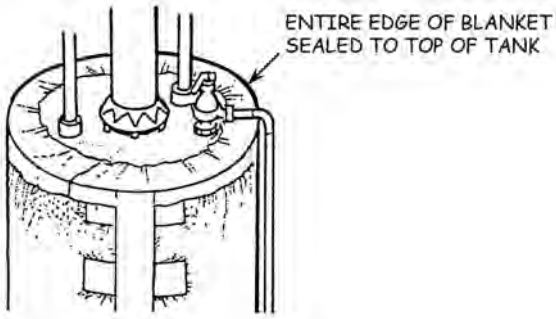
5. COVERAGE

- **Gas Water Heaters**
  - Top of tank shall not be insulated on natural draft units.
  - Top cover shall be installed on power-vented units (closed combustion and induced draft), with 3" clearance from flue system and/or inducer fan.
  - Side insulation shall:
    - Completely surround tank to provide 100% coverage.
    - Extend from top of tank to bottom of drain valve neck.
  - Side insulation shall not extend beyond bottom of tank, nor shall it in any way restrict combustion air access.
- **Electric Water Heaters**
  - Top of tank shall be completely covered with insulation.
  - Side insulation shall:
    - Completely surround tank to provide 100% coverage.
    - Extend down to bottom of drain valve neck.



6. TOP SEAMS AND EDGES

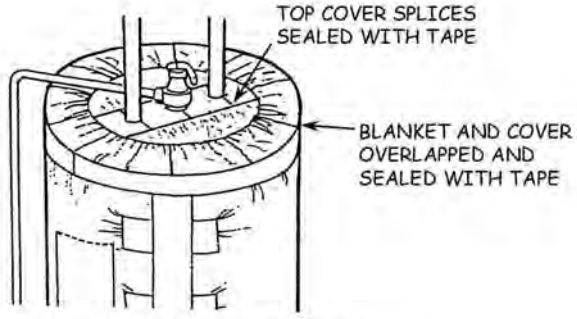
- **Gas Water Heaters**
  - Top edge of blanket shall be sealed to top of tank with tape around the entire perimeter of tank.
- **Electric Water Heaters**
  - Top Seams
    - Perimeter of top cover shall be sealed to top edge of blanket with tape.
    - All seams and slits in cover shall be sealed with tape.



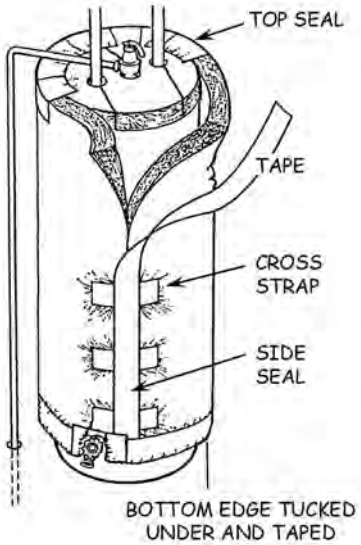
GAS UNIT - NO TOP COVER

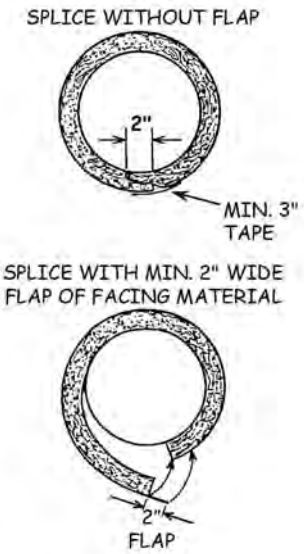
7. SIDE SEAMS AND BOTTOM EDGE

- **Side Seams on All Water Heaters**
  - Cross Straps
    - All splices shall be reinforced with minimum 10" long cross straps of tape.
    - Cross straps shall be located a maximum of 18" apart.
  - Splices With Minimum 2" Wide Flap of Facing Material
    - Pieces shall be joined securely and sealed with tape the full length of the flap.
  - Splices Without Flap
    - Blanket shall be overlapped at least 2".
    - Seams shall be sealed with tape the full length of the splice.



ELECTRIC UNIT - TOP COVER INSTALLED

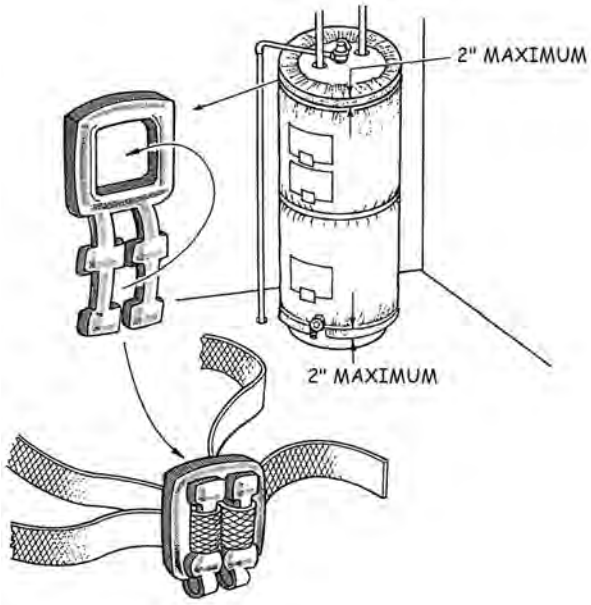




- **Bottom Edge on Water Heaters Within the Living Space (<u>Not</u> In an Enclosure)**
  - Bottom edge fiberglass shall <u>not</u> be left exposed.
    - The bottom edge shall be sealed to the tank with tape, <u>or</u>
    - The facing shall be tucked under and taped permanently in place.

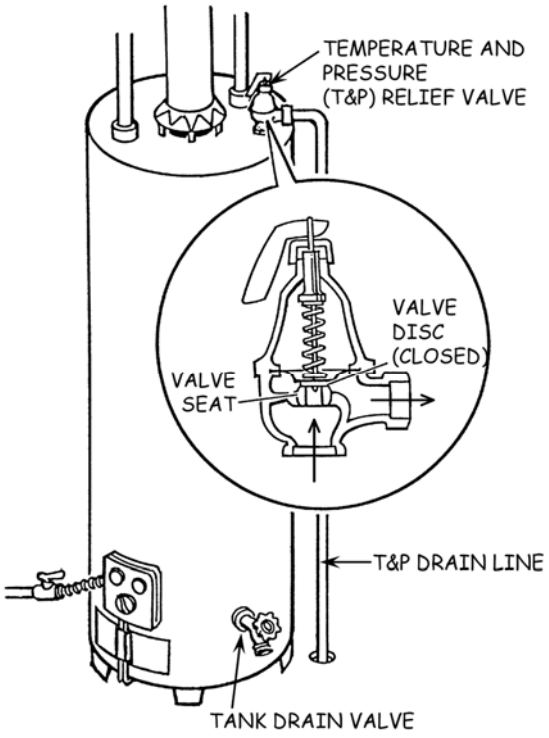
8. BLANKET STRAPS AND BUCKLES

- **All Water Heaters**
  - A minimum of three (3) blanket straps shall be installed in addition to tape.
  - Straps shall be secured with buckles or other mechanical strap locks; tying of straps is not allowed.
  - Straps shall be installed:
    - One strap within 1-2" of the top of water heater, and
    - One strap within 1-2" of the bottom of blanket, or as close to that as feasible, and
    - One strap midway on the blanket.
  - Straps shall not be placed over thermostat cover plates, controls, valves or burner access door.
  - Straps shall provide a snug fit, with minimum compression of blanket under straps only.



9. TEMPERATURE AND PRESSURE PROTECTION

- **Temperature and Pressure**
  - In accordance with the CSD Field Guide and WIS Sections 42 and 43 (Water Heater Storage – Gas and Electric), tank shall be protected by temperature and pressure device.
  - Blanket installation shall be adjusted as described in this section.
- **Electric Water Heaters**
  - Tank shall be protected by a Temperature and Pressure (T&P) valve.
- **Gas Water Heaters**
  - Tank shall be protected by a:
  - Temperature and Pressure (T&P) Valve, or
  - Automatic Gas Shutoff Valve (AGSV), which is triggered by tank temperature and required when a TPV is not feasible.
- **All Water Heaters**
  - T&P valve shall not be covered by the blanket.
  - AGSV (if present), and gas pipe/flex to/from the AGSV, shall not be covered.
  - End of T&P drain line:
    - Shall be open and unobstructed (not capped or plugged).
    - Shall not be covered or obstructed by the blanket.
    - If T&P drain line is not present, insulation shall not obstruct outlet of the valve.



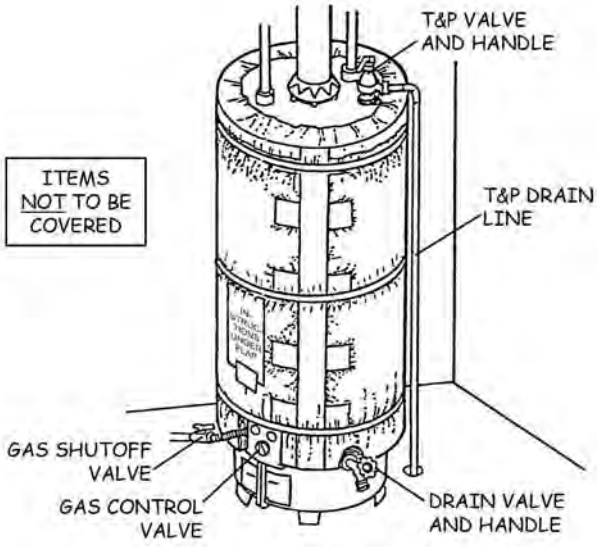
10. TANK DRAIN VALVE

- **All Water Heaters**
  - The tank drain valve shall not be covered by the blanket.
  - Minimum 1/2" clearance required between the blanket and the valve.

ADDITIONAL CRITERIA FOR GAS WATER HEATERS

11. THERMOSTAT CONTROL UNIT

- **Restrictions**
  - Gas control valve shall not be covered by blanket or tape.
  - Strap shall not be placed over front of control valve.



12. BURNER ACCESS AND DRAFT HOOD

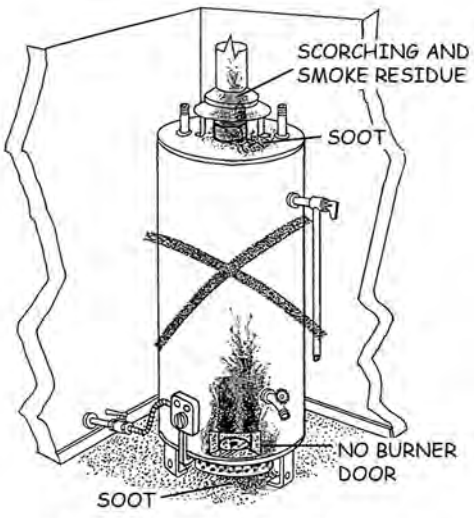
- **Clearance**
  - Minimum 3" clearance required from blanket and tape to edge of:
    - Burner access opening.
    - Draft hood opening.

13. COMBUSTION AIR SUPPLY

- **Clearances**
  - Air path shall not be obstructed.
  - On Flammable Vapor Ignition Resistant (FVIR) Water Heaters, combustion air inlets shall be identified, and shall not be covered.
  - When unit is located in attic with loose fill insulation present, blocking shall be installed in accordance with CSD WIS Section 20A (Ceiling Insulation for Conventional Homes).

14. COMBUSTION SAFETY REQUIREMENT—GAS UNITS

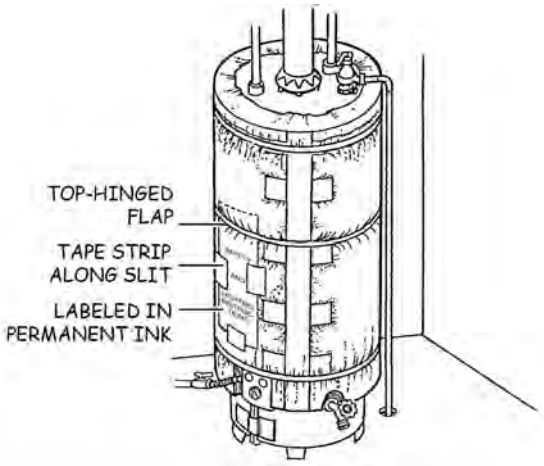
- **Evidence of Improper Combustion**
  - Insulation shall not be installed when there is evidence of improper combustion, such as:
    - Soot accumulation near draft hood or on floor underneath tank.
    - Scorching or smoke residue at the draft hood or combustion chamber access.
- **Combustion Chamber Access Cover**
  - At least one access cover shall be present.
  - There shall be no signs of scorching or incomplete combustion.
- **Other CAS Fail**
  - Insulation shall not be installed until any and all water heater CAS Hazards are corrected.



TANK WITH EVIDENCE OF IMPROPER COMBUSTION IS NOT INSULATED

15. OPERATION AND SAFETY INSTRUCTIONS—GAS UNITS

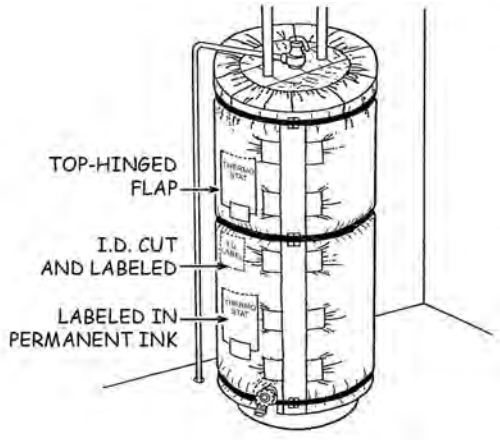
- **Blanket Flaps**
  - Identification label, safety information and lighting instructions shall be identified and made easily accessible.
  - A flap (top-hinged when possible) shall be cut in blanket to provide access.
  - Flaps shall be held closed with tape.
    - A minimum of one tape strip shall be installed along slit opposite flap hinge.
    - All slits longer than 12" shall be secured with tape installed lengthwise along the slit.
  - Flaps shall be labeled in permanent ink to identify what is underneath (e.g., “Safety Instructions”).
  - Client shall be shown how to access information contained beneath the blanket flaps.



ADDITIONAL CRITERIA FOR ELECTRIC WATER HEATERS

16. THERMOSTATS AND IDENTIFICATION LABEL

- **Upper and Lower Thermostats**
  - Locations shall be identified and made easily accessible.
    - Blanket shall be cut on sides and bottom to create a top-hinged flap over each thermostat cover plate.
    - Flap shall be held closed with tape installed along bottom slit.
    - Each flap shall be labeled in permanent ink: “Thermostat” or “ID Label”.



- **Identification Label**
  - Flaps shall be held closed with tape.
    - A minimum of one tape strip shall be installed along slit opposite flap hinge.
    - All slits longer than 12" shall be secured with tape installed lengthwise along the slit.
  - Flaps shall be labeled in permanent ink to identify what is underneath (e.g., model number, thermostat).
  - Client shall be shown how to access information contained beneath the blanket flap.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

17. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers’ website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

Not applicable to this measure.

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NOTES

MULTI-FAMILY CENTRAL WATER HEATER INSULATION

Lead Paint Risk Factor
NONE

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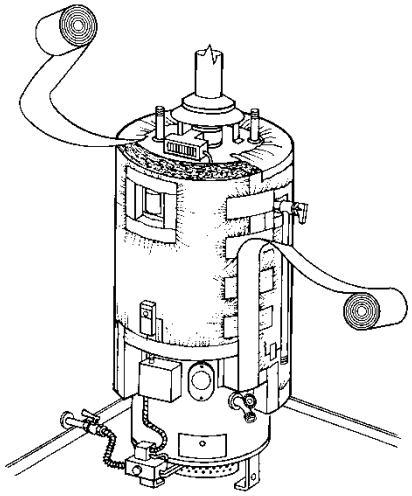
MULTI-FAMILY CENTRAL WATER HEATER INSULATION

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

This measure is not applicable to conventional homes.

PART 2: MOBILE HOME CRITERIA

This measure is not applicable to mobile homes.



PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

MF WATER HEATER INSULATION REPAIR

1. WATER HEATER SEISMIC (EARTHQUAKE STRAPS)

- **General Application**
  - Straps shall be added when a water heater is not strapped, or was not strapped properly, AND:
    - The water heater is replaced or repaired.
    - It is required by the local jurisdiction (proof of requirement must be on file with the agency).
    - A water heater blanket is feasible and will be installed.
  - Strap kits must be selected in compliance with WIS Appendix A (Material Specifications) and installed in compliance with manufacturer's instructions.

MF WATER HEATER INSULATION INSTALLATION

2. MULTI-FAMILY INSTALLATION REQUIREMENTS

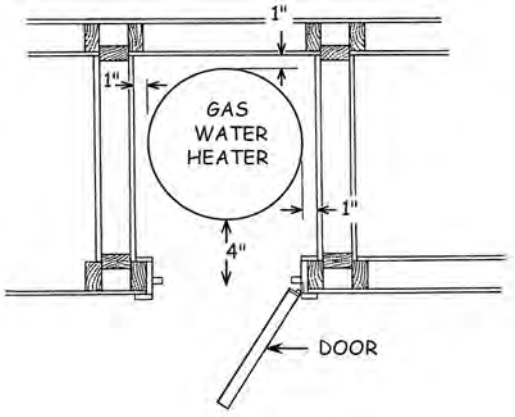
- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

3. MF STORAGE WATER HEATERS ONLY

- **This section does not apply to Tankless Water Heaters or MF Boilers/Chillers.**

4. MF UNIT LOCATION AND CLEARANCES

- **All Water Heaters**
  - Insulation shall be installed only on tanks not exposed to the weather:
- **Gas Water Heaters**
  - Clearance requirements prior to blanket installation:
    - 1" minimum clearance on sides and back.
    - 4" minimum clearance in front.
- **Electric Water Heaters**
  - Clearance requirements prior to blanket installation:
    - 1" minimum clearance on sides and back.
    - Front clearance shall be adequate to allow enclosure door to close without unusual force.
- **Adjacent Vertical Water Pipes (*Less* than 1" from Tank)**



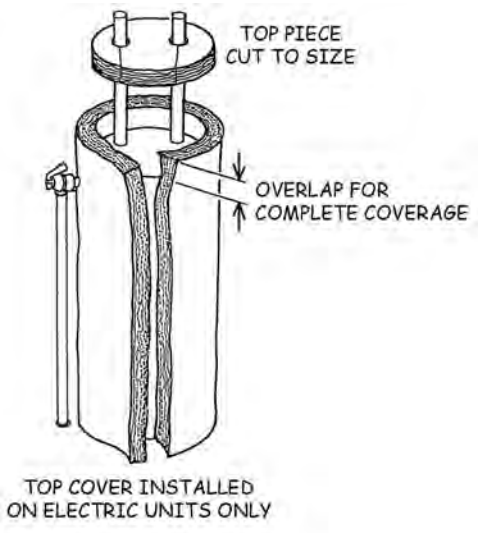
- Blanket shall be placed between tank and pipe when possible.
- When blanket will not fit under pipe, blanket shall be placed around (over) pipe and sealed with tape.

5. MF EARTHQUAKE STRAPS AND BRACES

- **Units with Straps and/or Braces Attached to Tank**
  - Earthquake straps and bracing devices shall not be installed over insulation.
  - Bracing shall be fit tight to the body of the tank.
  - The blanket shall be slit to fit around straps and braces.
  - All slits shall be securely sealed with tape.

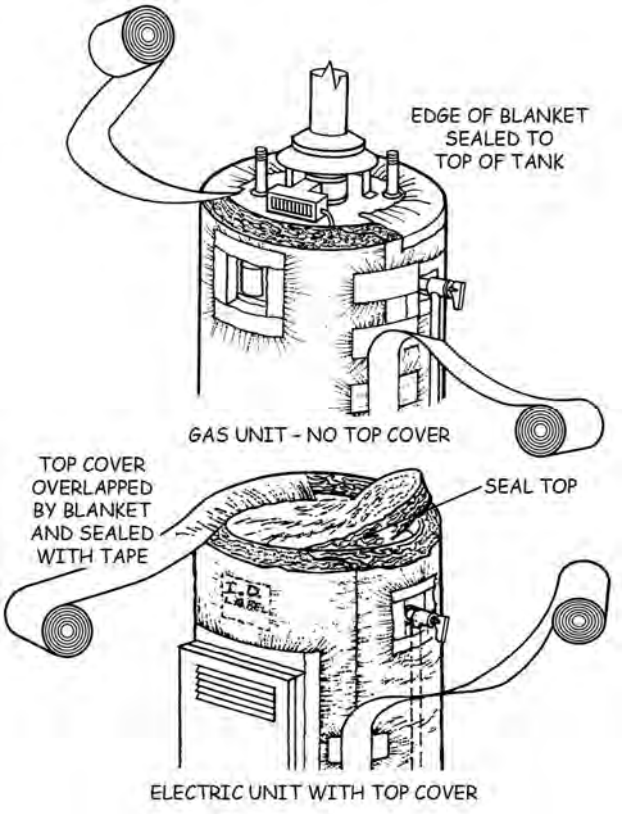
6. COVERAGE

- **Gas Water Heaters**
  - Top of tank shall not be insulated.
  - Side insulation shall:
    - Completely surround tank to provide 100% coverage.
    - Extend from top of tank to bottom of drain valve neck.
  - Side insulation shall not extend beyond bottom of tank or in any way restrict combustion air access.
- **Gas Boilers**
  - Boilers shall not be externally insulated.
- **Electric Water Heaters**
  - Top of tank shall be completely covered with insulation.
  - Side insulation shall:
    - Completely surround tank to provide 100% coverage.
    - Extend down to bottom of drain valve neck.



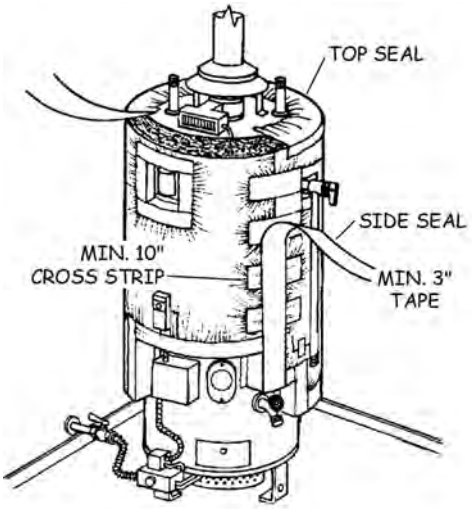
7. TOP SEAMS AND EDGES

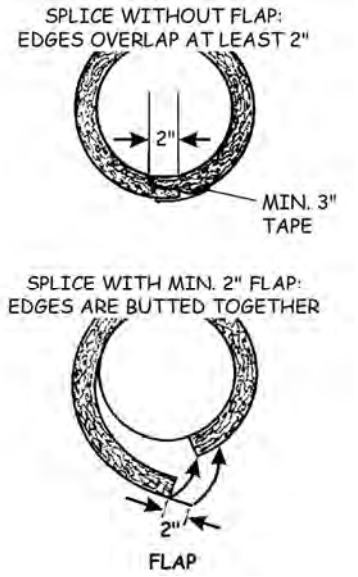
- **Gas Water Heaters**
  - Top edge of blanket shall be sealed to top of tank with tape around the entire perimeter of tank.
- **Electric Water Heaters**
  - Perimeter of top cover shall be sealed to top of blanket with tape.
  - All seams and slits in cover shall be sealed with tape.



8. SIDE SEAMS AND EDGES

- **All Water Heaters**
  - Side Seams
    - Cross Straps
      - All vertical seams shall be reinforced with minimum 10" long cross straps of tape.
      - Cross straps shall be located a maximum of 18" apart.
    - Splices with minimum 2" wide flap of facing material
      - Splices shall be joined securely and sealed with tape the full length of the flap.

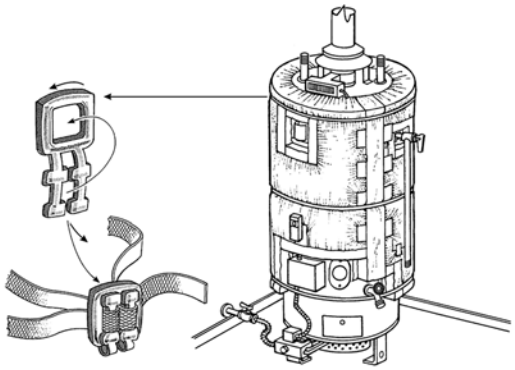




    - Splices without flap
      - Blanket shall be overlapped at least 2".
      - Seam shall be sealed with tape the full length of the splice.
  - Exposed Edges
    - Locations subject to frequent human usage (e.g., laundry room)
      - All exposed fiberglass edges shall be sealed with tape (i.e., where blanket is cut out or trimmed back to provide required clearance, including bottom edge).

9. BLANKET STRAPS AND BUCKLES

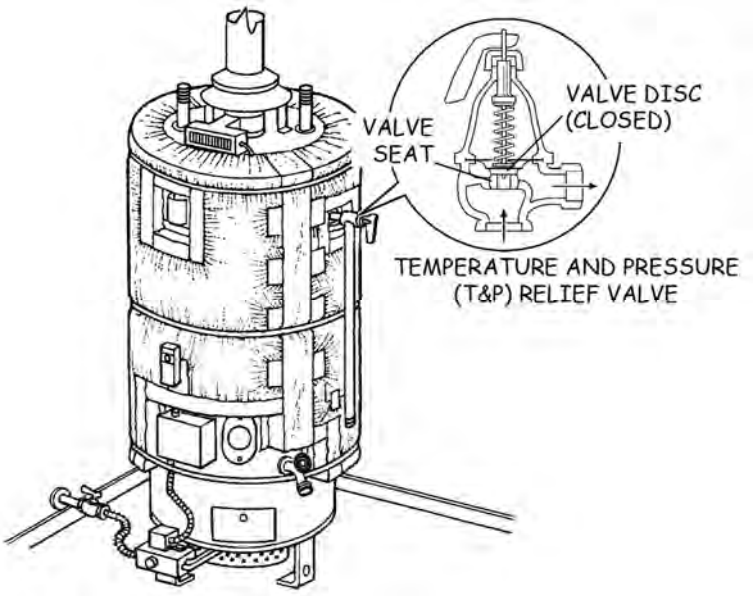
- **All Water Heaters**
  - A minimum of three (3) blanket straps shall be installed:
    - One within 1-2" of the top of water heater, and
    - One within 1-2" of the bottom of blanket, or as close to that as feasible, and
    - One strap midway on the blanket.
  - Blanket straps shall <u>not</u> be placed over controls, valves, clean-out cover or burner access door.
  - Straps shall be mechanically secured with buckles; tying straps <u>not</u> allowed.
  - Straps shall provide a snug fit, with minimum compression of blanket under straps only.



EXAMPLE OF
BLANKET STRAP AND BUCKLE

10. TEMPERATURE AND PRESSURE PROTECTION

- **Temperature and Pressure Requirements**
  - In accordance with the CSD Field Guide and CSD WIS Sections 42 and 43 (Water Heater – Storage Gas and Storage Electric), tank shall be protected by temperature and pressure device. Blanket installation shall be adjusted as described in this section.
- **All Water Heaters**
  - In accordance with the CSD Field Guide, tank shall be protected by a:
    - Temperature and Pressure (T&P) valve, or
    - Automatic Gas Shutoff Valve (AGSV).
  - T&P valve shall not be covered by the blanket.
  - AGSV (if present), and gas pipe/flex to/from the AGSV, shall not be covered.
  - End of drain line:
    - Shall be open and unobstructed (not capped or plugged).
    - Shall not be covered or obstructed by the blanket.

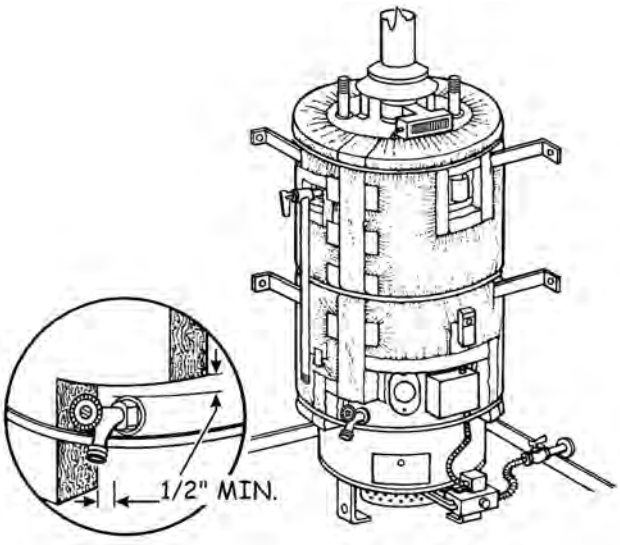


11. TANK DRAIN VALVE

- **All Water Heaters**
  - The tank drain valve shall not be covered by the blanket.
  - Minimum 1/2" clearance required between the blanket and the valve.

12. WATER HEATER PIPE INSULATION

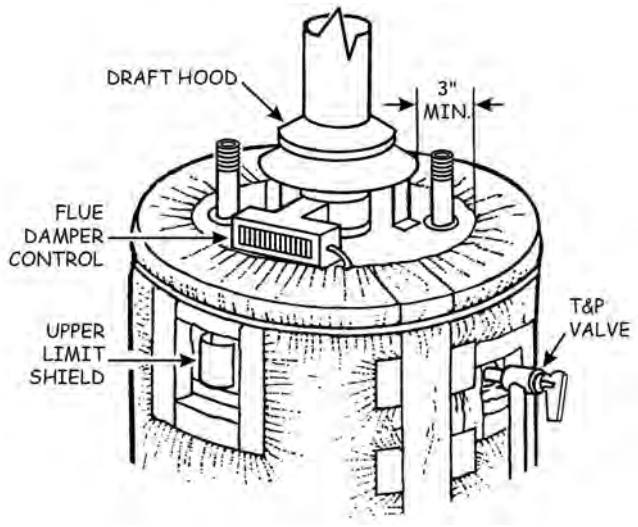
- **All Water Heaters**
  - Pipe insulation shall be installed as prescribed in CSD WIS Section 18.

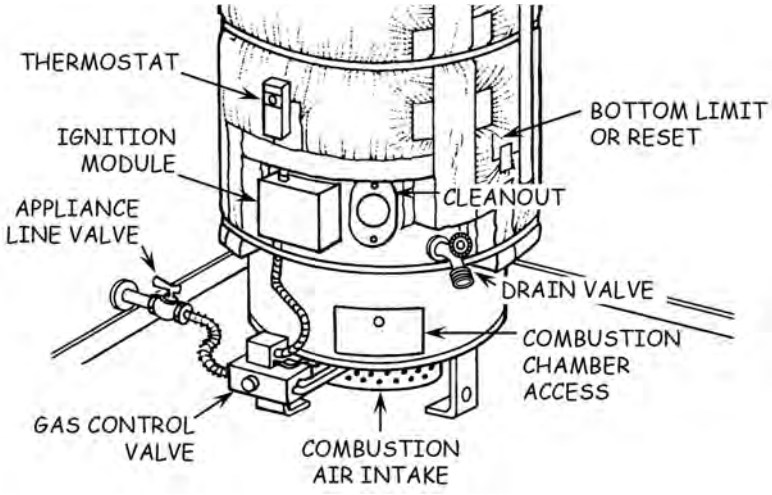


ADDITIONAL CRITERIA FOR GAS WATER HEATERS

13. SAFETY CLEARANCES—GAS UNITS

- **Draft Hood**
  - Minimum 3" clearance between draft hood opening and tape or blanket.
- **Flue Damper**
  - Blanket, tape and strap shall not cover control unit or interfere with damper operation.
- **Controls and Valves**
  - Blanket, tape and straps shall not cover:
    - Upper Limit Switch/Bulb/Shield
    - Thermostat
    - Ignition Module
    - Gas Control Valve
    - Appliance Line Valve
- **Bottom Limit Switch/Manual Reset**
  - A hinged flap (top-hinged when possible) shall be cut to mark location.
  - Flap shall be labeled in permanent ink and taped closed on the side opposite hinge.
- **Cleanout/Inspection Port**
  - Minimum 1" clearance between cover plate and blanket, tape or strap.
- **Combustion Chamber Access**
  - Minimum 3" clearance between access and blanket, tape or strap.



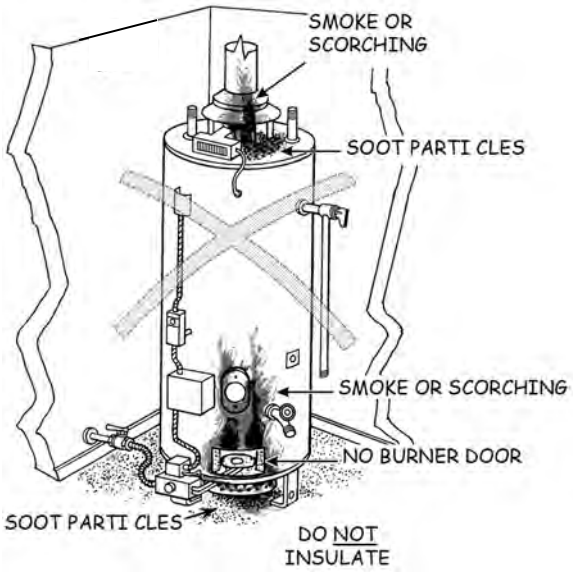


14. OPERATION, SAFETY AND ID LABELS—GAS UNITS

- **Gas Water Heaters**
  - Identification label, safety information and lighting instructions shall be identified and made easily accessible.
    - A flap (top-hinged when possible) shall be cut in blanket to provide access.
    - Flaps shall be held closed by tape.
      - Minimum of one strip across slit opposite hinge side of flap.
      - All slits longer than 12" shall be secured with tape installed lengthwise along the slit.
    - Flaps shall be labeled in permanent ink to identify what is underneath (e.g., "Safety Instructions").
    - Multi-family building management shall be shown how to access information contained beneath the blanket flap.

15. COMBUSTION SAFETY REQUIREMENT—GAS UNITS

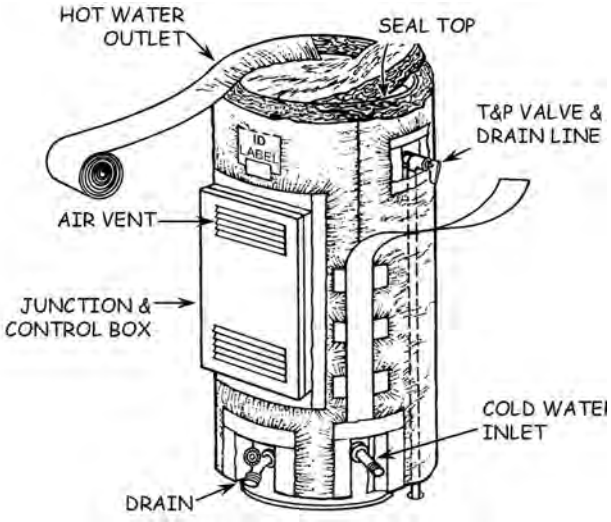
- **Evidence of Improper Combustion**
  - Tank and pipe insulation shall not be installed when any of the following is present:
    - Soot accumulation near draft hood or on floor underneath tank.
    - Scorching or smoke residue at the draft hood or combustion chamber access.
- **Combustion Chamber Access Cover**
  - Tank and pipe insulation shall be installed only when at least one access cover is present.



ADDITIONAL CRITERIA FOR ELECTRIC WATER HEATERS

16. ID LABEL AND THERMOSTAT ACCESS—ELECTRIC UNITS

- **ID Label (make, model, size and electrical information)**
  - Label location shall be outlined (but not cut) and shall be labeled in permanent ink (e.g. "I.D. Label").
  - Multi-family building management shall be shown how to access information contained beneath the blanket flap.
- **Flush-Mount, Unvented Thermostat Covers**
  - A flap shall be cut and secured as prescribed in Item 13.
  - Flap shall be marked in permanent ink (e.g., "Thermostat").
- **Junction Box and Housing**
  - Blanket shall be trimmed to fit around surface-mount boxes.
  - Blanket shall be secured to tank/box with tape that covers all exposed fiberglass edges.
- **Air Vents**
  - Air vents in junction box or cover plate shall not be covered by blanket, tape or strap.



PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

Not applicable to this measure.

WATER HEATER PIPE INSULATION

Lead Paint Risk Factor
NONE

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WATER HEATER PIPE INSULATION

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

PIPE INSULATION REPAIR

1. REPAIR FEASIBILITY

- **All Units**
  - When poorly-functioning, degraded pipe insulation is present, it shall be removed and new material installed rather than repaired.
  - Limited repair (i.e., cutting back of existing pipe insulation to prevent fire hazard) is required, if the client is not physically capable of making the correction.

PIPE INSULATION INSTALLATION

2. PIPES TO BE INSULATED

- **All Water Heaters (Including Tankless)**
  - Insulation shall be installed on hot and cold water pipes which are:
    - Insulation in conformance with CSD WIS Appendix A (Material Specifications).
    - Connected to the water heater.
    - Rigid or flexible lines, as feasible.
    - Free of leaks.
    - Under continuous water pressure (for storage tanks only).

3. R-VALUE

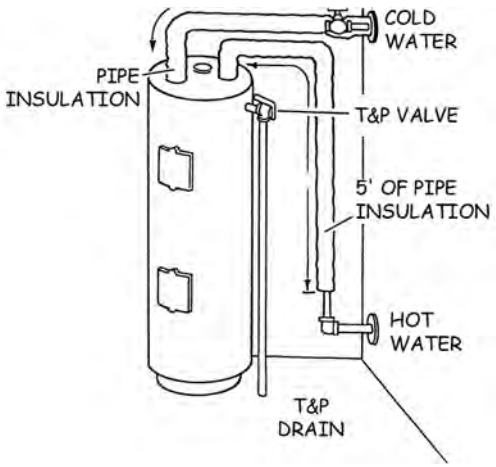
- **R-Value shall be in conformance with Table 18-1.**

TABLE 18-1: PIPE INSULATION MINIMUM R-VALUE

Pipe Diameter	Minimum Wall Thickness	Minimum R-value
1" or Less	1.0"	R-4
Over 1"	1.5"	R-6

4. COVERAGE REQUIREMENTS

- **Water Heater Pipes**
  - Insulation shall cover all accessible portions of each pipe (hot and cold) in accordance with the CSD Field Guide.
  - Insulation shall begin at the tank *unless* prevented by clearance requirement (see Item 5).
  - Elbows and curves shall be covered without gaps.
  - Valves shall be covered, but handles shall be left clear and unobstructed.



5. COVERAGE RESTRICTIONS

- **All Units**
  - Insulation shall not cover:
    - Temperature and pressure (T&P) valve or automatic gas shutoff valve.
    - Valve handles.
    - Control and safety devices.
    - T&P drain line.
    - Leaking pipes.
- **Gas Units**
  - Clearances shall be in conformance with table 18-2, or as specified by pipe listing.

TABLE 18-2: CLEARANCE BETWEEN INSULATION AND VENT PIPE/COMPONENT

Pipe/Component	Clearance from Insulation
Single-wall Pipe	6"
Type B Double-wall Pipe	1"
Type L Double-wall Pipe	3"
Draft Hood Opening	Shall not be obstructed

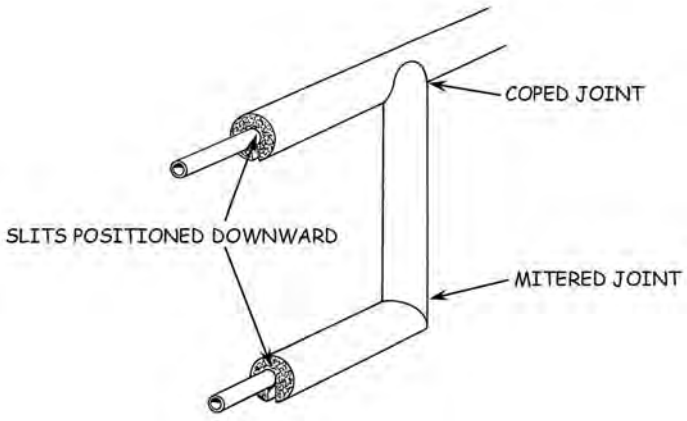
PREFORMED PIPE INSULATION

6. POSITION OF SLITS

- **All Units**
  - Slits shall be positioned downward on horizontal pipe.

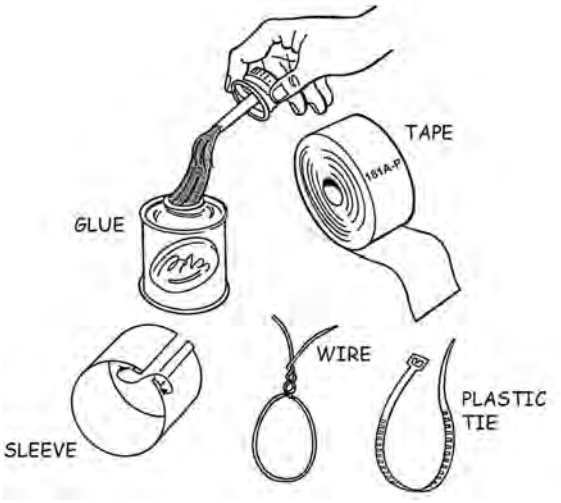
7. CORNERS, BENDS, AND JOINTS

- **All Units**
  - Insulation shall be mitered and/or notched on bends, corners, and joints to provide complete closure without gaps.



8. GENERAL ATTACHMENT REQUIREMENTS

- **All Units**
  - Insulation shall be firmly secured with plastic ties (e.g., UV-resistant cable ties), tape, wire, or sleeves.
  - All slits and joints shall be glued or taped to achieve complete closure.
  - Tape shall be used on bends, 90º elbows, and joints.
  - All material shall be corrosion-resistant.



9. GLUE FOR ATTACHMENT

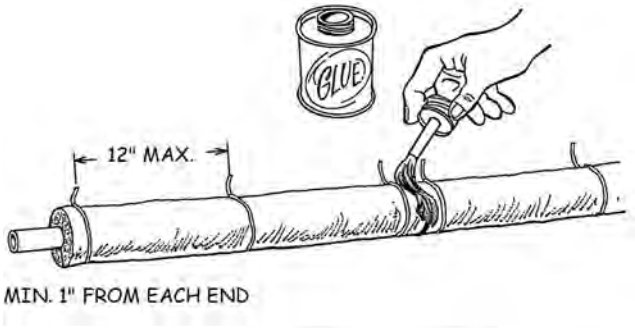
- **All Units**
  - Glue shall be compatible with insulation material and manufacturer's instructions.

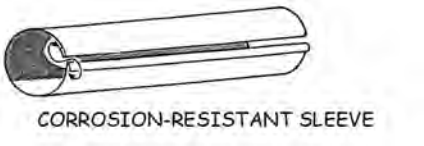
10. TIES AND TAPE FOR ATTACHMENT

- **All Units**
  - Tape shall be in compliance with CSD WIS Appendix A (Material Specifications).
  - Attachments shall be installed:
    - A maximum of 12" apart, and
    - Within 1" of each end.
  - 1/4" total compression at ends only.

11. SLEEVES FOR ATTACHMENT

- **Sleeves:**
  - Shall not compress insulation *except* for 1/4" total compression at ends.





PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

12. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

Not applicable to this measure.

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NOTES

DUCT INSULATION

Lead Paint Risk Factor
NONE

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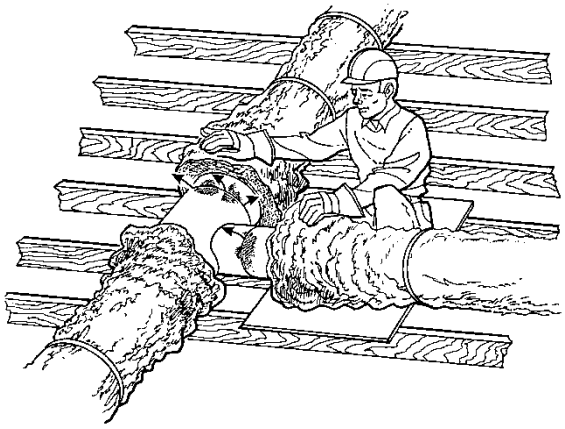
DUCT INSULATION

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

DUCT INSULATION REPAIR

Repair to existing duct insulation shall be performed as part of standard Duct System Repair and Sealing activities described in CSD WIS Section 6.

DUCT INSULATION INSTALLATION

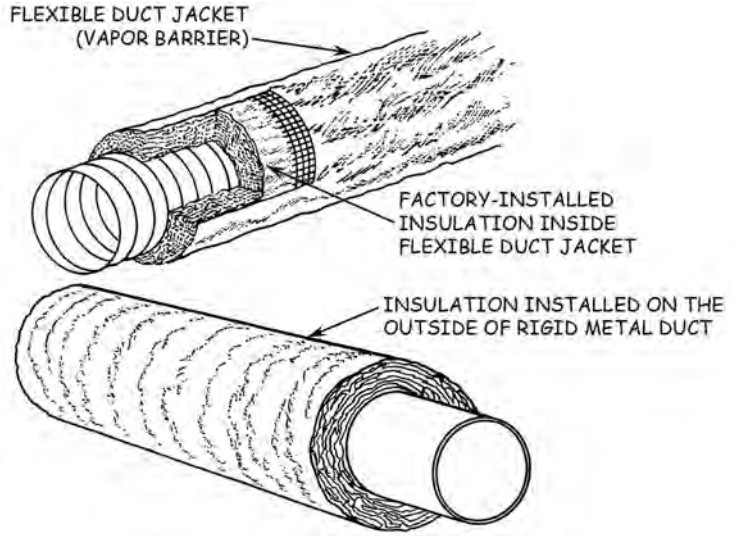


1. PREPARATION

- **All Material**
  - Duct leaks shall be sealed before ducts are insulated in conformance with CSD Field Guide Appendix B.
  - Broken or missing supports shall be repaired.
  - Duct insulation materials shall conform to CSD WIS Appendix A (Material Specifications).

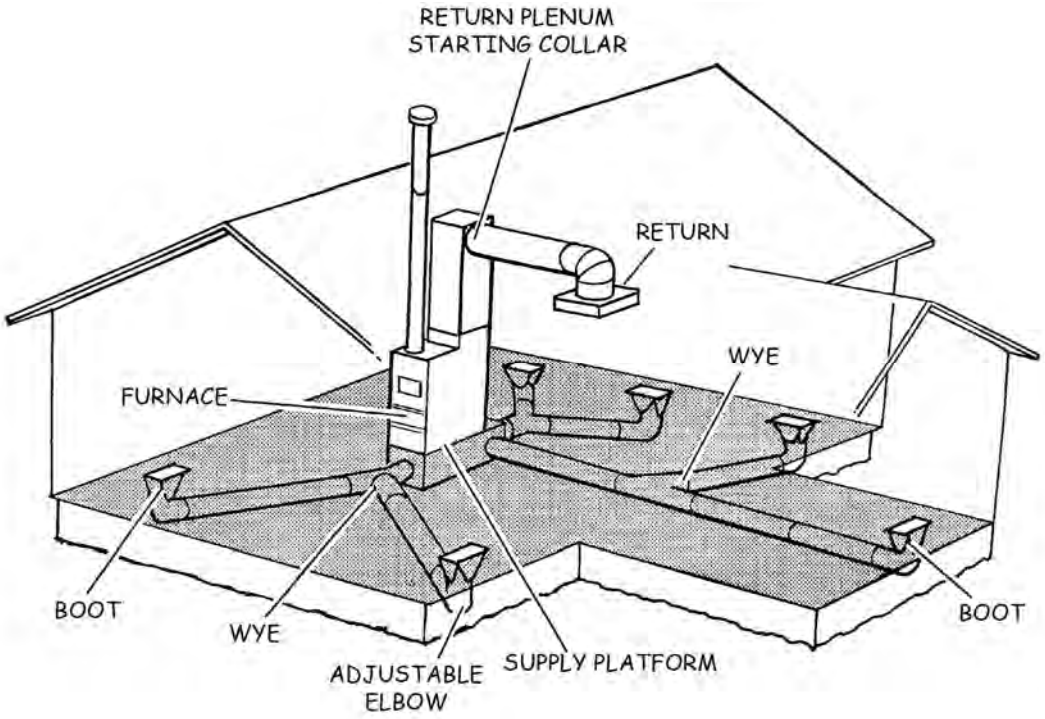
2. MATERIAL USAGE BY LOCATION

- **Insulation**
  - Shall be rated for indoor or outdoor locations, depending upon actual location of ducts.
  - Insulation and attachment materials hall be in compliance with CSD WIS Appendix A (Material Specifications).
- **R-Value by Climate Zone**
  - Climate Zones 1 – 10, 12, 13: R-6
  - Climate Zones 11, 14 – 16: R-8
- **Vapor Barrier/Retarder**
  - Vapor retarder required for all refrigerated air conditioning ducts.
  - Vapor retarder shall be placed on outermost side of insulation.



3. COVERAGE

- **All Material**
  - All air ducts, air connectors, plenums, distribution boxes and system components shall be insulated.
    - Insulation is to be installed on portions of the duct system located outside of conditioned space.
    - Mechanical ventilation duct shall be insulated in accordance with fan manufacturer's specifications.
    - Rigid metal ducts located entirely within conditioned space shall also be insulated to prevent condensation.
  - 100% coverage is required, without gaps or openings.

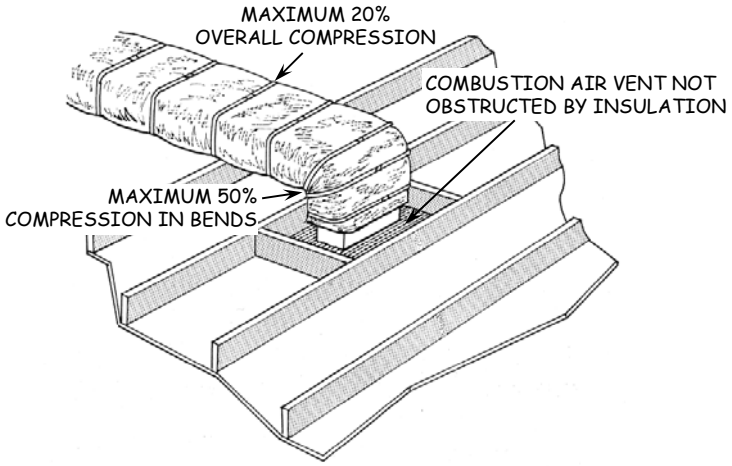


4. MAXIMUM ALLOWABLE COMPRESSION

- **All Material**
  - Maximum 20% overall compression by attachments.
  - Maximum 50% compression in corners/bends.

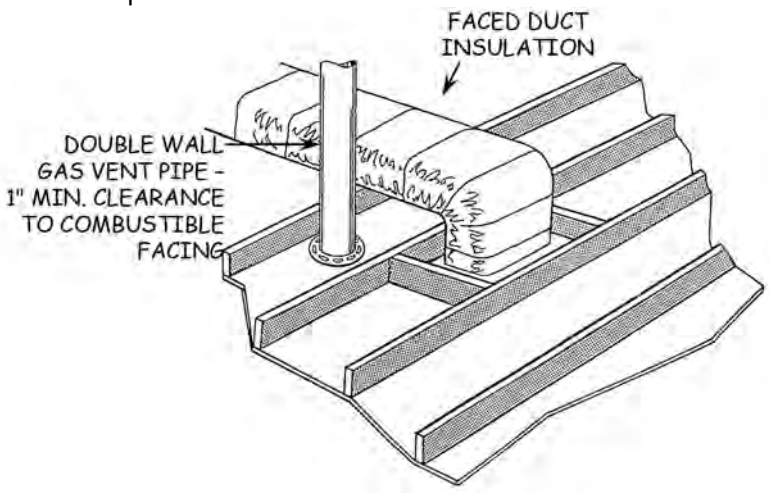
5. CVA VENTS

- **All Material**
  - Duct wrap shall <u>not</u> obstruct CVA vents.



6. CLEARANCES TO HEAT PRODUCING DEVICES

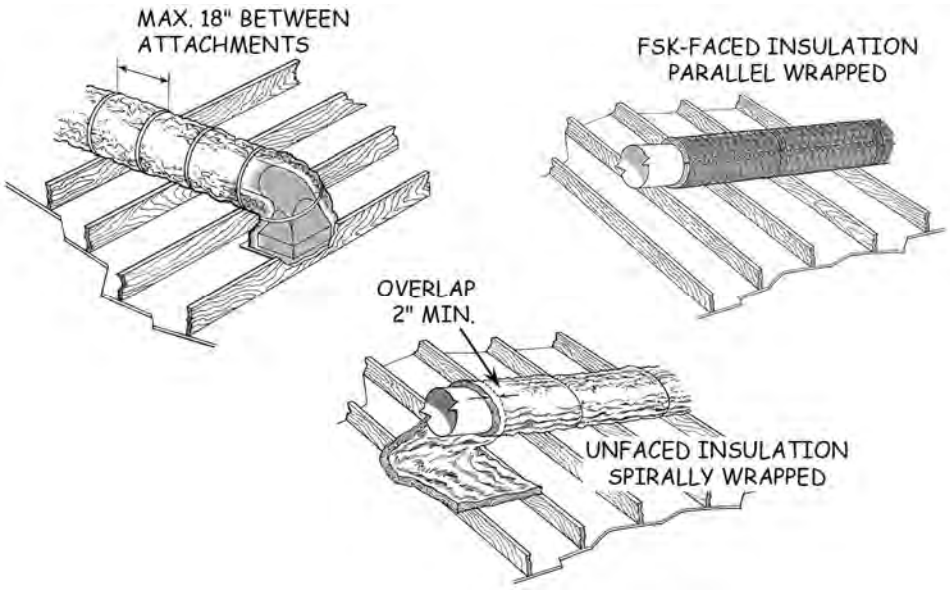
- **Faced Duct Insulation and Combustible Attachment Material**
  - 6" clearance required from single-wall vent pipe.
  - 1" clearance from Type “B” double-wall gas vent pipe.
  - 3" clearance from all other heat producing devices.
- **Unfaced Mineral Fiber Insulation and Non-combustible Attachments.**
  - No clearance requirement.



7. ATTACHMENT REQUIREMENTS

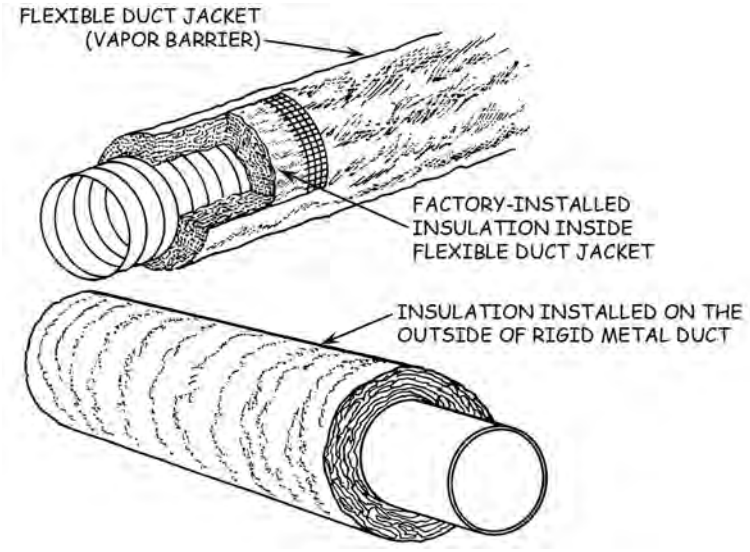
- **Rigid Fiberglass Insulation**
  - Insulation shall be securely attached (e.g., with stickpins).
  - Seams shall be sealed without gaps:
    - Metallic pressure sensitive tape marked “181A-P”, or
    - Duct mastic labeled “181A-M” reinforced with mesh tape.
- **Flexible Insulation**
  - Insulation shall be permanently secured with any of the following:
    - Drawbands
    - Non-corrosive wire, 20-gauge minimum.
    - Rot-proof nylon twine.
    - Rust resistant nails or staples.
    - Pressure-sensitive tape (e.g., metallic or FSK) wrapped a minimum of 3 times around the circumference or per manufacturer’s instructions.

- Spirally Wrapped
  - Wraps of unfaced insulation shall overlap each other at least 2".
  - Insulation shall be mechanically secured as needed to prevent gaps or openings.
- Parallel-Wrapped
  - Faced wraps shall be secured and sealed with pressure-sensitive tape or as prescribed by manufacturer.
  - Unfaced wraps shall:
    - Overlap each other at least 1".
    - Be mechanically secured with fasteners (drawbands, wire, nails, or staples) installed maximum 18" apart along the lengthwise seam (overlap) of the insulation.



8. VAPOR BARRIER/RETARDER (JACKET) REQUIREMENTS

- **Vapor Retarder:**
  - Is required for all refrigerated air conditioning ducts.
  - Vapor retarder shall be placed on the outermost side of insulation.
  - Material shall be in conformance with CSD WIS Appendix A (Material Specifications).

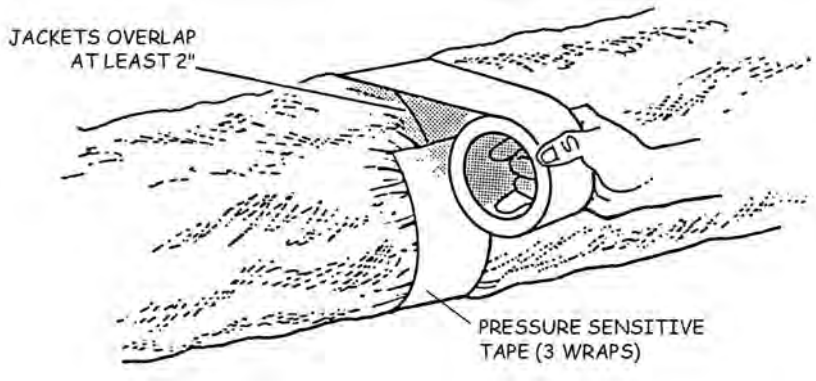


9. JACKET SPLICES

- **Installation Requirements**
  - When two jacket ends are joined together, they shall overlap at least 2".
  - Overlap shall be secured/sealed with a drawband and/or 3 staggered wraps of pressure sensitive tape.

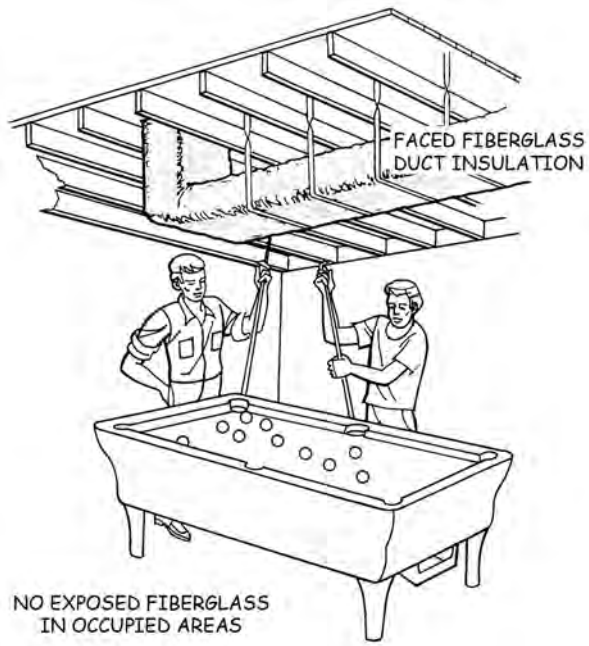
10. DUCT TERMINATION

- **Jacket shall be pulled over insulation and secured/sealed to fitting with one or more of the following:**
  - A drawband.
  - 3 staggered wraps of pressure sensitive tape.
  - Mastic and mesh tape.



11. EXPOSED DUCTS

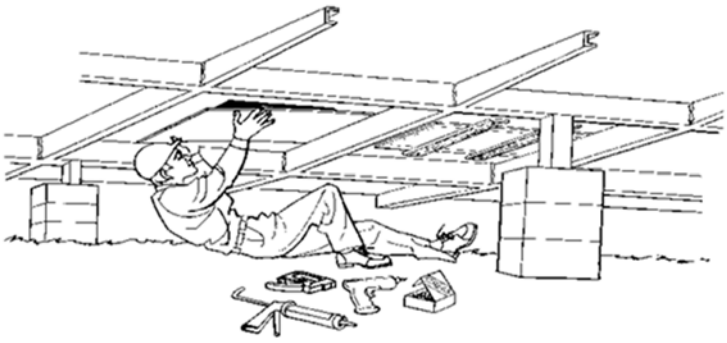
- **Ducts Located Outdoors**
  - Uninsulated Ducts
    - When external insulation is installed, materials shall be:
      - Listed for exterior applications.
      - Selected and installed in conformance with manufacturer's instructions and local codes.
    - In cases where HVAC ducts hang below the level of the rigid air barrier and insulation, the ducts shall be insulated and an additional air barrier shall be provided that is sealed to the rigid air barrier.
- **Ducts Located in Areas Subject to Human Contact**
  - When fiberglass insulation is installed, it shall be faced.
  - Fiberglass edges shall not be left exposed in the living space.
  - If unfaced duct insulation is existing, installation of facing shall not be required.



PART 2: MOBILE HOME CRITERIA

12. EXPOSED DUCTS

- **Ducts in Unconditioned Spaces**
  - Ducts in unconditioned spaces (e.g., crawlspace, attic, unconditioned basements) shall have continuous insulation and vapor barrier sufficient to prevent dew point on surface of ducts.
- **Ducts Located Near Missing/Deteriorated Bellyboard**
  - Ducts exposed by missing or deteriorated bellyboard shall be protected by repairing bellyboard or installing mineral fiber insulation before insulating ducts (even if it is not feasible to abandon the belly return and install a central ducted return).
- **Ducts Located Against Floor or Framing**
  - Determine if ducts are within the thermal, pressure, and vapor boundary.
  - Insulation shall cover all accessible portions of exposed ducts.
  - Adhesive shall be applied to attach insulation and prevent gaps.
  - Mechanical fasteners that encircle duct or attach to undercarriage shall be added as needed to permanently secure insulation.
    - Wire, drawbands, metal straps or equivalent shall be used.
    - Fasteners shall be installed at the ends of each piece of insulation and at intervals not exceeding 2' (unless obstructed by framing).



- **Ducts within Floor Assemblies**
  - Inspection and/or testing shall be conducted to determine whether ducts are within thermal, pressure, and vapor boundaries.
  - If ducts are within thermal, pressure, and vapor boundary, no action will be required.
  - If ducts are not within thermal, pressure, and vapor boundary, continuous air barrier, insulation, and vapor retarder shall be installed either on the ducts or at the belly liner.
- **Exposed Metal Ducts**
  - All exposed metal shall have continuous insulation and vapor retarder installed.
- **Vermin-Proofing**
  - Vermin access points will be identified and treated appropriately (e.g., sealing of access holes).

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

13. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

14. CLIENT EDUCATION

- **Duct System**
  - Client shall be educated on duct system changes, how to operate and maintain the system, and any potential health concerns (e.g., lead, asbestos) that may be present.

15. CLEAN-UP REQUIREMENTS

- **All Units**
  - A HEPA vacuum shall be used.
  - Contact the local waste management company to determine any special requirements for the recycling of insulation material in the local area.
- **Access Inside the Living Space**
  - All areas between an indoor access and home entrance shall be vacuumed.
  - The area between the home entrance and the insulation truck shall be cleaned (swept or vacuumed).
- **Access Outside the Living Space**
  - All areas between the access and the insulation truck shall be cleaned (swept or vacuumed).

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NOTES

CEILING INSULATION FOR CONVENTIONAL HOMES

Lead Paint Risk Factor
NONE

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Section 20A

CEILING INSULATION FOR CONVENTIONAL HOMES

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

1. EXISTING INSULATION CONDITION

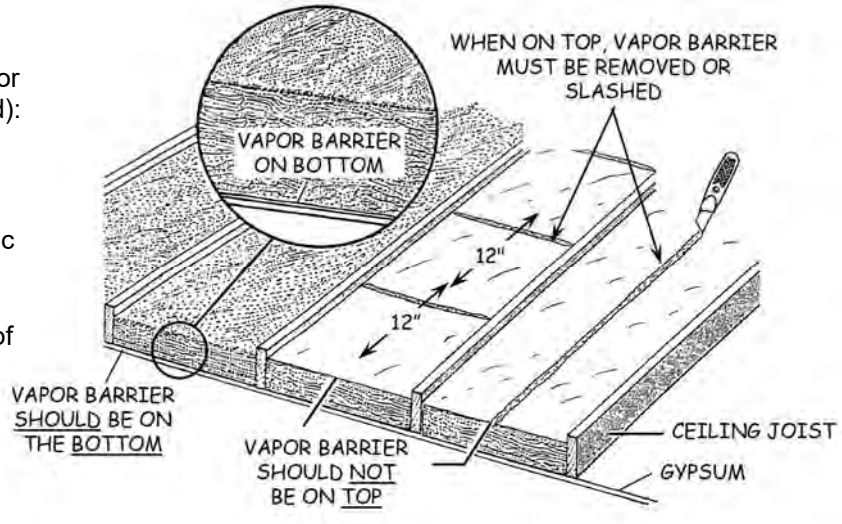
- **All Attics**
  - If existing insulation was damaged by entry of moisture into the attic, no additional insulation shall be installed unless:
    - The source of the moisture leak was corrected, or will be corrected within the program.
    - The existing insulation is fully dry.
  - Seal all feasible leakage locations (including duct and shell leaks, and thermal bypasses in the ceiling) before insulation is installed.
  - If unfeasible to seal thermal bypasses, installation of insulation will not be automatically prohibited unless the bypass source is documented to cause condensation and moisture damage in the attic (and where the issue cannot be corrected within the program scope).
  - For acceptable insulation types, see CSD WIS Appendix A (Material Specifications).
  - Existing (batt) insulation shall be in contact with the air barrier prior to installing additional insulation.

2. ASBESTOS-CONTAINING MATERIAL

- **Prohibited Installation of Insulation**
  - Insulation shall not be installed over vermiculite materials unless asbestos testing confirms that ACM is not present.
  - Installation of insulation shall not disturb existing ducts made of asbestos, or ducts insulated with ACM.

3. VAPOR BARRIER

- **All Insulation**
  - Vapor barrier criteria apply to flexible mineral fiber batts/blankets installed directly onto the attic floor, knee wall, or skylight well.
  - Vapor barrier shall not be installed over existing insulation.
  - When insulation is installed, vapor barrier shall be:
    - Placed toward winter warm side (e.g., directly on attic floor).
    - Rated no higher than 1 perm.
  - When existing batts are incorrectly installed with vapor barrier on top (facing upward):
    - Vapor barrier shall be removed from attic, or
    - Batts shall be turned over to place facing against attic floor, or
    - Vapor barrier shall be slashed the entire length of batt or across the width of the batt at 12" intervals.



4. ATTIC PREPARATION

- **Preparation of Home**
  - When attic access is indoors, the pathway from the entrance door to the attic access shall be protected with runners.
  - Before entry is made into the attic from the living space, a drop-cloth must be placed under the attic access.
  - When entry is through an access inside a closet, the clothing and other personal property must be removed or covered.
  - Care shall be taken to prevent damage to the home and furnishing by the insulation hose, ladders, etc.
  - All cutting of mineral fiber batts for blocking or baffling purposes shall occur outside the living space or inside the attic.
- **Preparation of Attic**
  - Install one insulation depth marker for every 300 sq. ft. of attic area, with the bottom of the marker at the air barrier to determine where additional insulation is needed.
    - Markers shall be left in place after insulation is installed for verification by the Quality Control Inspector.

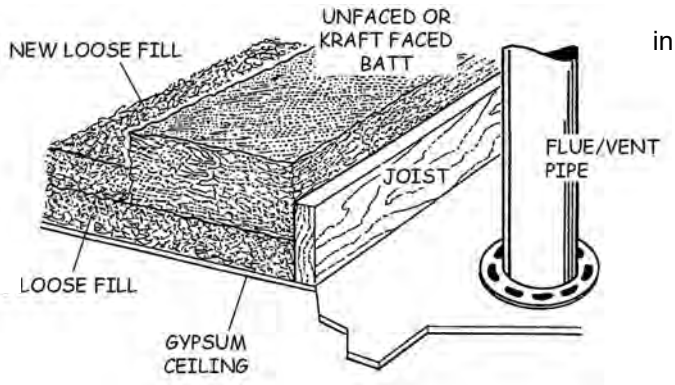
5. INSULATION LEVELS

- **Maximum R-Value for LIHEAP Contract**
  - Climate Zones 1 & 11-16: R-38
  - Climate Zones 2-10: R-30
- **R-Value for DOE Contract**
  - R-value shall be determined by:
    - the DOE Priority List Table; or
    - Energy Audit result.

BLOCKING REQUIREMENTS

6. PERMANENT BLOCKING

- **Blocking Materials**
  - Batts
    - Flexible mineral fiber, faced or unfaced, is allowed (as noted in each subsection).
  - Metal
    - Corrosion-resistant metal, minimum 0.007" thick.
    - Metal blocking shall be permanently attached to the ceiling/framing with staples, nails, or screws.
  - Eave Vent Chutes and Baffles
    - Commercially available plastic chutes and cardboard baffles, or 0.007" metal.
    - Eave chutes and baffles shall not be used to block heat-producing devices (HPDs).
  - Structural Wood
    - Framing members and attached sheathing (e.g., plywood).



- **Blocking for Loose Fill Insulation**
  - A barrier (blocking and/or structural wood) shall extend from the attic floor to the prescribed height above installed loose fill.

- Blocking height shall be achieved with structural wood alone, or a combination of wood and permanent blocking material, as long as the continuous blocking/barrier extends from the attic floor to above loose fill.
- Unfaced and faced flexible blocking may rest on top of other insulation, with vapor barrier facing either up or down.

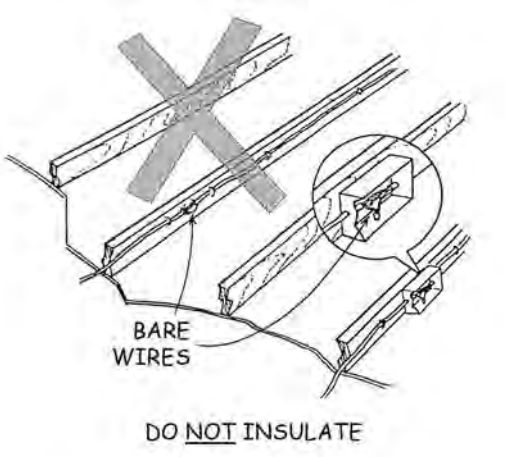
- **Flexible Insulation**
  - No blocking is required where loose fill is not present.
  - When flexible insulation is installed over loose fill, blocking/barrier shall prevent loose fill from entering the clearance zone.
- **Clearance Zone**
  - Clearance zone shall provide a cleared space free of insulation that surrounds a heat producing device, vent, etc.
  - Clearance from blocking to protected item shall be a minimum of 3″, or as specified for the item, but no greater than necessary to provide proper blocking.
  - After insulation has been installed, the clearance zone shall be free of loose fill material.
  - When a cover/box/insulation is placed as a protective barrier above an HPD, the covering material shall be at least 24" above the top of the HPD.

7. TEMPORARY BLOCKING COVER

- **Loose Fill**
  - A temporary cover may be placed over permanent blocking to prevent accidental "over-blow" of loose fill into clearance zone.
  - The cover shall be removed after insulating.

8. ELECTRICAL WIRING

- **All Insulating Materials**
  - Insulation shall not be installed over energized wires that are not insulated or have frayed or decayed insulation.
- **Loose Fill**
  - When electrical hazards exist, hazard area shall be blocked as described in the following table.

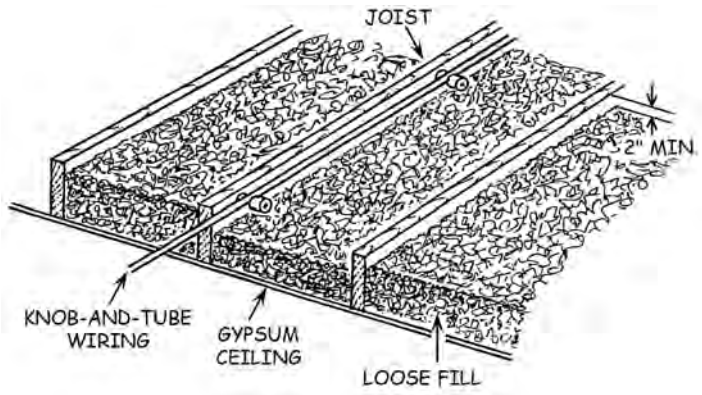


Wire Hazard	ELECTRICAL WIRING REQUIREMENTS
Open Junction Boxes	• Protect box with a standard cover plate OR a minimum 14-1/2" x 12" piece of unfaced mineral fiber batt that covers the box and equals or exceeds height of installed loose fill. • When a cover plate is installed, it is acceptable to blow loose fill insulation over the covered junction box
Wire Hazard	**Do NOT cover wires with loose fill insulation, and…**
Wire Connections Protruding from a Junction Box	• Protect connections with a box extension AND standard cover plate. • Install mineral fiber blocking that exceeds the height of adjoining loose fill by 4", and extends away at least 14-1/2" x 12" in all directions.
Wire Connections without Junction Box (Spider Web)	• Protect connections with mineral fiber blocking that exceeds the height of adjoining loose fill by 4", and extends away at least 14-1/2" x 12" in all directions.
Knob-and-Tube	• Insulation shall be installed as prescribed in the CSD Field Guide and this section.
Junction Boxes	• All electrical junctions will be flagged to be seen above the level of the insulation

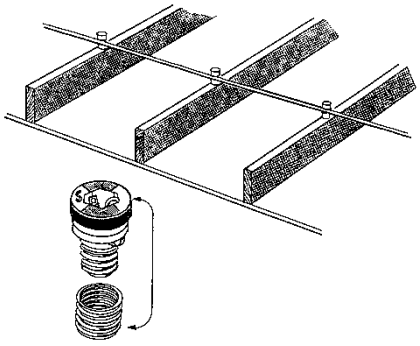
KNOB-AND-TUBE (K&T) WIRING

9. K&T WIRING—PROCEDURES

- **Insulation which encapsulates knob-and-tube wiring shall not be installed, when prohibited by local code.**
- **All Insulation**
  - Attic with knob-and-tube wiring shall not be insulated *unless* the wiring has been surveyed by a licensed electrical contractor and certified to be:
    - Live and acceptable for encapsulation, or
    - Abandoned and disconnected.

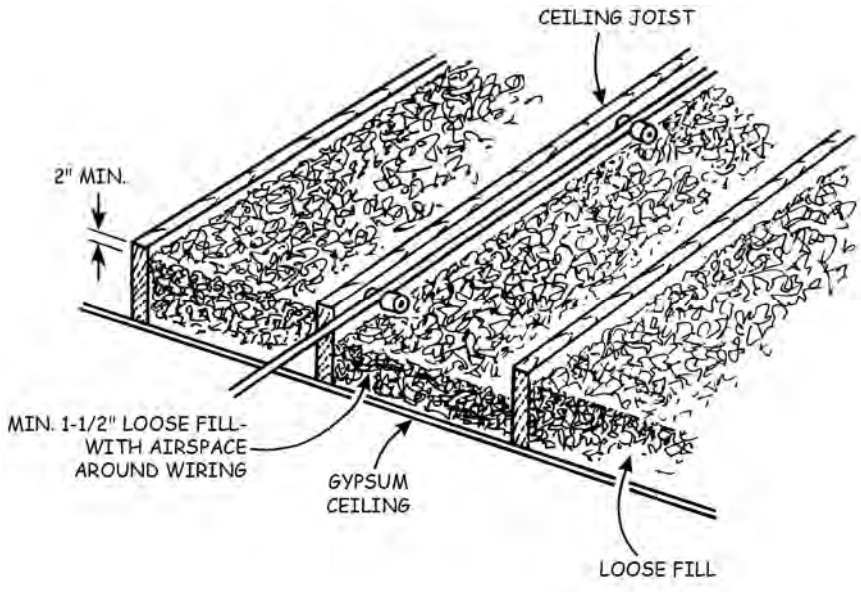


  - All provisions of this section, the CSD Field Guide Measure-Specific Policies, and the current California Electrical Code (CEC)[1] shall be met.
    - When blocking is installed to protect knob-and-tube wiring, it shall be installed as prescribed in Item 10.
- **The following requirements apply to all attics insulated:**
  - Insulation shall be non-combustible in accordance with the CEC requirements.[2]
    - Barriers and supports shall be non-combustible and shall not contain any electrical conductive material.



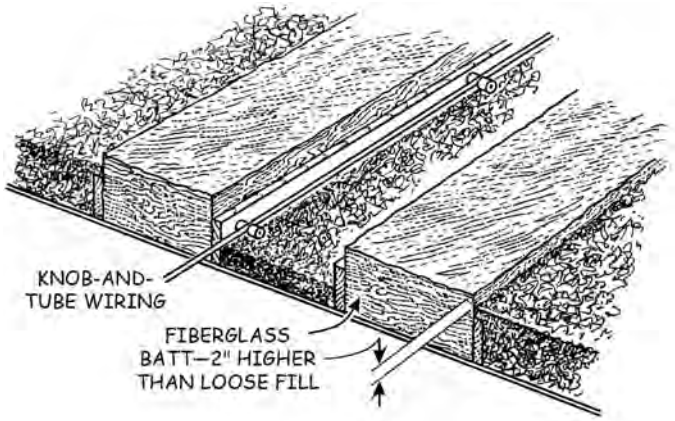
10. K&T WIRING—BLOCKING AND CLEARANCES

- **Loose Fill**
  - Insulation shall be installed under wiring only if at least 1-1/2" can be installed.
  - Insulation shall not make contact with the wire.
  - Free airspace shall be maintained around wire, and top shall be left open.
  - Blocking required if joist to which wire is attached does not exceed height of insulation by at least 2".

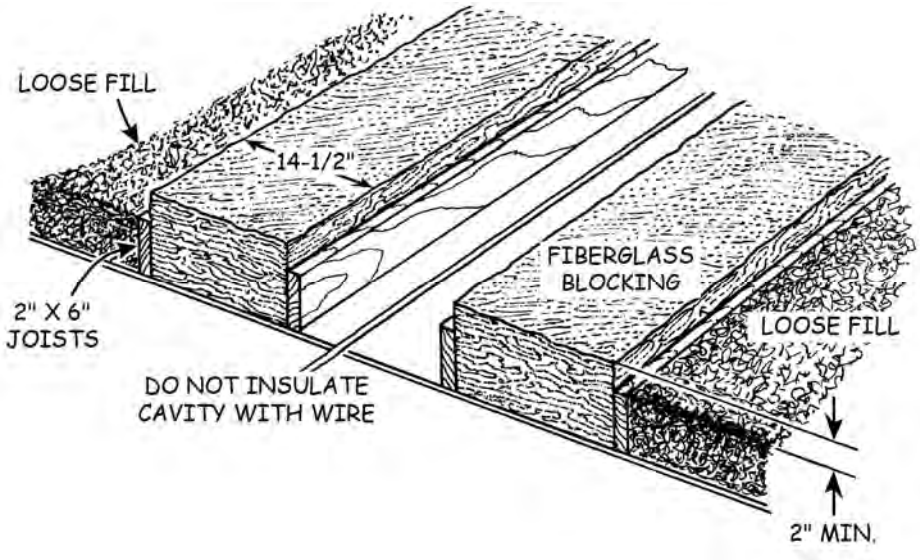


10. K&T WIRING—BLOCKING AND CLEARANCES (cont.)

- **All Blocking**
  - Shall exceed height of loose fill by 2".
  - Not required if height of joist to which wire is attached exceeds height of loose fill by 2".
- **All Blocking (Except Joist)**
  - Shall be non-metallic and non-combustible.

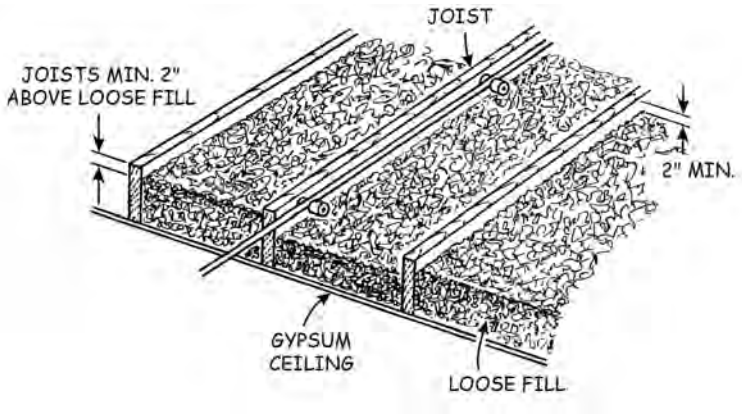


- **Loose Fill**
  - If wiring is on attic floor:
    - Cavity containing wiring shall not be insulated.
    - Blocking shall be installed in adjacent cavities.
  - Mineral fiber blocking required.
  - Blocking shall exceed height of insulation by 2" and must extend at least 14-1/2" away.

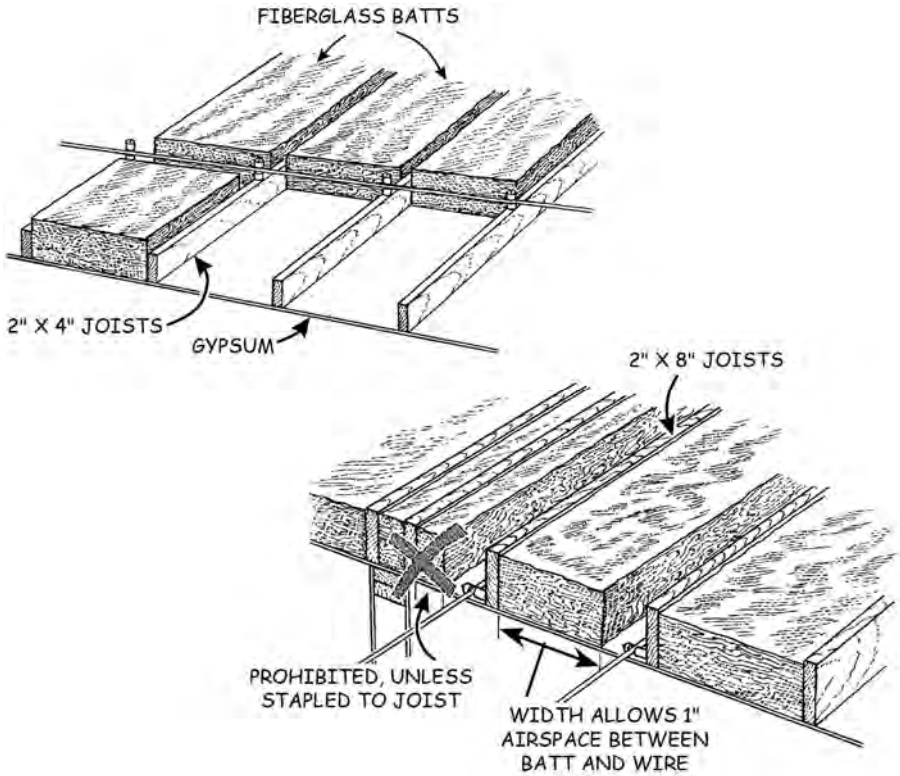


10. K&T WIRING—BLOCKING AND CLEARANCES (cont.)

- **Joist Blocking**
  - No blocking of loose fill required if height of joist exceeds the height of loose fill by 2".

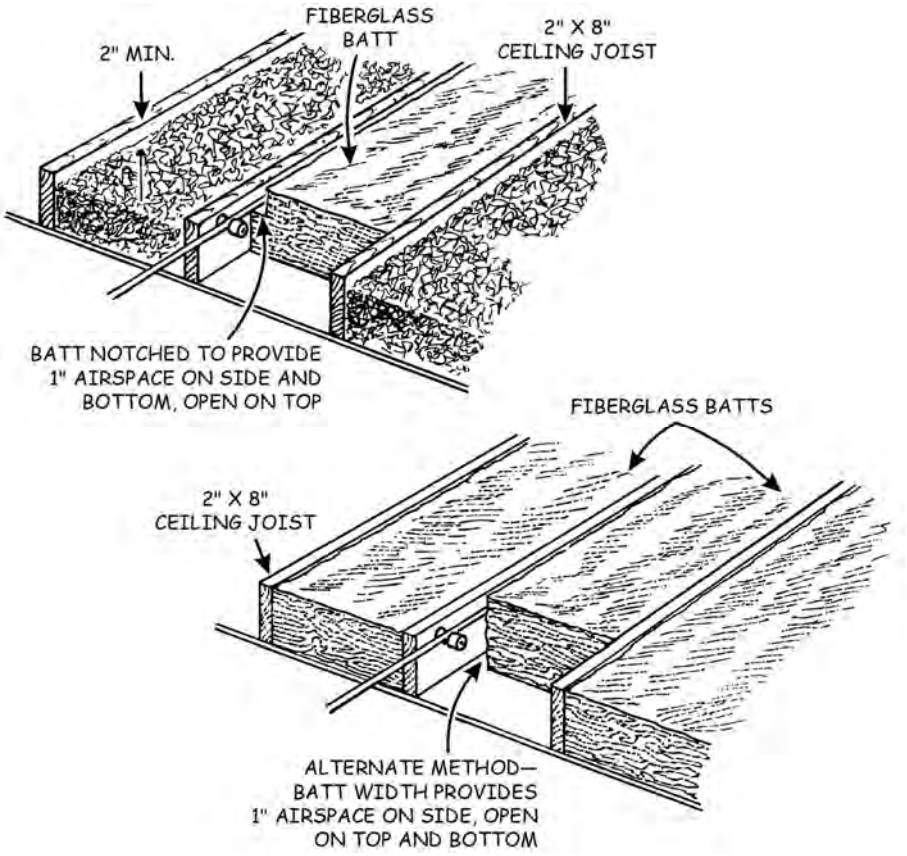


- **Flexible Mineral Fiber Batt Blocking**
  - Batts with foil vapor barrier not allowed.
  - Free standing batts shall be:
    - Wider than they are tall, or
    - Stapled to the joist.
  - Undersized (narrow) batts are allowed when wedged snugly between two joist members.
  - 1" airspace required between insulation material and wire.



10. K&T WIRING—BLOCKING AND CLEARANCES (cont.)

- **Flexible Mineral Fiber Batt Insulation**
  - May be placed under wiring.
  - 1" free air space shall be maintained around wire and the top shall be left open.
- **Flexible Mineral Fiber Batt Over Loose Fill**
  - Mineral fiber batts may be placed over existing loose fill to achieve desired R-value.
  - Only unfaced batts shall be installed.



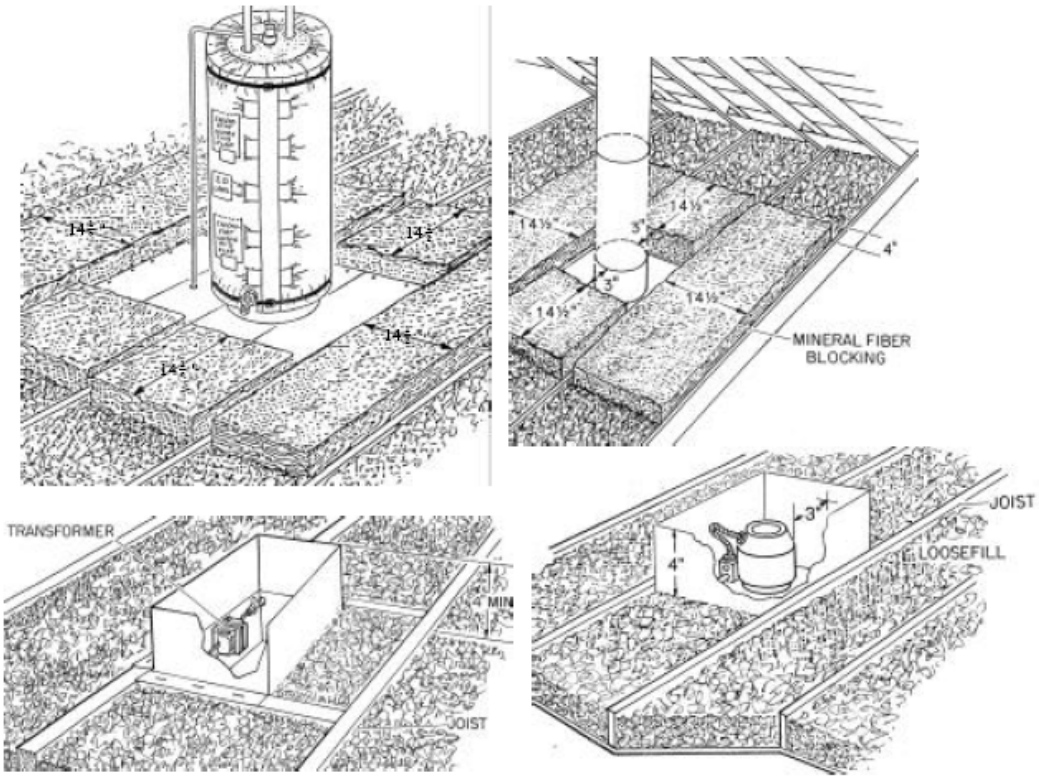
Section 20A

GENERAL BLOCKING AND CLEARANCE REQUIREMENTS

11. BLOCKING FOR HEAT PRODUCING DEVICES (HPD)

- **HPDs shall be blocked in accordance with the table below:**

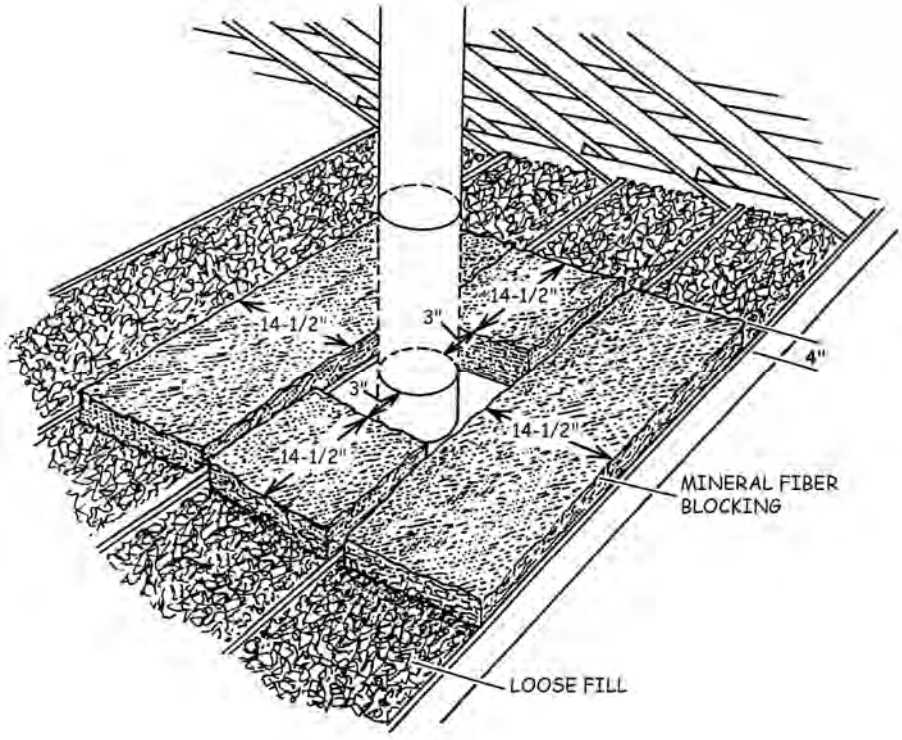
HPD TYPE	GENERAL BLOCKING REQUIREMENTS FOR ALL HPD TYPES
HPDs types include, but are not limited to, the following: • Recessed light fixtures ("IC" and "Non-IC" types). • Exposed fluorescent fixtures • Doorbell transformers. • Motors for range hoods and exhaust fans. • Appliance vent pipes made of metal • Masonry chimneys. • Gas and electric appliances (e.g., water heater or furnace) • Any other device that produces heat.	- **With Loose Fill Insulation** • 3" clearance zone required around HPD. (Note: Blocking is not required if the HPD is mounted above top of insulation.) • Flexible mineral fiber blocking shall extend at least an additional 14-1/2" away from the clearance zone in all directions. • Non-combustible blocking material (dam) is required. - Metal blocking (dam) shall be permanently attached to the ceiling/framing with staples, nails, or screws. - Blocking shall extend from the attic floor and exceed height of loose fill by 4". • If covered by a fire-rated, airtight enclosure instead of a dam, 24" minimum top clearance is required. - Top cover shall have an R-value of 0.50 or less. - Insulation must not cover the top of the enclosure. - Caulk, mastic, or foam will be used on all edges, gaps, cracks, holes, and penetrations of closure material. - Note: Gypsum enclosures that house fluorescent light fixtures do not require protection from loose fill insulation. - **Flexible Insulation** • 3" clearance from HPD required on all sides.



BLOCKING FOR APPLIANCE VENTS, CHIMNEYS, AND HPD CAVITIES

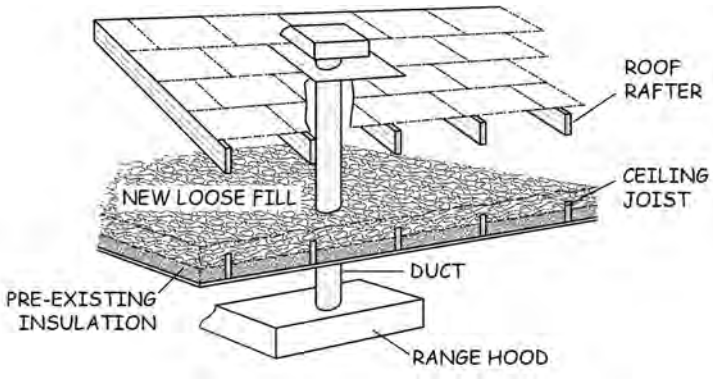
12. GAS AND SOLID FUEL VENT PIPES AND MASONRY CHIMNEYS

- **Loose Fill**
  - Gas and solid fuel vent pipes and masonry chimneys shall be blocked as described in the General Requirements to protect HPD.
- **Flexible**
  - See General Blocking Requirements.
- **Vent Pipes Not in Use**
  - Pipes not currently in use (e.g., abandoned) shall be blocked.



13. KITCHEN AND BATH TYPE EXHAUST VENTS

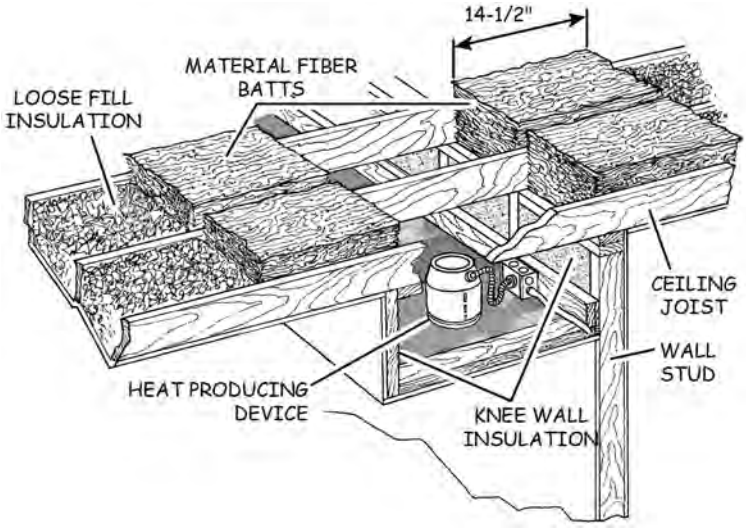
- **Screened Openings (Passive Vents)**
  - Shall be blocked per Item 20.
- **Vent Hose/Duct**
  - Acceptable to cover by loose fill, when fan is below the ceiling.
  - Shall <u>not</u> be obstructed at its termination (open end) except for 1/4" mesh.



- **Vent Termination**
  - Exhaust systems which terminate in the attic shall be extended to the exterior.
  - The vent pipe shall:
    - Be connected to a roof or wall termination.
    - Conform to local codes.
  - Eave vent termination is acceptable, if allowed by local code.

14. RECESSED INTERIOR SOFFITS CONTAINING HPD

- **Loose Fill**
  - Soffits shall be blocked as described in the General Blocking Requirements to protect HPD.
  - Accessible knee walls (12" or higher) shall be insulated in conformance with this section.
- **Flexible Insulation**
  - See General Requirements.



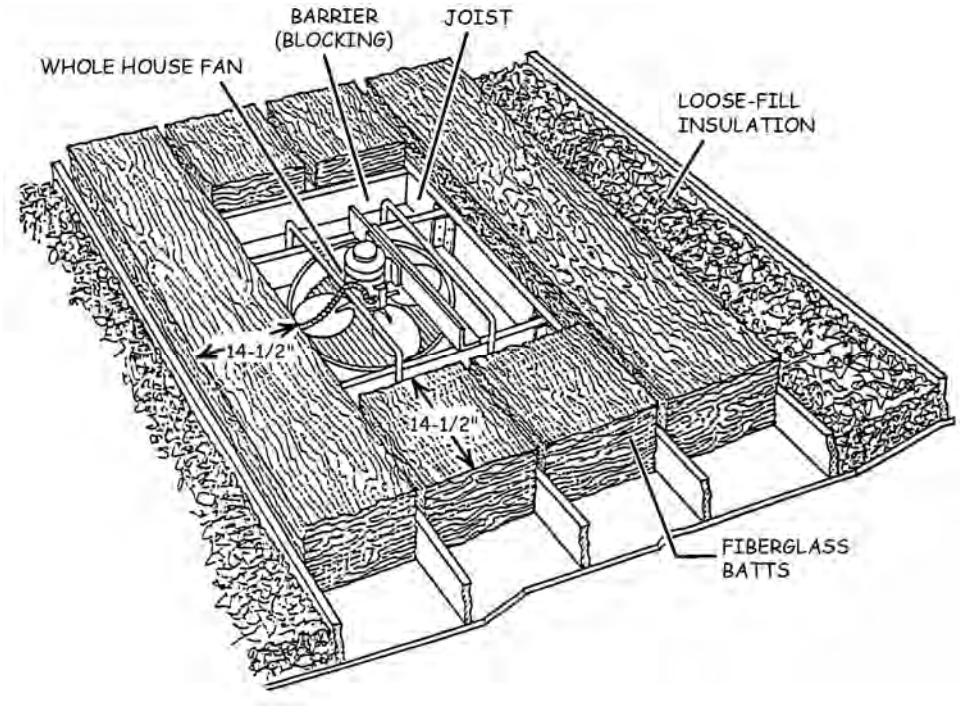
BLOCKING FOR APPLIANCES LOCATED IN ATTICS AND COMBUSTION AIR SUPPLY

15. ALL APPLIANCES

- **Insulation**
  - Blocking in conformance with General Blocking Requirements is required, *unless* an exception is noted.
  - Insulation "over-blow" shall be cleared from unit, clearance zone, and platform.

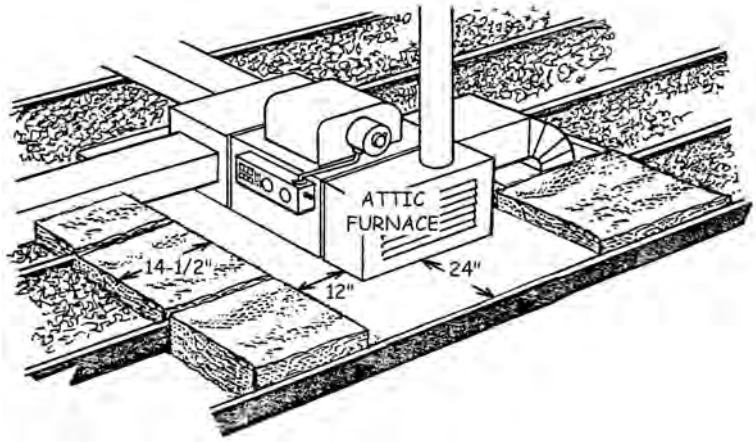
16. WHOLE-HOUSE FANS

- **Insulation**
  - Sides of fan insulation box assembly will be insulated to the same R-value as adjoining insulated assembly
- **Loose Fill**
  - Blocking required, even when a shroud is present on the fan.
  - 3" clearance zone required for fan motor.
- **Flexible**
  - 3" clearance required for fan motor.
- **Sealing**
  - Fan insulation box frame shall be continuously weatherstripped to ensure a tight fit.



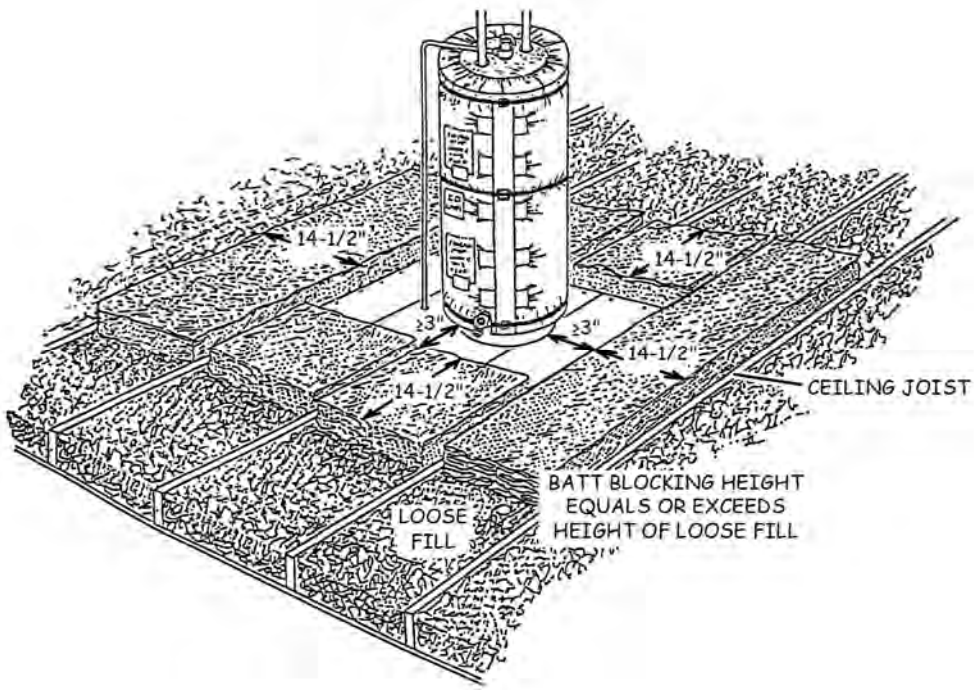
17. FURNACES AND HEAT PUMPS

- **Loose Fill**
  - A clearance zone is required around all units.
    - 12" clearance around back, sides, and top.
    - 24" clearance in front.
    - 3" clearance for vent pipes.
  - Blocking in conformance with General Blocking Requirements is required, *unless* bottom of unit is *more* than 4" above loose fill.
  - If HVAC unit is suspended or draws combustion air from the bottom:
    - 12" clearance shall be provided below unit, or
    - Flexible insulation shall be installed below which extends 12" beyond unit on all sides (no exposed loose fill beneath unit).
- **Flexible**
  - 12" clearance required on all sides; 3" clearance for vent pipes.
  - 6" clearance below units drawing combustion air from bottom.
- **Platforms and Catwalks**
  - Insulation shall be installed underneath both.
  - Insulation shall <u>not</u> be installed on top of platforms.



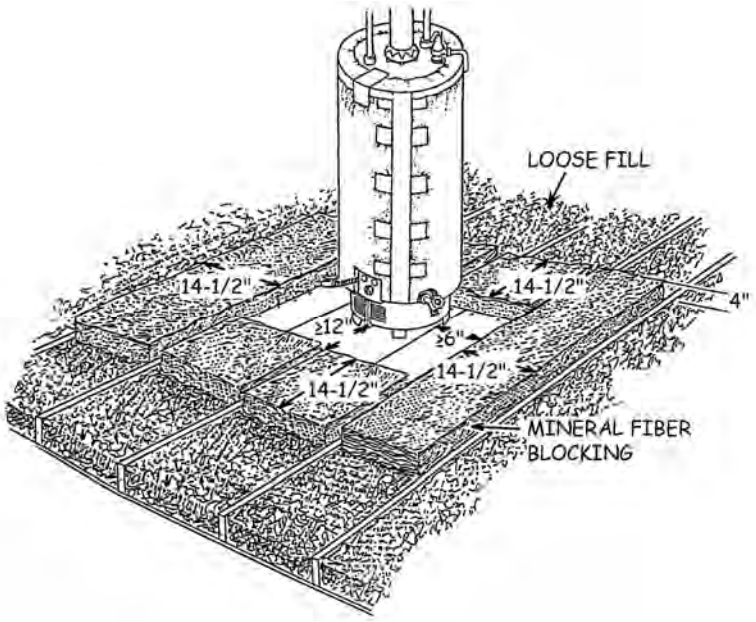
18. WATER HEATER—<u>ELECTRIC</u> UNITS

- **Loose Fill**
  - 3" clearance zone required around unit.
  - Blocking in conformance with General Blocking Requirements is required if bottom of unit is below top of installed loose fill.
- **Flexible**
  - 3" clearance from unit required on all sides.



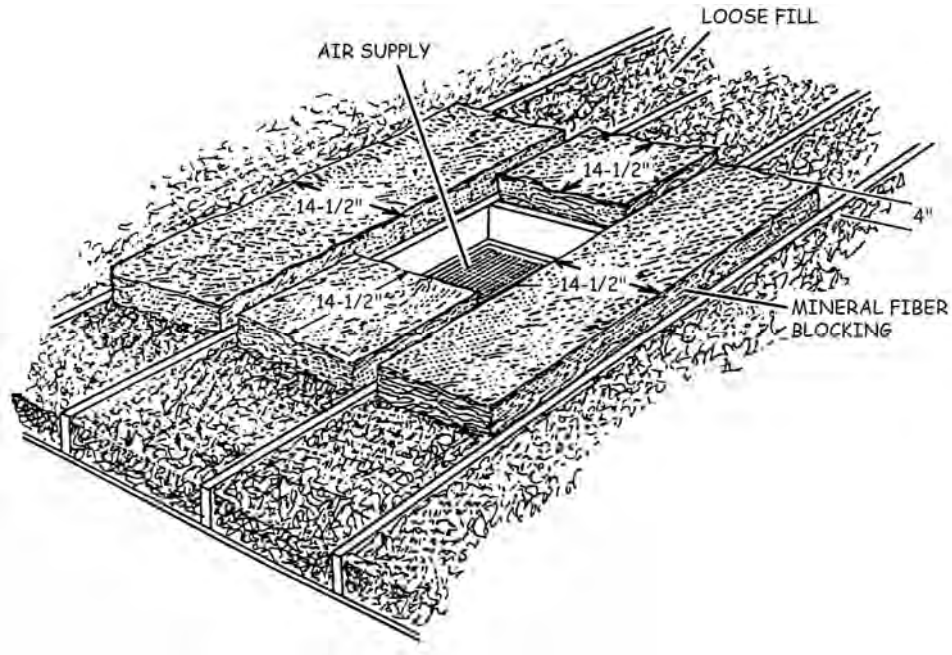
19. WATER HEATER—GAS UNITS

- **Loose Fill**
  - A clearance zone is required around the unit.
    - 6" clearance around sides and back.
    - 12" clearance in front.
    - 3" clearance for vent pipes.
  - Blocking, in conformance with General Blocking Requirements is required if bottom of unit is not at least 4" above installed loose fill.
- **Flexible**
  - 6" clearance around sides and back.
  - 12" clearance in front.
  - 3" clearance required for vent pipes.



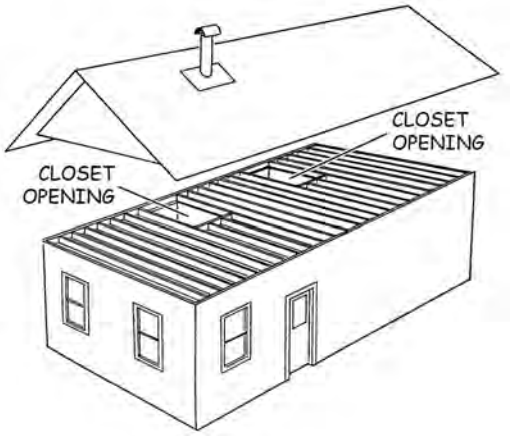
20. COMBUSTION AIR SUPPLY

- **Loose Fill**
  - Blocking:
    - Is required.
    - May be either flexible mineral fiber batts or metal barriers.
    - Shall not obstruct the air supply.
    - Shall be in conformance with General Blocking Requirements.
  - Any insulation, pre-existing or overblown, which obstructs the screen shall be removed.
- **Flexible**
  - Must not obstruct air supply.



21. CLOSET OPENINGS

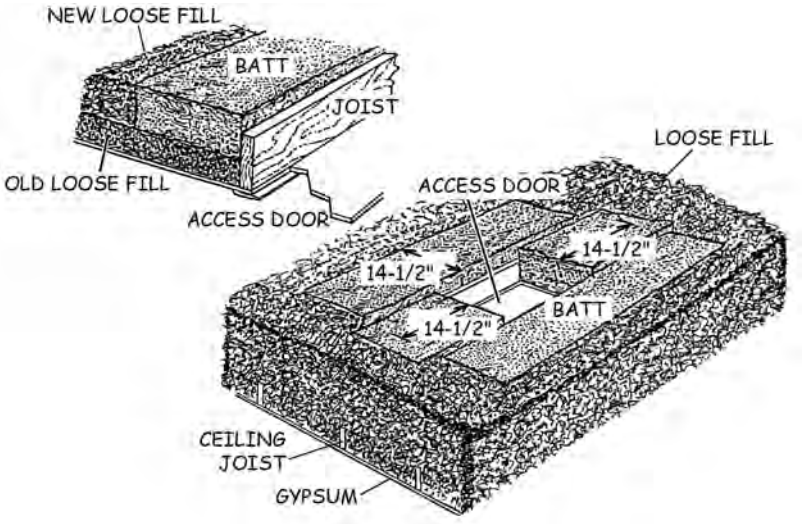
- **All Insulation**
  - Ceiling Vents Used for Combustion Air Supply
    - When closet opening is used for combustion air supply, it shall be blocked per Item 20.
  - Ceiling Vents Not Used for Combustion Air
    - The opening shall be sealed and covered with insulation.
    - Vents shall be sealed with minimum 1/2" gypsum or plywood, or with 0.007" metal.
  - Vents shall not be sealed with mineral fiber batts or foam board.



ATTIC ACCESS BLOCKING AND INSTALLATON OF INSULATON

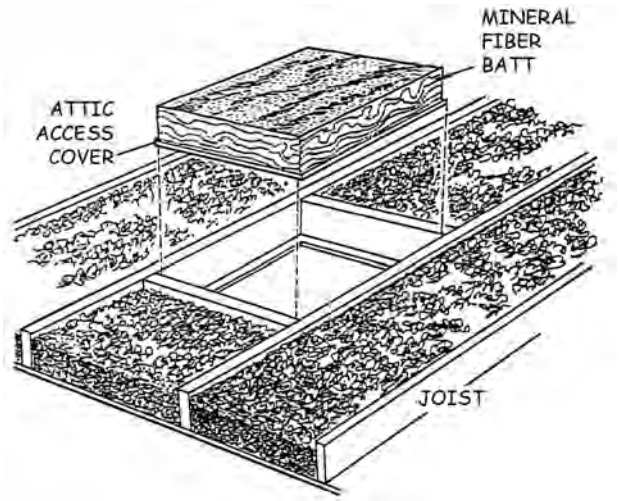
22. ATTIC ACCESS BLOCKING

- **Loose Fill**
  - Each functional/usable access shall be blocked.
  - Flexible mineral fiber blocking shall extend from the attic floor to the top of loose fill.
    - Batts shall extend at least 14-1/2" away from access opening in all directions.
    - Metal barrier material shall not be installed.
  - Two-by joists and other wood members:
    - Where wood extends from attic floor to top of installed loose fill, additional blocking is not required.
    - Where wood extends from attic floor but does not equal height of installed loose fill, blocking shall be added.
      - Mineral fiber batt is acceptable to use in combination with wood members to achieve required height.
      - Unfaced or faced batt may be placed on top of existing loose fill.
    - Where wood is not present, flexible mineral fiber blocking shall rest on the attic floor and extend to the top of loose fill.
- **Flexible**
  - Blocking is required only where unblocked loose fill is present at the access opening.



23. ATTIC ACCESS DOOR/COVER INSULATION

- **All Insulation**
  - All attic entry doors/covers accessed from conditioned space shall be insulated in accordance with the CSD Field Guide.
    - Horizontal: same R-value as attic floor.
    - Vertical: same R-value as knee walls and skylight wells.
  - Insulation shall be:
    - Rigid or flexible material.
    - Non-compressible.
    - Permanently attached.
  - Multiple Accesses
    - Each attic entry door/cover accessed from conditioned space, even if not functional/usable, shall be insulated.

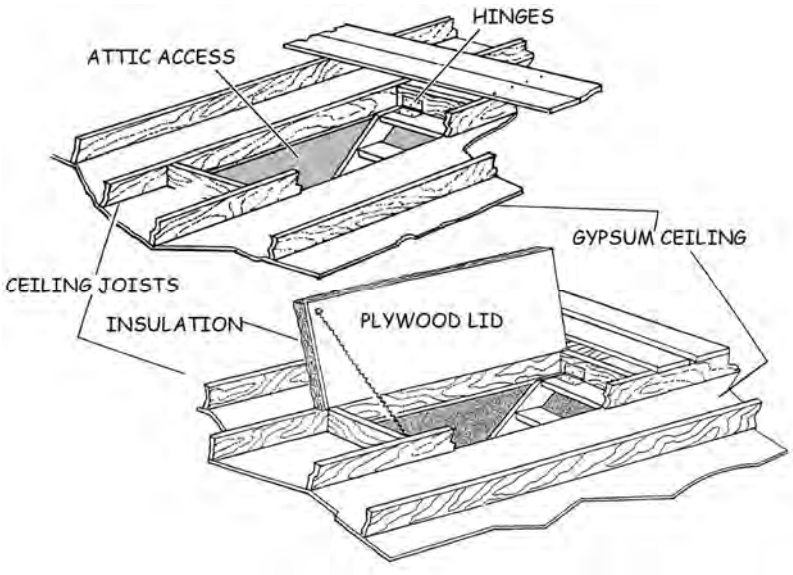


24. ATTIC ACCESS DOOR/COVER WEATHERSTRIPPING

- **See CSD WIS Section 9 (Weatherstripping).**
- **Materials**
  - Access hatch frames will be sealed using caulk, gasket, weatherstrip, or otherwise sealed with an air barrier material, suitable film, or solid material in conformance with CSD WIS Appendix A (Material Specifications) for sealing materials.

25. DISAPPEARING STAIRS

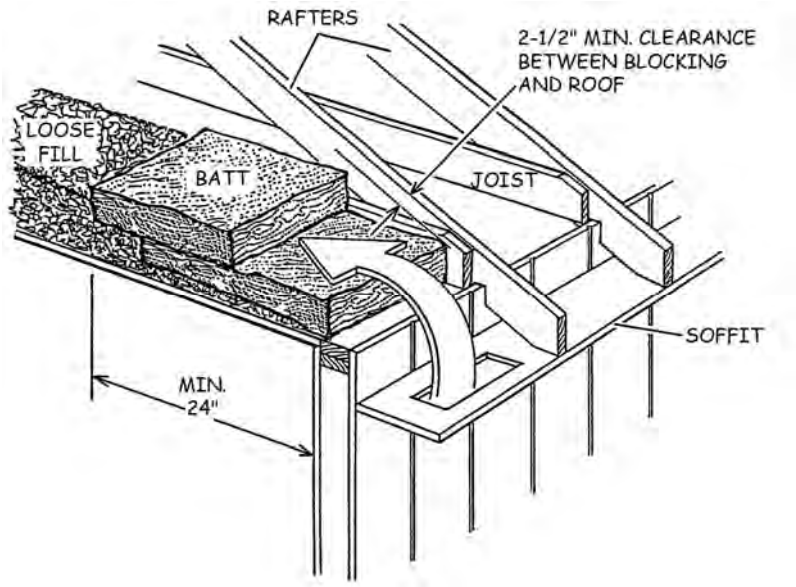
- **All Insulation**
  - When accessed from conditioned space:
    - Hinged lid shall be installed if not already present.
    - Non-compressible insulation, with R-value equivalent to attic floor, shall be permanently attached to the lid and include a protective barrier or baffle.
    - With loose fill insulation, blocking shall conform to attic access blocking requirements in Item 22.
  - Stairs with Bottom Door (or lid, if no bottom door); OR
  - Stairs with Top Lids
    - Weatherstrip as prescribed in CSD WIS Section 9.
    - Entire pull-down stair assembly will be covered with an airtight and removable/ openable enclosure inside the attic space.



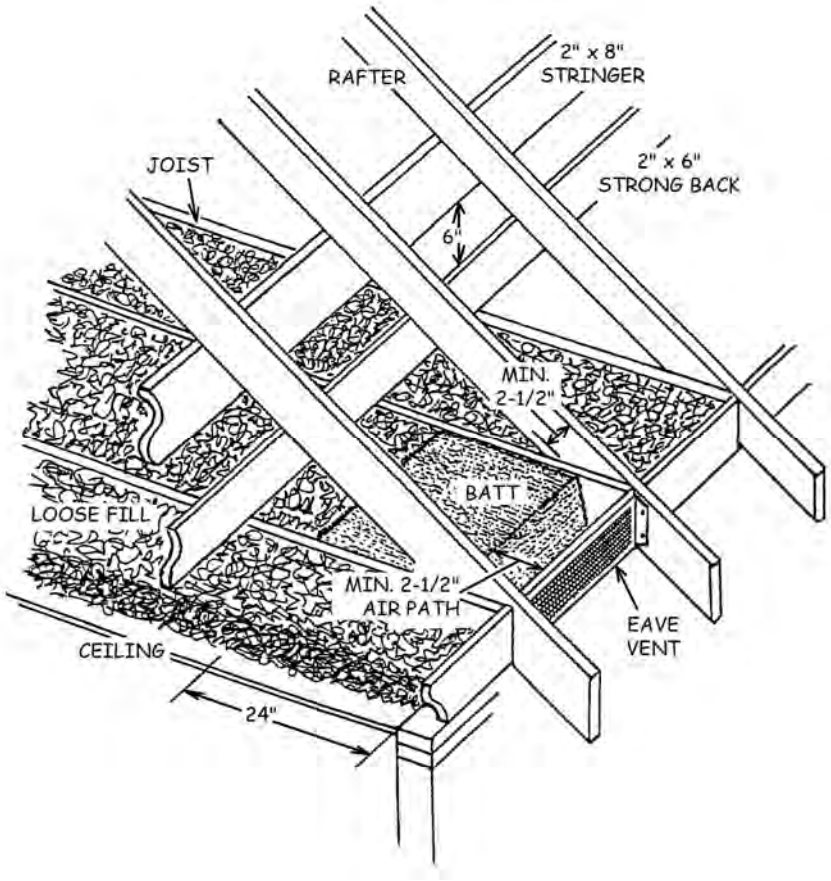
BLOCKING OF VENTS AND BUILDING CAVITIES

26. EAVE AND SOFFIT VENTS

- **Flexible**
  - Minimum 2-1/2" clearance required between roof sheathing and insulation.
- **Loose Fill**
  - Blocking (batt, chute, baffle, etc.) shall be installed which extends to the top plate.
  - Minimum 2-1/2" clearance required between roof sheathing and blocking.
  - Vent screens shall be free of loose fill.

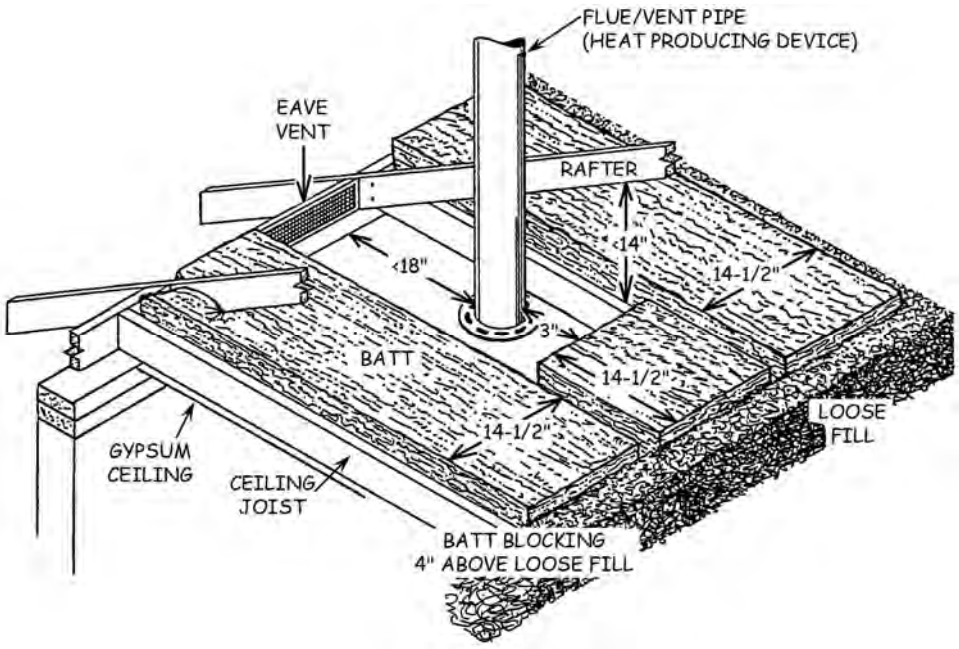


- **Horizontal Mineral Fiber Blocking**
  - Shall rest on existing loose fill, provided no loose fill is exposed at the top plate.
  - Blocking which extends inward 14-1/2" shall exceed height of the loose fill by 4".
  - Blocking which extends inward 24" shall equal or exceed height of the loose fill.
- **Restricted Access**
  - Flexible mineral fiber blocking shall be installed.
  - Minimum 2-1/2" clearance between blocking and roof sheathing.
  - Minimum 2-1/2" air path between vent and blocking.
  - Blocking
    - Shall be placed over existing loose fill, if unfaced batt is used and loose fill is not blocking vent.
    - Shall exceed height of loose fill or extend inward at least 24".



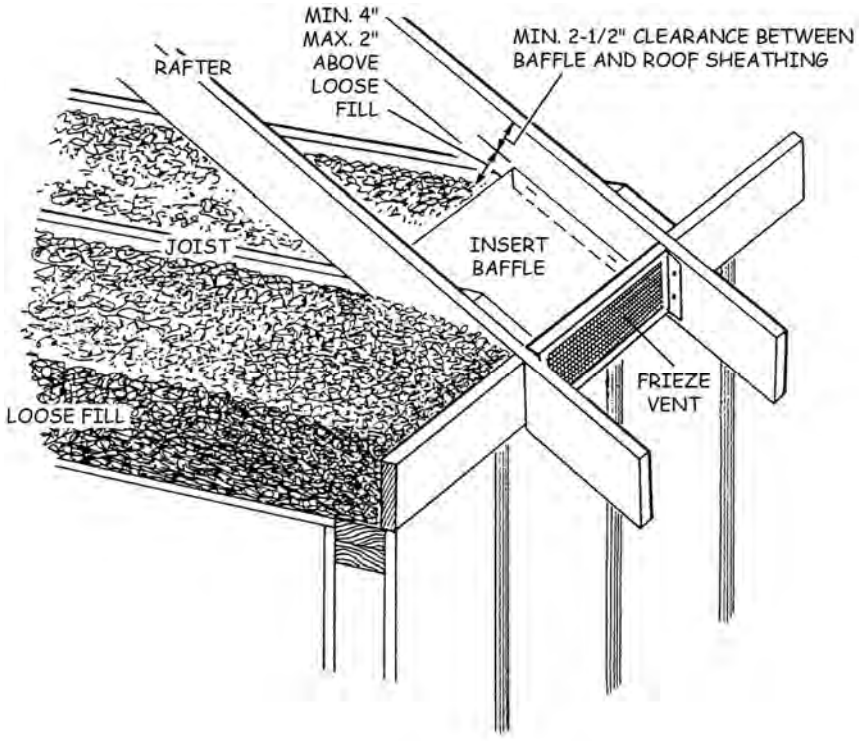
26. EAVE AND SOFFIT VENTS (cont.)

- **Restricted Access (HPD Present)**
  - Applies when HPD is *less than* 18" from an eave/soffit vent and clearance between floor joists and rafters is *less than* 14" at edge of clearance zone (as illustrated below).
    - Clearance zone shall be free of loose fill.
    - Minimum 3" clearance required between HPD and blocking.
    - Between joists adjacent to the HPD, flexible mineral fiber blocking shall be installed which rests on the attic floor, extends inward at least 14-1/2", and or exceeds height of the installed loose fill by 4".
    - Along the outside of each joist adjacent to the HPD, flexible mineral fiber blocking shall be installed (may rest on existing loose fill) which extends away from the clearance zone at least 14-1/2" and/or exceeds height of installed loose fill by 4".



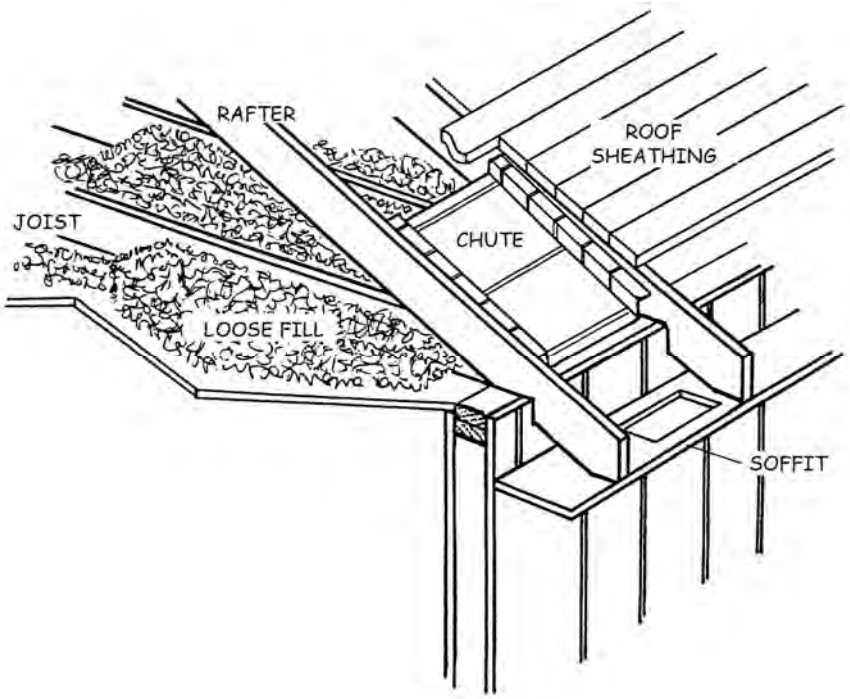
26. EAVE AND SOFFIT VENTS (cont.)

- **Baffles and chutes attached to rafters shall:**
  - Rest on (begin at) the top plate and extend above the loose fill a minimum of 4" and a maximum of 12".
  - Be permanently attached with a minimum of two mechanical fasteners per rafter.
  - Be kept 3" away from heat producing devices, if non-metal.
- **Baffles and chutes may be made of:**
  - Preformed plastic, commercially available.
  - Precut cardboard, commercially available.
  - Minimum 0.007" metal.
  - Plywood or gypsum.



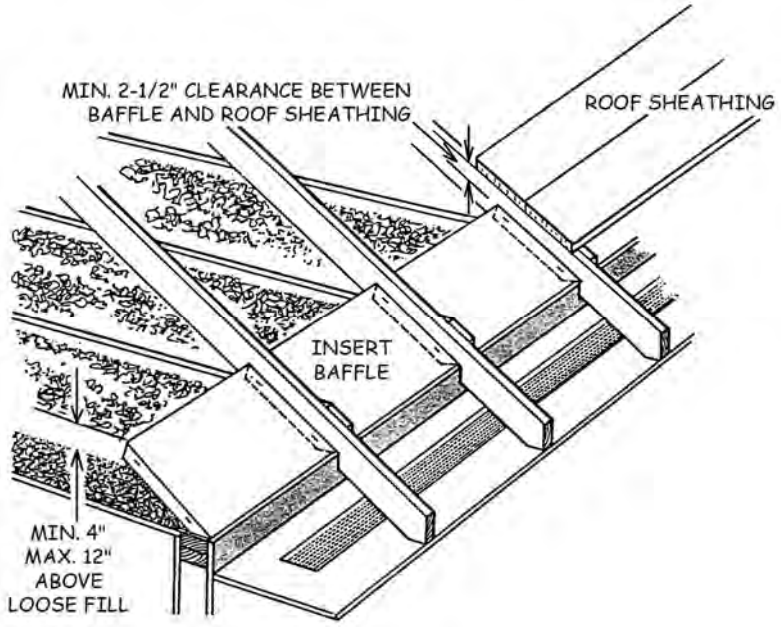
26. EAVE AND SOFFIT VENTS (cont.)

- **Preformed Ventilation Chutes**
  - Molded rigid plastic.
  - Minimum air path:
    - 2" x 12" for 16" OC rafters.
    - 2" X 18" for 24" OC rafters.
  - Restricted Access
    - Flexible mineral fiber blocking shall be installed.
    - Minimum 2-1/2" clearance between blocking and roof sheathing.
    - Minimum 2-1/2" air path between vent and blocking.
  - Chutes shall:
    - Rest on (begin at) top plate and extend above the loose fill by a minimum of 4" and a maximum of 12".
    - Be permanently attached at the top with at least one mechanical fastener on each side.
    - Be installed in a manner which prevents new loose fill from blowing around the bottom and edges.



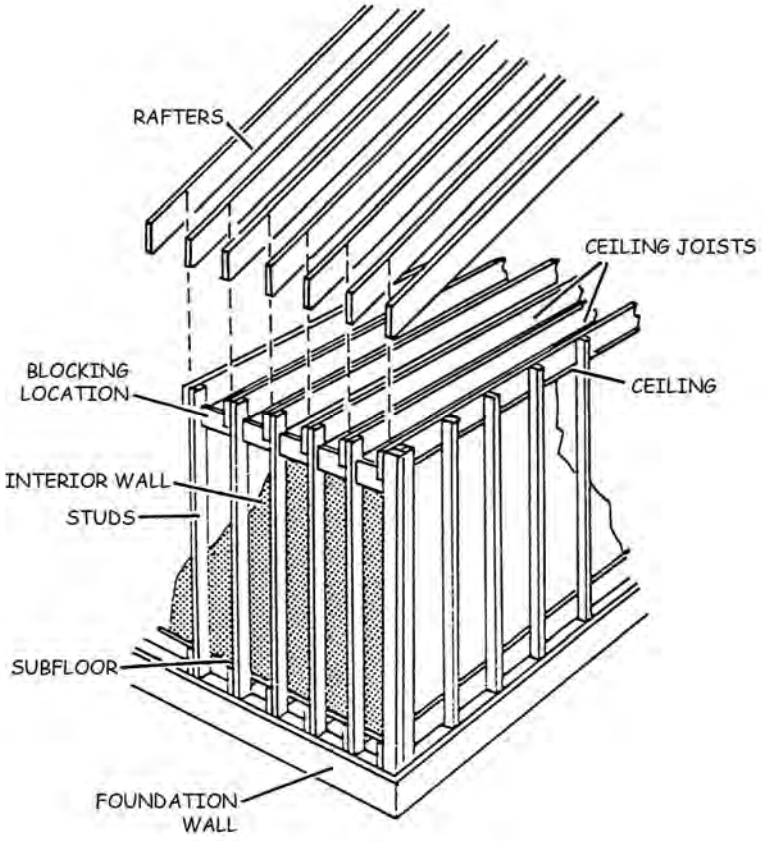
27. CONTINUOUS SOFFIT VENTS

- **All Loose Fill**
  - Blocking (batts, baffles, or chutes) shall be installed as prescribed in Item 26.
  - All vents, individual or continuous, shall be protected with blocking.
  - Loose fill that falls on the vent screen must be removed.
- **Flexible**
  - Minimum 2-1/2" clearance required between roof sheathing and insulation.
  - Must rest on attic floor.



28. BALLOON FRAMING

- **Loose Fill**
  - Blocking shall conform with General Blocking Requirements to prevent loose fill from falling down open wall cavities and into crawl space or basement.



29. UNVENTED FLAT ROOFS

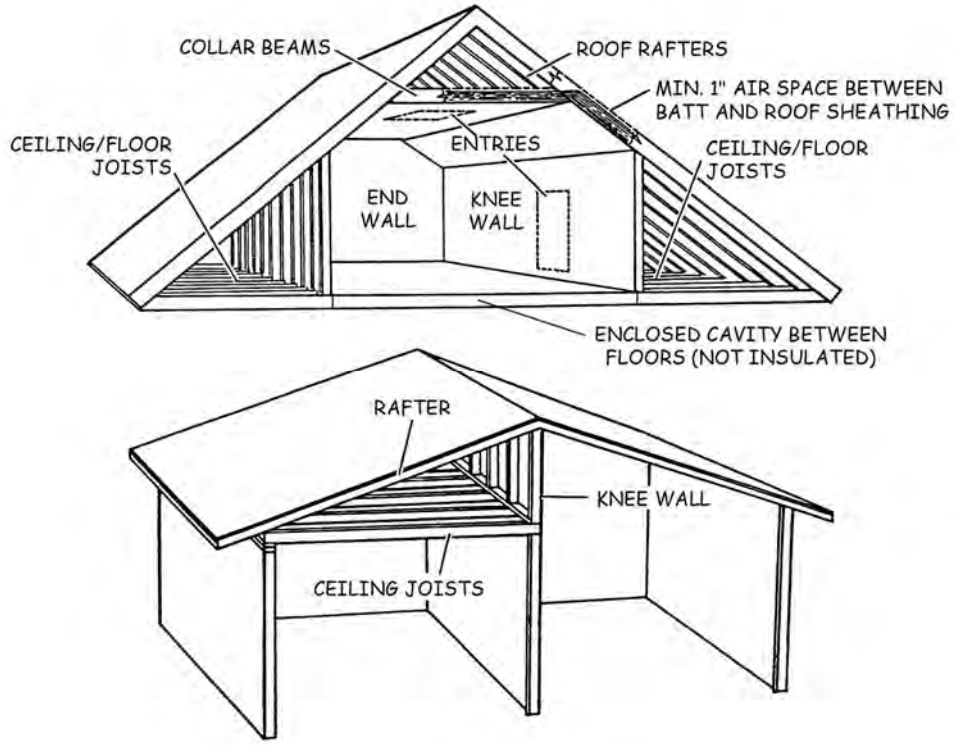
- **Ventilation**
  - Code compliant ventilation shall be installed before insulation is installed.
- **Installation**
  - Roof cavities shall be blown with loose fill insulation (or roof cavities will be dense packed with insulation) without gaps, voids, compressions, misalignments, or wind intrusions.

30. DENSE PACKING

- **Preparation**
  - Existence of air barrier material in-line with the knee-walls shall be installed or verified when dense-packing.
  - Cavities shall be free of hazards, intact, and able to support dense pack pressures.
  - Access shall be gained and each cavity must be probed, locating all attic floor joists and blockers.
  - Interior will be masked and dust controlled during drilling when accessing from interior.
  - Electricity supply will be confirmed and will support blowing machine power demand.
  - Blowing machine pressure test will be performed with air on full, feed off, agitator running, and gate closed.
  - Hose outlet pressure will be at least 80" of water column (IWC) or 2.9 pounds per square inch (psi) for cellulose insulation; for other types of dense pack insulation, check manufacturer specifications for blowing machine set up.
  - Air barrier material shall not bend, sag, or move once dense-packed.

31. KNEE-WALLS, PARTIAL SLOPED CEILINGS, AND ENCLOSED CAVITIES

- **Knee Walls & Skylights**
  - Uninsulated knee wall areas over 12" in height after new insulation is installed, and uninsulated skylight wells, shall be insulated to the R-value specified in CSD Field Guide.
  - All knee-walls will have a top and bottom plate or blockers installed using a rigid material
  - All joints, cracks, and penetrations will be sealed in finished material, including interior surface to framing connections.
- **Partial Sloped Ceiling and Knee Wall Combinations**
  - Mineral fiber batts may be installed in partial sloped ceiling cavities.
  - Minimum 1" air space required between batts and roof sheathing.
  - Loose fill not allowed.
- **Enclosed Cavities**
  - If an enclosed cavity is present (i.e., a portion of the attic that is sealed on all sides, or the space between floors), insulation shall not be installed inside that cavity in conformance with the Residential Compliance Manual.
- **Installation of Insulation**
  - Insulation shall be installed using one of the following methods:
    - New batts shall be installed in accordance with manufacturer specifications.
    - All existing batted insulation will be adjusted to ensure it is in full contact with the interior cladding and the top and bottom plates.
  - If rigid material is used, material will be installed to cover 100% of the surface of the knee-wall.
  - If foam sheathing is used, sheathing will be listed for uncovered use in attic, or covered with a fire barrier.
  - Insulation will be installed in full contact with all sides of existing cavity without gaps, voids, compressions, misalignments, or wind intrusions.
  - Strapping material will have a minimum expected service life of 20 years.
- **Knee-Walls without Framing**
  - A rigid insulated sheathing shall be mechanically fastened to code required R-value.



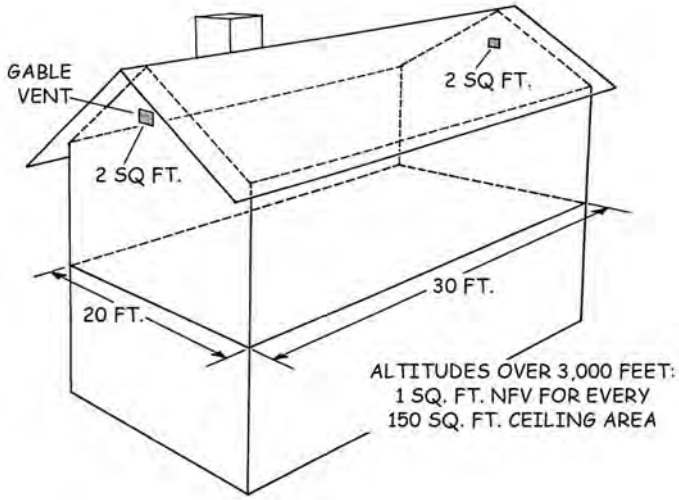
32. KNEEWALL DENSE PACKING

- **Backing**
  - All knee-walls will have top and bottom plate or blockers installed using rigid materials.
  - When knee-wall floor and walls are being insulated, the floor joist running under the knee wall will be air sealed.
  - If fabric is used before dense packing, it will be secured with 1" crown staples every 2" or with furring strips every wall stud.
  - If rigid material is used, material will be installed to cover 100% of the surface of the accessible knee wall area.
  - If foam sheathing is used, sheathing will be listed for uncovered use in an attic or covered with a fire barrier.
- **Installation of Dense Packing**
  - All existing batted insulation shall be adjusted to ensure it is in full contact with the interior cladding and the top and bottom plates.
  - Insulation that is blown behind fabric or air barrier material shall be blown dense to a minimum specification of 3.5 pounds per cubic foot for cellulose.
  - Follow manufacturer's requirements for fiberglass dense pack applications.

ATTIC VENTING

33. VENTING

- **All Insulation**
  - For ceiling insulation to be installed, venting shall comply with CSD WIS Section 21 (Attic and Crawlspace Ventilation).
  - Additional venting shall be installed (where needed) before insulation is installed.
  - Cross ventilation for each separate space is required.



PART 2: MOBILE HOME CRITERIA

See CSD WIS Section 20B (Ceiling/Roof Insulation for Mobile Homes).

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

34. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - This measure shall only be installed when the whole building is being served. Installation shall occur in conformance with Part 1: Installation Requirements for Conventional Homes.
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

35. QUALITY OF INSTALLATION

- **Level Installation**
  - Completed attic sections shall be confirmed to have an even level of insulation at the prescribed R-value in conformance with the CSD Field Guide.
  - Installation shall be installed in accordance with manufacturer specifications without gaps, voids, compressions, misalignments, or wind intrusions.
  - If the top of the existing insulation is below the top of the framing, new batts will be installed parallel with framing members.
  - If the top of the existing insulation is above the top of the framing, new batts will be installed perpendicular to framing members.
  - Once installed, insulation shall not be compressed or scattered to impact the efficiency of the insulation R-value.
  - Clearance zone for HPDs and vents shall be cleared of over-blown insulation.

36. CLEAN-UP REQUIREMENTS

- **All Units**
  - A HEPA vacuum shall be used when insulation is installed.
- **Access Inside the Living Space**
  - All areas between an indoor access and home entrance shall be vacuumed.
  - The area between the home entrance and the insulation truck shall be cleaned (swept or vacuumed).
- **Access Outside the Living Space**
  - All areas between the access and the insulation truck shall be cleaned (swept or vacuumed).

37. CLIENT EDUCATION

- **Disappearing Stairwell**
  - Educate client on how to use the hatch to ensure integrity of insulated and sealed assembly throughout its service life.
  - The purpose of the entire measure (insulation, air seal, protective barrier, proper attic stair operation) shall be communicated to client.
- **Attic Hatch**
  - Purpose of insulation and proper hatch operation will be communicated to client.
- **Whole House Fan**
  - Educate client on how to use the whole-house fan (when present) to ensure integrity of the fan insulated assembly throughout service life and to prevent disturbance to insulation.

38. INSULATION CERTIFICATE

- **Required Documentation**
  - In accordance with Title 24, when insulation is installed (ceiling, wall, or floor), completion of the insulation certificate (CSD 610 Form) shall be required and a copy provided to the client.
  - Manufacturer's information, and total installed R-value, shall be documented in the posted Insulation Certificate (CSD 610 Form).
  - The certificate shall be completed and signed by the contractor responsible for installing the insulation. The manufacturer, brand, R-value, etc. Of the insulation installed in the roof/ ceiling, walls, floor and slab edge are documented. The installer also verifies compliance with the applicable mandatory measures (i.e. Infiltration and exfiltration) for the building envelope.

REFERENCED STANDARDS

[1] CEC Article 394 (Concealed Knob-and-Tube Wiring), Sec. 394-12 (Uses Not Permitted)

[2] CEC Section 394-4

Back to Main ToC

NOTES

CEILING/ROOF INSULATION FOR MOBILE HOMES

Lead Paint Risk Factor
NONE

TABLE OF CONTENTS

Section 20B

CEILING/ROOF INSULATION FOR MOBILE HOMES

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

See CSD WIS Section 20A (Ceiling Insulation for Conventional Homes).

PART 2: MOBILE HOME CRITERIA

1. EXISTING INSULATION ASSESSMENT

- **All Mobile Home Roof Cavities**
  - If existing insulation was damaged by entry of moisture into the roof cavity, no additional insulation shall be installed unless the:
    - Source of the moisture leak was corrected, or will be corrected within the program; and
    - The existing insulation is fully dry.
- **Roof Condition**
  - Existing roof shall be free of damage and deterioration which would prevent restoration to a watertight condition following installation.
- **Sealing of Leakage Locations**
  - Seal all feasible leakage locations (including duct and shell leaks, and thermal bypasses in the ceiling/roof) before insulation is installed.
  - If unfeasible to seal thermal bypasses, installation of insulation will not be automatically prohibited unless the bypass source is documented to cause condensation and moisture damage in the attic (and where the issue cannot be corrected within the program scope).

2. APPROVED INSTALLATION METHODS

- **Approved ceiling/roof installation methods are:**

METHOD	REQUIREMENTS FOR APPROVED METHODS
Roof Cap Insulation	• Shall be installed only on mobile homes where: - A ceiling structure is not capable of supporting, or is too shallow to accept, a minimum R-11 cavity fill. - Dwelling is equipped with a functioning permanent refrigerated air conditioning and/or forced air electric heating system. • Shall consist of rigid insulating material installed over the existing roof and capped with an overlay of metal roofing or a synthetic membrane. • Maximum total system weight shall be 1-1/2 lbs./sq. ft. • Minimum R-value shall be R-11.
Gable End	• Method shall not be used to insulate the entire roof cavity, but is performed *in conjunction with* interior ceiling bore OR exterior roof edge cavity fill methods. • Shall be used to fill the area immediately adjacent to gable ends, subject to the following restriction. - Insulation shall be blown only within an area where proper distribution can be verified by visual inspection. - Insulation shall be blown-in leaving a minimum 1-inch gap for air circulation. • Minimum R-value shall be R-11, maximum of R-30.

Section 20B

METHOD	REQUIREMENTS FOR APPROVED METHODS
Interior Ceiling Bore Cavity Fill	• Shall be installed in any mobile home with: - A ceiling structure capable of supporting the added insulation and blowing pressure. - A roof cavity deep enough to accept the required R-value. - Insulation shall be blown-in leaving a minimum 1-inch gap for air circulation. • Minimum R-value shall be R-11, maximum of R-30.
Exterior Roof Edge Cavity Fill	• Shall be installed only in a mobile home with a metal roof AND: - A ceiling structure capable of supporting the added insulation and blowing pressure. - A roof cavity deep enough to accept the required R-value. - Insulation shall be blown-in leaving a minimum 1-inch gap for air circulation. • Minimum R-value shall be R-11, maximum of R-30.

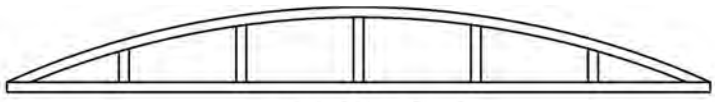
GENERAL REQUIREMENTS FOR ALL INSTALLATION TYPES

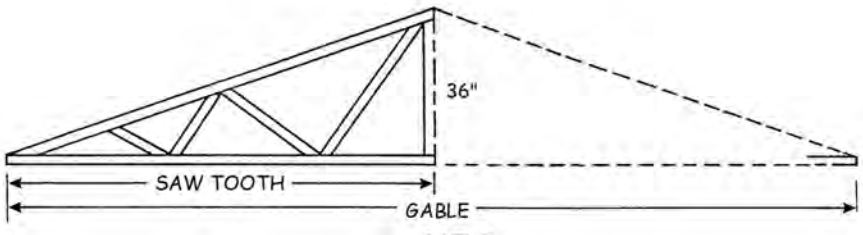
3. SYSTEM DESIGN

- **Systems**
  - System design for roof cap insulation shall be submitted to and approved by the CA Department of Housing and Community Development (HCD) prior to any installation activities.
  - Materials for ceiling/roof insulation installation shall match quality of existing roofing material.

4. STRUCTURAL REQUIREMENTS

- **All Insulation Methods**
  - Trusses shall be capable of withstanding:
    - The added weight of the insulation system.
    - The increased snow load resulting from reduced heat loss through the roof.
  - Ceiling condition shall be such that all holes, cracks, and other bypasses into the roof cavity can be effectively repaired and sealed to minimize permeation of household moisture into the roof cavity.
  - Loose ceiling panels will be secured.
  - Temporary ceiling bracing will be recommended during the insulation installation process.
- **Cavity Fill Method-Specific**
  - Ceiling shall be structurally adequate to support the weight of the added insulation plus the blowing machine pressure without bulging or sagging.
    - Maximum ceiling panel deflection after cavity fill shall be 1/4" in 4' of lateral run.



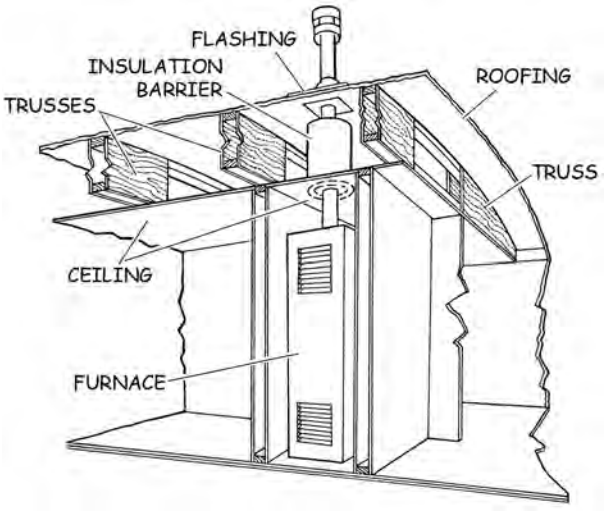


5. INTERIOR PREPARATION

- **Preparation of Home**
  - When attic access is indoors, the pathway from the entrance door to the attic access shall be protected with runners.
  - Before entry is made into the attic from the living space, a drop-cloth shall be placed under the attic access.
  - When entry is through an access inside a closet, the clothing and other personal property shall be removed or covered.
  - Care shall be taken to prevent damage to the home and furnishing by the insulation hose, ladders, etc.
  - All cutting of mineral fiber batts for blocking or baffling purposes shall occur outside the living space or inside the attic.
- **All Insulation Methods**
  - Blower door analysis and shell sealing as prescribed in the CSD Field Guide Appendix C and CSD WIS Section 7 (Minor Envelope Repair) shall be performed prior to installation of any insulation system.
- **Ceiling Soundness**
  - Ceiling Panel Reattachment:
    - Existing attachments shall be tight and secure.
    - Additional attachments shall be installed as needed for support and to prevent excessive ceiling sag.
  - Ceiling Panel Repair
    - Weak, deteriorated, or broken ceiling panels anywhere in the area to be insulated shall be repaired, as needed, to prevent ceiling panel collapse or excessive sag.
    - Repairs in open, visible areas shall match the existing finish or material.
- **Combustion Flues**
  - Ensure all combustion appliance flues terminate outdoors and maintain proper clearances in conformance with the CSD Field Guide Appendix A.
  - A distance no less than 2" will be maintained between any combustion appliance vent and combustible materials, unless a zero-clearance vent is in place.
- **Containment**
  - Special precautions shall be taken to limit fiberglass and construction dust exposure to the client and occupant belongings.

6. HEAT PRODUCING DEVICE (HPD) BAFFLING

- **Location Requirements**
  - All recessed lights, furnace vents, water heater vent pipes, and other heat-producing devices shall be protected with a non-combustible barrier (blocking) as defined in CSD WIS Section 20A (Ceiling Insulation for Conventional Homes).
  - Non-IC rated light fixtures shall be replaced with airtight IC-rated fixtures.
- **Barrier Requirements**
  - All protective barriers shall:
    - Be permanently secured.
    - Extend from the ceiling to 4" above the installed insulation.
    - Completely surround the heat-producing device.
    - Provide a minimum of 3" airspace on all sides.
- **Barrier Installation Access**
  - Access for installation may include the

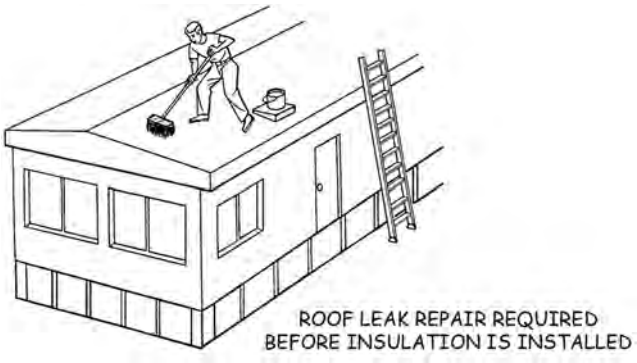


removal of:
- The heat-producing device.
- The ceiling trim or trim collar.
- A small amount of ceiling material immediately surrounding the heat-producing device.
- The roof flashing.

- **Post Baffling Requirements**
  - Heat-producing devices removed shall be properly reinstalled.
  - Gaps created by removing ceiling material shall be filled with the material removed or other appropriate material as needed.
  - The space between combustion appliance vents and the ceiling will be sealed with fire-rated materials.
  - Ceiling collars and other trim material shall be properly reinstalled.
  - All ceiling air leaks created during baffling shall be sealed, in accordance with the applicable portions of:
    - CSD WIS Section 7 (Minor Envelope Repair), and
    - CSD WIS Section 8 (Caulking).

7. ROOF REPAIR (INCIDENTAL REPAIRS TO CEILING INSULATION)

- **Leaks**
  - All leaks which can allow household moisture to penetrate the walls or ceiling and permeate the roof cavity shall be sealed.
  - Dishing and pooling issues that allow standing water shall be addressed.
  - All broken mushroom vents shall be replaced or removed and sealed.
- **Roof Cap System**
  - Leaks in the existing roof shall be sealed prior to installation of roof cap.
- **Ceiling Cavity Repair**
  - Defective roof-mount flashing devices shall be replaced.
  - All cracks and gaps 1/16" or larger shall be repaired with such materials as:
    - Self-adhering flexible sheet roof repair material.
    - Roof repair compound in combination with roof repair fiberglass mesh.
  - Cracks *less* than 1/16" wide may be sealed without fiber reinforcement using an elastomeric sealant or roof repair compound, which is compatible with the existing roof surface.
  - All surfaces shall be cleaned and materials shall be applied in conformance with manufacturer's instructions.


ROOF LEAK REPAIR REQUIRED
BEFORE INSULATION IS INSTALLED

ROOF CAP INSULATION METHOD

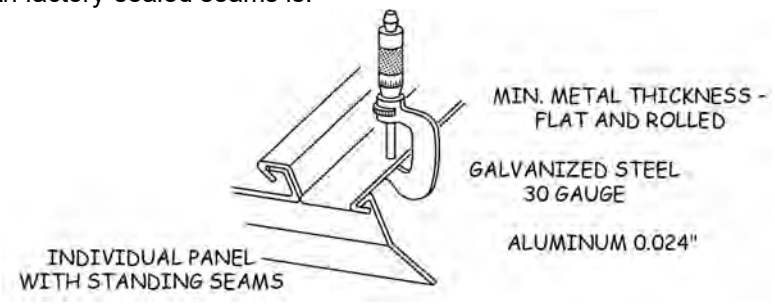
8. APPROVED MATERIALS

- **Insulation and associated materials shall comply with CSD WIS Appendix A (Material Specifications).**

9. INSTALLATION REQUIREMENTS

- **Metal Roof Access Restrictions**
  - Any metal roofing roll-back, cutting, boring, or penetrating is prohibited.

- **Metal Roof Cap Systems**
  - Continuous roll-on roofing with factory-sealed seams is:
    - Required on curved roof.
    - Recommended on all roofs.
  - Individually installed panels:
    - Shall not be applied to curved roof surfaces.
    - Shall have interlocking standing seams which permanently seal against water penetration.



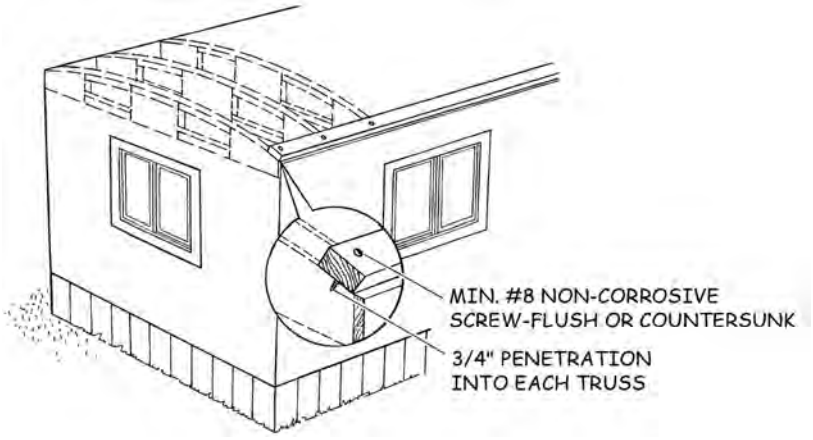
- **Synthetic Membranes**
  - Splicing Restrictions
    - Membranes which are spliced and attached with a permanent vulcanizing process may be installed in strips and sealed along the lengthwise seams on site.
      - Strip length shall equal the roof length.
      - Strip width shall be a minimum of 6'.
- **Splicing and Attachment**
  - Membranes which are spliced and attached with glue and/or mechanical attachments shall be supplied full-size with factory-sealed seams.
  - On-site seam sealing is not allowed.
  - A single membrane shall cover:
    - An entire single-wide roof.
    - The entire roof of each section of a multi-section mobile home.

10. OTHER SYSTEM COMPONENTS

- **Wood Edging and Furring Thickness**
  - Height of wood shall equal height of insulation ± 3/8".
- **All Metal Components**
  - Shall be manufactured for the application in which they are used.
  - Shall meet the thickness requirements listed in CSD WIS Appendix A (Material Specifications) *unless* lighter weight material is approved by the HCD State Plan Check Engineer.
  - Shall be installed, secured, and sealed in conformance with manufacturer's instructions.

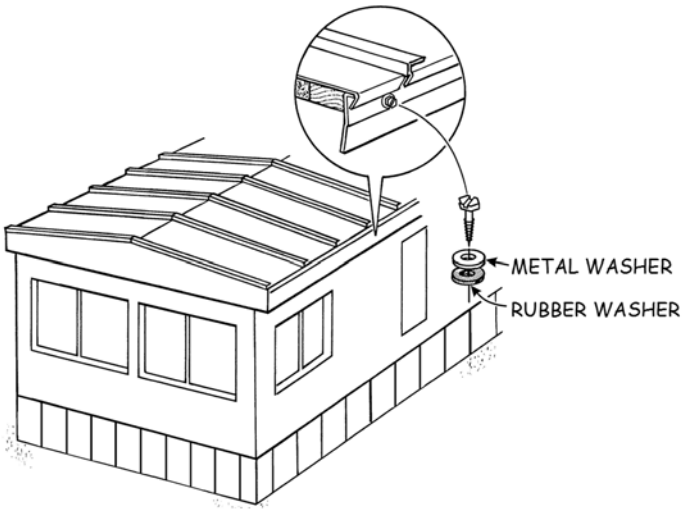
11. COMPONENT ATTACHMENT

- **All Components**
  - Attachment requirements in this section shall apply *unless* superseded by manufacturer's instructions or applicable codes.
- **Wood Edging and Furring**
  - Method of Attachment
    - Screws shall be used to attach wood members to the framework of the existing roof.
    - Screws shall penetrate the wood framework 3/4" minimum.
    - Screw heads shall be flush or countersunk.

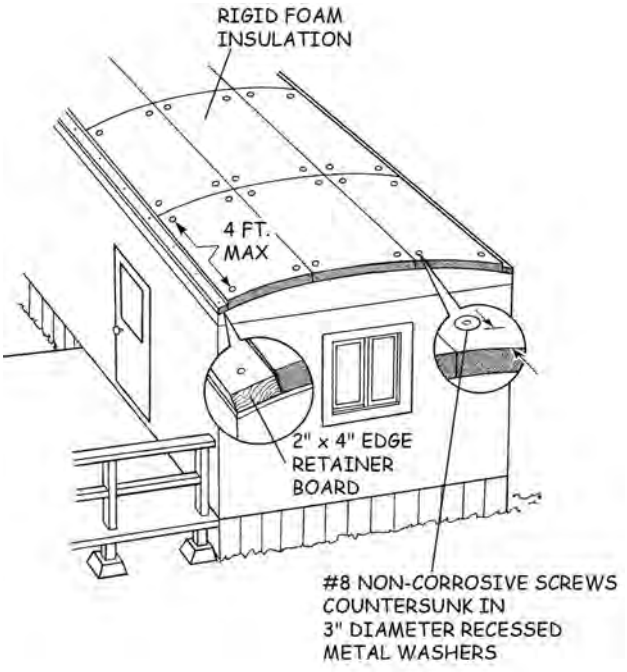


11. COMPONENT ATTACHMENT (cont.)

- **Wood Edging and Furring (cont.)**
  - Screw Placement
    - A minimum of one screw shall be:
      - Installed within 4" of the ends of each piece.
      - Penetrate each underlying truss.
- **Metal Edging, Drip Rail, Ridge Cap, and Similar Components**
  - Method of Attachment
    - Metal components shall be securely attached to the mobile home framework with screws to ensure permanent attachment.
    - All screws shall penetrate wood (by 3/4" minimum) when attaching roof edging and drip rails.
    - Screws shall be spaced 4" OC maximum.

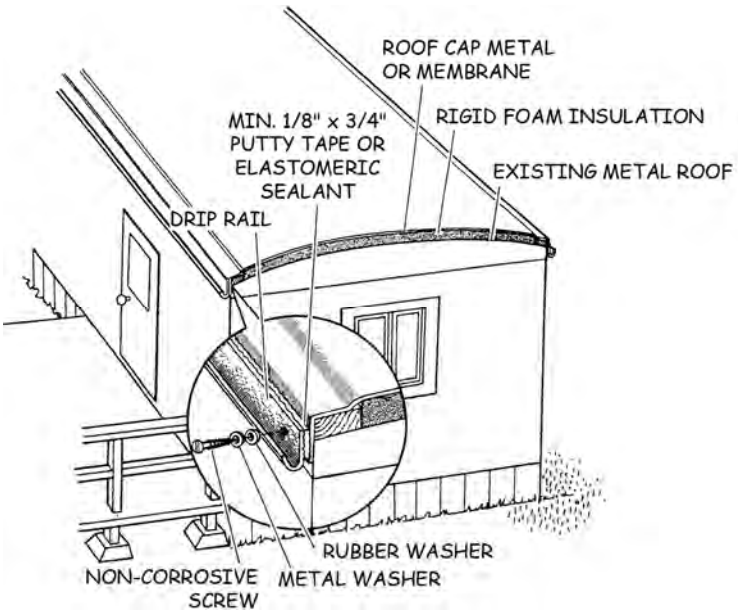


- **Rigid Insulation Materials**
  - Attachment Components
    - Insulating panes shall be secured to the metal roof with screws and washers.
    - Washers shall contain a center recess to place the screw head flush with or below the surface of the insulation.
  - Screws shall be:
    - Placed within 6" of each corner.
    - Spaced elsewhere 4' OC maximum.



12. COMPONENT SEALING

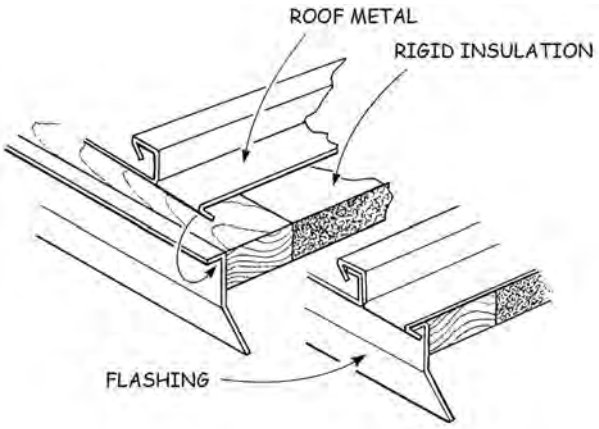
- **Metal Roof Edging, Drip Rails and Other Water Barrier Components**
  - All penetration points shall be made watertight.
  - Secure the component with screws to compress the sealant.
  - Exposed screws shall be sealed with one of the following:
    - Tight-fitting rubberized metal washers.
    - Tight-fitting pliable water-sealing washers backed by non-corrosive metal washers.
  - Additional sealing with elastomeric sealant or putty tape a minimum of 1/8" thick shall be provided between the component and the mounting surface in any location where water may penetrate.

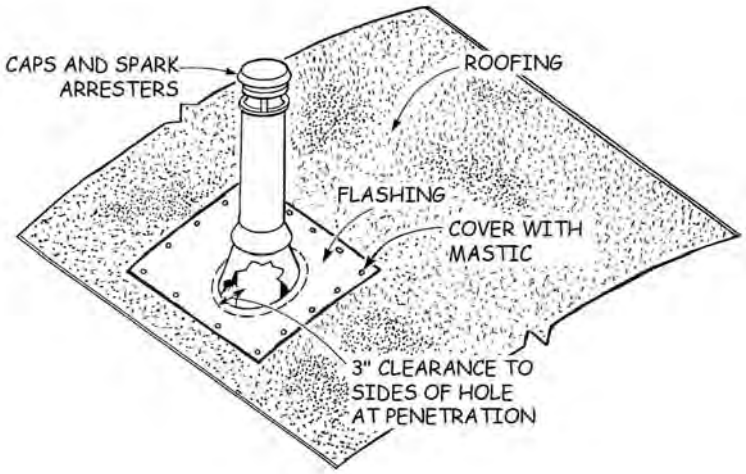


- **Roll-on Metal Roofing and Flexible Membranes**
  - Shall be installed, secured, and sealed as prescribed by the manufacturer.
- **Individual Panel Metal Roofing**
  - Shall be installed, secured, and sealed as prescribed by the manufacturer.
  - Standing seams and end joints shall be sealed with elastomeric sealant *unless* instructed otherwise by the manufacturer.

13. GAS AND SOLID FUEL APPLIANCE VENTS AND FLASHINGS

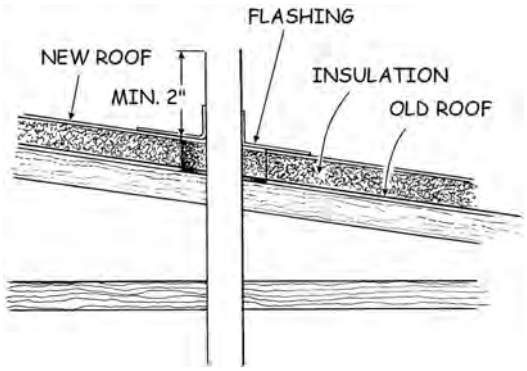
- **All Roof Cap Systems**
  - Each fuel-fired appliance vent shall be a listed assembly specified by the appliance manufacturer.
  - All components shall be installed in accordance with listing specifications, manufacturer's instructions, and applicable codes.
    - Pre-existing, non-conforming conditions shall be corrected.
    - Defective components shall be replaced.
    - When proper height of termination above the new roof cap cannot be achieved through adjustment:
      - Additional listed parts shall be acquired to extend the assembly, or
      - A new listed assembly shall be installed which meets the specified height requirement.
  - Clearance between the vent pipe and the installed insulation shall be the greater of 3" or the manufacturer's specified clearance to combustibles.





14. PLUMBING VENTS, AIR PLENUMS, AND FLASHINGS

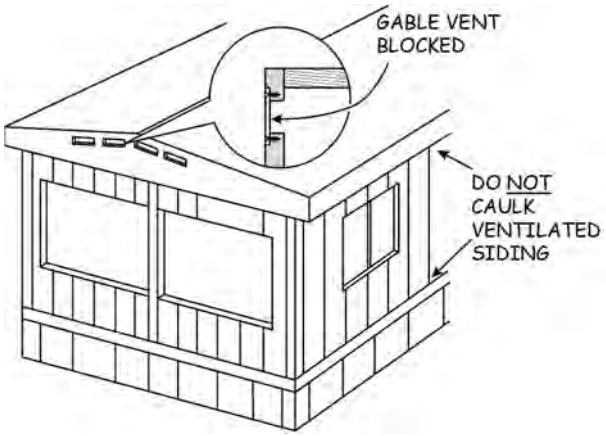
- **All Roof Cap Systems**
  - Plumbing vent pipes shall extend a minimum of 2" above the surface of the roof cap.
  - Exhaust ducts, including those for kitchen and bathroom fans, shall extend through the surface of the roof cap to the outdoors.
  - All broken mushroom vents will be replaced or removed and sealed.
  - Extension components shall be:
    - Compatible with existing components.
    - Securely assembled and properly aligned.
    - Installed in conformance with manufacturer's instructions and applicable codes.



  - Evaporative coolers shall be properly reinstalled.
    - The plenum shall extend sufficiently through the roof cap to facilitate installation of a watertight seal.
    - All mounting hardware shall be installed in a manner which provides adequate support and a watertight seal at the surface of the new roof cap.

15. ROOF CAVITY VENTILATION

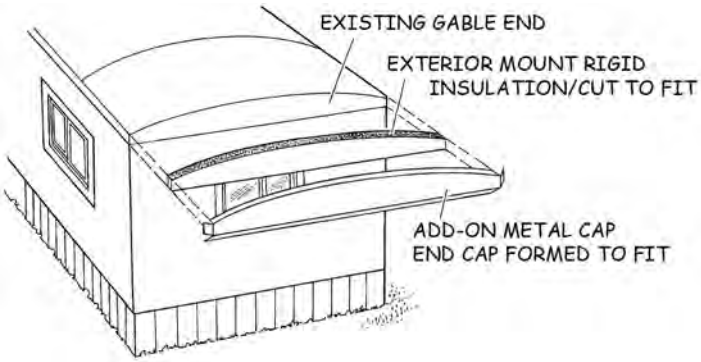
- **Existing Roof Vents**
  - All existing roof cavity vents shall be tightly blocked and sealed.
- **Ventilated Walls**
  - Bypasses into roof cavities at the top of ventilated walls shall be blocked.
  - Exterior caulking shall not be installed on the top and bottom of ventilated walls.



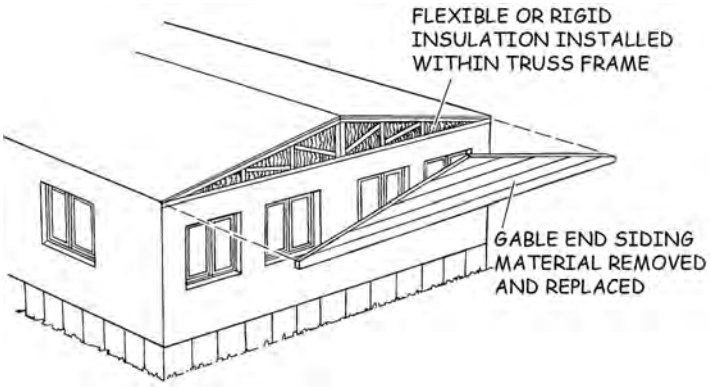
GABLE END METHOD

16. GABLE END INSULATION

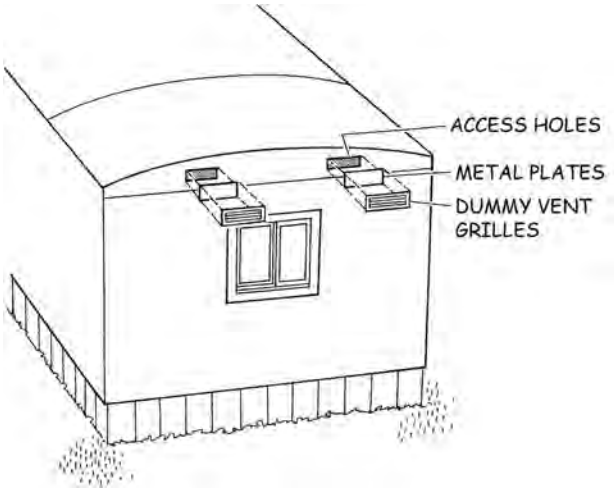
- **Truss Height Requirement**
  - Gable ends shall be insulated when the truss height is 10" or more at the apex.
- **Exterior Surface Mount Method**
  - Application:
    - Cut rigid insulation to fit the gable end cavity.
    - Obtain a metal end cap form to fit the enclosure.
    - Attach cap over the insulation.
    - Metal enclosure shall bear a permanent finish which is compatible in color and design with the surrounding materials.



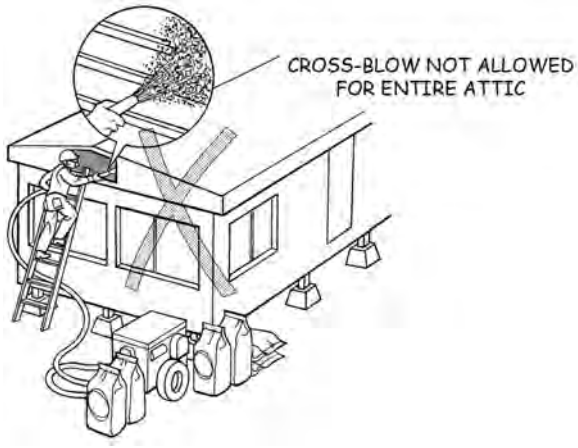
  - Attachment
    - Metal enclosure shall be secured with non-corrosive screws spaced a maximum of 4" OC.
  - Sealing
    - All seams, joints, and penetrations shall be sealed with elastomeric sealant or putty tape.
    - Screws shall be sealed as prescribed in Item 11.
- **Interior Truss Mount Method**
  - Application
    - This method shall be used only when the gable end siding material can be safely removed and replaced.
    - Flexible or rigid mineral fiber, or foil-faced foam board insulation shall be securely installed within or behind the exposed gable end framework.
    - Foam not allowed, unless ceiling is minimum 5/16" gypsum or equivalent.



- **Gable End Cavity Fill Method**
  - This method shall be used only when the ceiling structure is capable of supporting the weight of the added insulation and the blowing pressure.
  - Application
    - The truss cavity immediately adjacent to each gable end shall be completely filled with loose fill fiberglass to create a thermal barrier over the entire gable end.
  - Exterior gable end access:
    - Siding material or vent grilles shall be removed or holes cut or drilled for access.



- When gable end holes are drilled for nozzle fill:
  - Minimum 2" diameter holes are required.
  - Holes shall be spaced so that insulation is not required to travel more than 2' laterally or 1' vertically upward.
  - A directional nozzle or curved fill tube shall be used to inject the insulation.
  - Loose fill fiberglass shall be used.
  - Gable end shall be returned to watertight condition with all holes and vents blocked and sealed in an aesthetically pleasing manner.



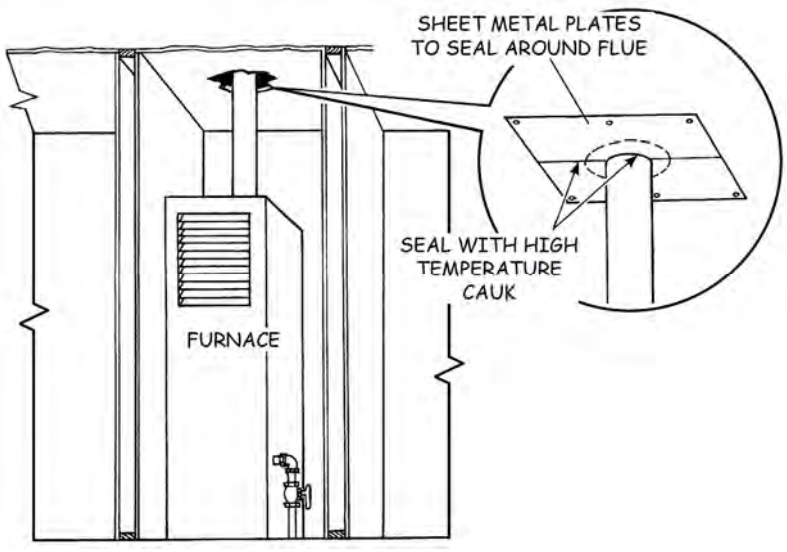
EXTERIOR ROOF EDGE CAVITY FILL METHOD

17. EXTERIOR ROOF EDGE CAVITY FILL

- **Roof Types Allowed**
  - Roof edge cavity fill shall be restricted to roofs which:
    - Are covered by metal roofing material.
    - Do not contain an underlayment of wood sheathing.
    - Can feasibly be detached and lifted in segments along the edge.
    - Have sufficient height to allow a minimum R-11 pressure fill.
- **Roof Condition**
  - Existing roof shall be free of damage and deterioration which would prevent restoration to a watertight condition following installation.

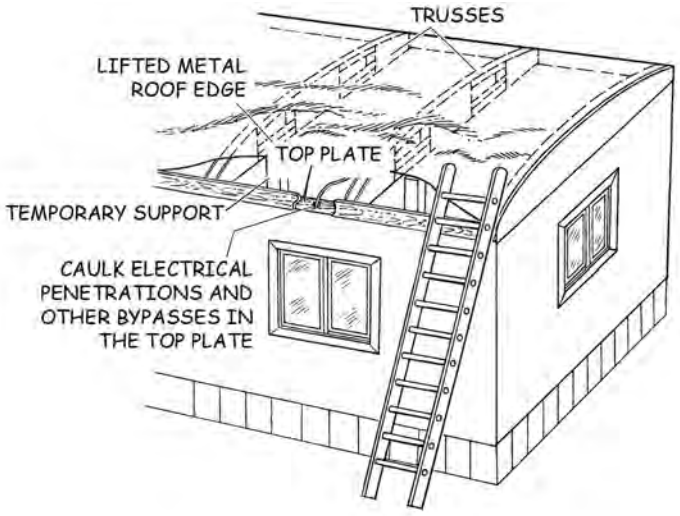
18. CAVITY-FILL ACCESS

- **Metal Roof Lifting**
  - The roof edge shall be lifted and temporarily supported only as required to access the truss space where the fill tube is inserted.
  - Roll-back of metal roofing is not allowed.
- **Bypass Sealing**
  - Utility penetrations and other holes in the top plate shall be sealed while the roof is lifted.
  - Eave vents and wall bypasses which communicate with the roof cavity shall be blocked and sealed.



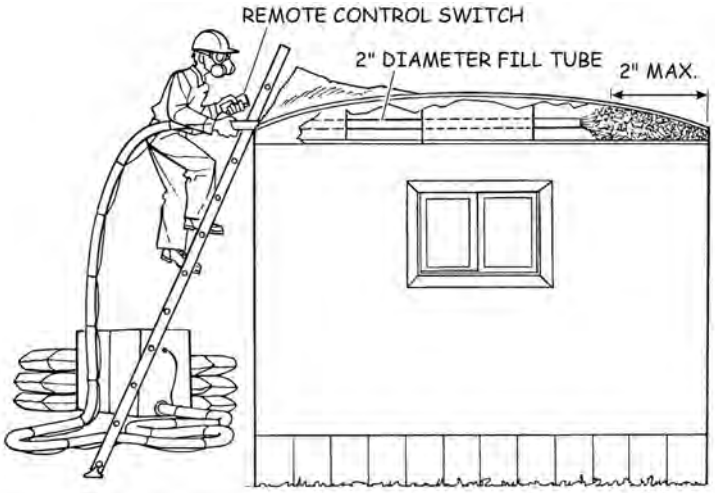
19. ROOFING REASSEMBLY

- **Metal Roofing**
  - Metal roofing shall be returned to its original position and reattached securely with non-corrosive fasteners (screws, staples, etc.).
    - Attachments shall penetrate wooden framework 3/4" minimum.
    - Staples shall be installed in new locations.
    - Screws placed in existing holes shall be sized to achieve a tight, secure attachment.



20. LOOSE-FILL INSTALLATION

- **Materials**
  - Loose fill fiberglass is approved.
  - Prohibited materials include cellulose and rock wool.
- **Fill Tube Requirements**
  - Maximum insulation travel shall be 2' past end of fill tube.
  - Fill tube diameter shall be 2" minimum.
- **Blowing Machine**
  - Blowing machine pressure test shall be performed with air on full, feed off, and gate closed.
  - Hose outlet pressure shall be set in accordance with manufacturer specifications.
- **Blower Controls**
  - Installer shall be equipped with a remote switch to control the blowing machine.

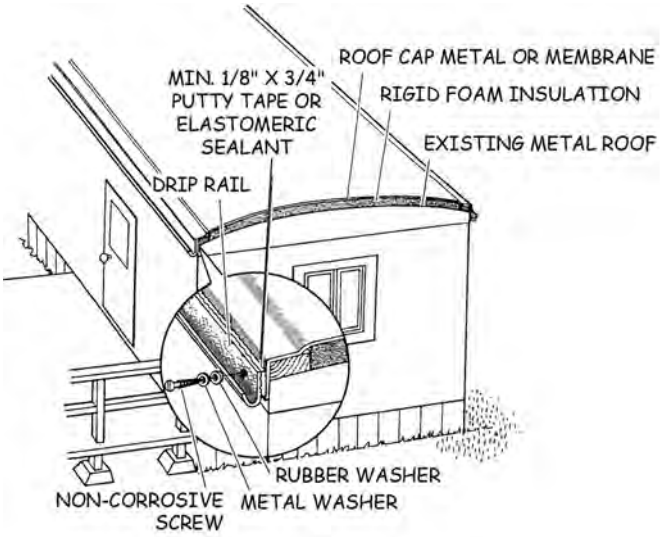


- **Density of Cavity Fill**
  - Insulation thickness and density shall meet the R-value requirements specified in Item 2.
  - Using fill tube, 100% of each cavity shall be filled to a consistent density.
  - Fill tube shall be inserted within 6” of the end of each attic cavity.
  - Insulation shall be installed into the void of the attic cavity:
    - If existing insulation is roof-mounted, insulation shall be blown below.
    - If existing insulation is ceiling-mounted, insulation shall be blown above.
    - If existing insulation is mounted at both locations, insulation shall be blown in between.
  - Avoid overfilling of roof edges and above attic trusses.
- **Ceiling Performance**
  - Excessive ceiling panel deflection caused by insulation weight and pressure shall be corrected.
    - Loose attachments shall be tightened.
    - Additional attachments shall be added, as needed, to secure ceiling panels to joists.
    - Other remedial action shall be taken as needed.

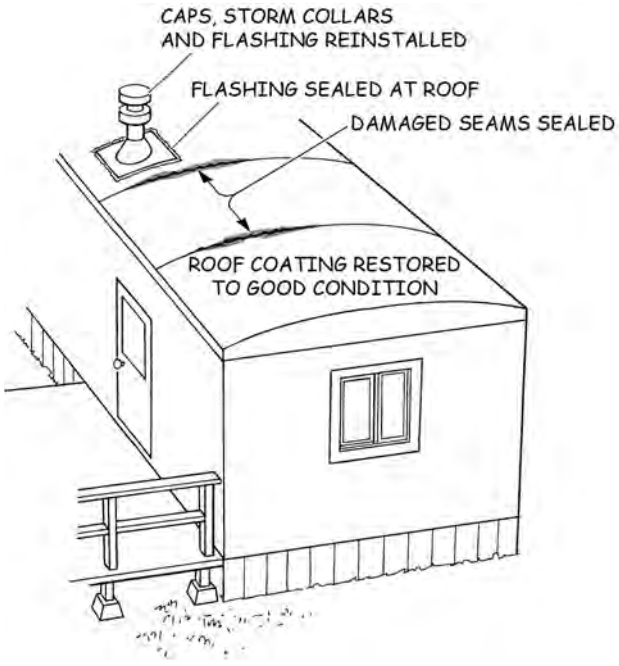
- Maximum ceiling panel deflection after cavity fill shall be 1/4" in 4' of lateral run.
- Temporary ceiling bracing is recommended during the insulation installation process.

21. ROOF EDGE COMPONENT REASSEMBLY AND SEALING

- **Components**
  - Damaged drip rail, flashing, etc., shall be replaced with compatible materials, as needed, to assure proper performance.
- **Attachment**
  - Attachment materials shall conform to CSD WIS Appendix A (Materials Specifications).
  - Roofing shall be reattached with screws, nails, or staples at least 3/4" in length.
  - Drip rail and flashing shall be securely attached with screws which penetrate the wooden framework at least 3/4".



- **Sealing**
  - Sealant materials shall conform to CSD WIS Appendix A (Material Specifications).
  - Sealants shall be applied between the metal roof and the attached components to create a permanent watertight seal at all penetration points.
  - Exposed screws shall be sealed with a tight-fitting rubberized metal washer, or metal and rubber washer combination.
  - Elastomeric sealant shall be applied to exposed seams and screw heads as needed to achieve a permanent, watertight seal.



22. POST-INSTALLATION ROOF INSPECTION AND REPAIR

- **Seams**
  - All roof seams shall be inspected, and those with evidence of damage or potential leakage shall be sealed.
- **Roof Penetration Flashings**
  - All affected flashings and termination devices shall be reinstalled, secured, and properly sealed.
- **Roof Coatings and Repairs**
  - Roof repairs and sealing shall be in conformance with Item 7.
  - The finished roof shall be secure and watertight.
  - Roof coating damaged during installation shall be repaired.
  - All repair materials shall be compatible with existing surfaces, appropriate for the application, and installed as prescribed by the manufacturer.

INTERIOR CEILING BORE CAVITY FILL METHOD

23. INTERIOR CEILING BORE CAVITY FILL MATERIALS

- **Materials**
  - Loose fill fiberglass is approved.
  - Prohibited materials include cellulose and rock wool.

24. ROOF HEIGHT REQUIREMENT

- **All Roof Types**
  - Roof cavity shall have sufficient height to allow a minimum R-11 pressure fill.

PRE-INSTALLATION REQUIREMENTS

25. CEILING BORE PREPARATION

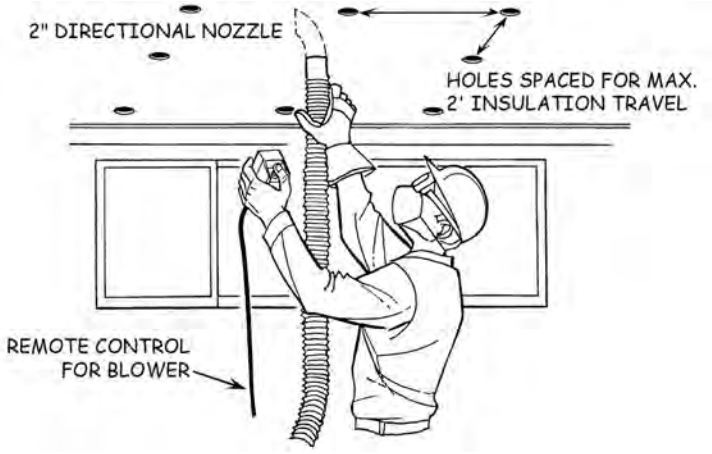
- **General Provisions**
  - Requirements set forth in Items 3–6 shall be met.
- **Interior Preparation**
  - All floors, furniture, appliances, clothing, and other personal belongings shall be protected (e.g., with drop cloths).

26. HOLE SIZE AND SPACING

- **Hole Size**
  - 2" *minimum* diameter, and
  - 3" *maximum* diameter.
  - Holes will be large enough to accommodate the chosen fill tube without damaging the ceiling material during installation.
- **Spacing**
  - Holes shall be placed so that insulation travel is 2' maximum.
  - All holes shall be placed in a straight line *except* where structural obstructions force deviation.
  - Equidistant holes will be drilled in a straight row parallel to the longitudinal exterior wall of the ceiling.
  - If a longitudinal ceiling trim piece exists, trim piece shall be removed and holes shall be drilled behind the trim.
  - There shall be, at a minimum, one hole between each roof truss.

27. BLOWER SPECIFICATIONS

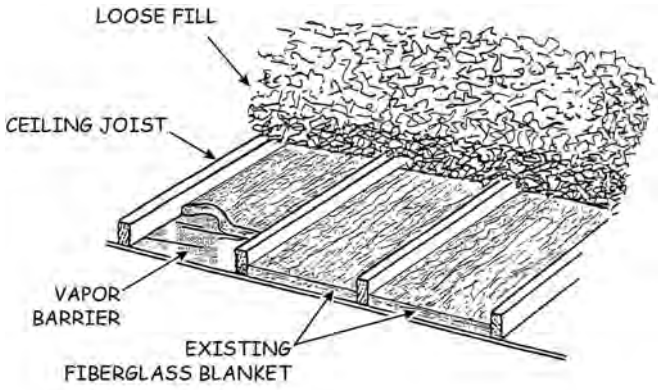
- **Nozzle Size and Type**
  - Nozzle diameter shall be no *more* than 1/2" *smaller* than hole diameter, to limit dust and blow-back.
  - Directional type nozzle, curved pipe or flex tube shall be used to direct blow in a 360° coverage pattern.
- **Blowing Machine**
  - Blowing machine pressure test shall be performed with air on full, feed off, and gate closed.
  - Hose outlet pressure shall be set in accordance with manufacturer specifications.



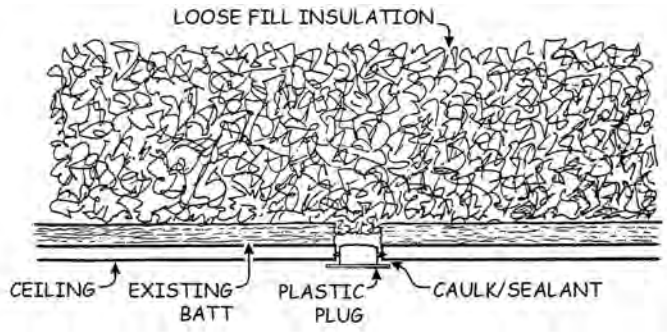
- **Blower Controls**
  - Installer shall be equipped with a remote control switch to control the blowing machine.

28. LOOSE-FILL INSTALLATION

- **Material Placement**
  - Fill hole shall extend through existing vapor barrier and insulation.
  - Loose-fill shall be installed on top of existing insulation.
  - Fill tube shall be inserted within 6" of the end of each attic cavity.
  - If existing insulation is roof-mounted, insulation shall be blown below.
  - If existing insulation is mounted at both locations, insulation shall be blown in between.



- **Density of Cavity Fill**
  - Insulation thickness and density shall meet the R-value requirements per Item 2.
  - Using fill tube, 100% of each cavity will be filled to a consistent density.
- **Ceiling Performance and Repair**
  - Excessive ceiling panel deflection caused by insulation weight and pressure shall be corrected.
    - Loose attachments shall be tightened.
    - Additional attachments shall be added, as needed, to secure ceiling panels to joists.
    - Other remedial action shall be taken as needed.
    - Maximum ceiling panel deflection after cavity fill shall be 1/4" in 4' of lateral run.
    - If existing trim was removed, it shall be reinstalled.
- **Plugs**
  - Custom-made plugs matching existing ceiling material is a best practice.
  - Plastic plugs are acceptable.
  - All plugs shall be sealed in place with caulking, construction adhesive, or other appropriate sealant.



PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

- **General**
  - See CSD WIS Section 20A (Ceiling Insulation for Conventional Homes).
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

29. INSTALLATION VERIFICATION

- **Completeness**
  - Installation process will be considered complete when installer and the Quality Control Inspector have verified that damage has not occurred to the roof or ceiling assemblies during the installation process.

30. CLEAN-UP REQUIREMENTS

- **All Units**
  - A HEPA vacuum shall be used when insulation is installed.
- **Access Inside the Living Space**
  - All areas between an indoor access and home entrance shall be vacuumed.
  - The area between the home entrance and the insulation truck shall be cleaned (swept or vacuumed).
- **Access Outside the Living Space**
  - All areas between the access and the insulation truck shall be cleaned (swept or vacuumed).

31. INSULATION CERTIFICATE

- **Required Documentation**
  - Manufacturer's information, and total installed R-value, shall be documented in the posted Insulation Certificate (CSD 610 Form).
  - In accordance with Title 24, when insulation is installed (ceiling, wall, or floor), completion of the insulation certificate (CSD 610 Form) shall be required and a copy provided to the client.
  - The certificate shall be completed and signed by the contractor responsible for installing the insulation. The manufacturer, brand, R-value, etc. of the insulation installed in the roof/ceiling, walls, floor, and slab edge are documented. The installer also verifies compliance with the applicable mandatory measures (i.e. infiltration and exfiltration) for the building envelope.

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NOTES

ATTIC AND CRAWLSPACE VENTILATION

Lead Paint Risk Factor
NONE

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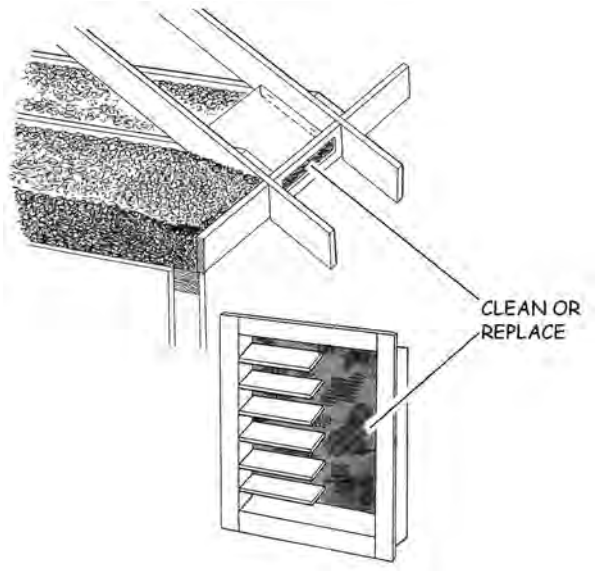
Section 21

ATTIC AND CRAWLSPACE VENTILATION

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

ATTIC/CRAWLSPACE VENTILATION REPAIR



1. EXISTING MESH

- **All Screened Vents**
  - Existing mesh shall be cleaned or replaced if opening is clogged.
  - Torn and defective mesh shall be replaced.
  - Removal of 1/16" insect screen and replacement with 1/8" to 1/4" is allowed, if additional Net Free Venting Area (NFVA) is required.

2. PRE-INSTALLATION REQUIREMENTS

- **All Jobs**
  - When additional NFVA is required, additional vents shall be installed before any insulation will be installed.
  - All exhaust systems that terminate in the attic or crawlspace shall be vented outdoors before any ventilation or insulation will be installed.

GENERAL VENTILATION INSTALLATION

3. VENT COMPOSITION

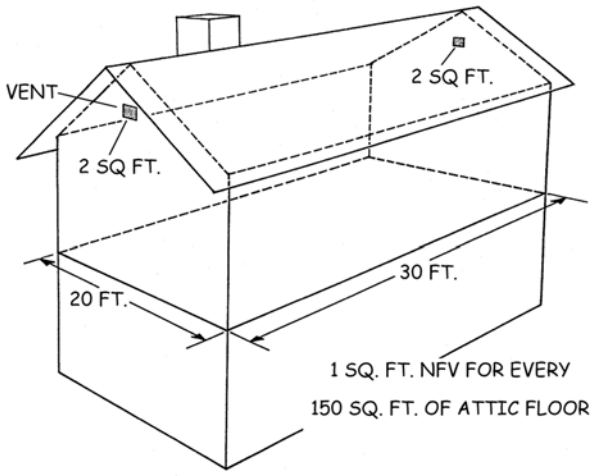
- **Compliant vents shall be constructed with the following characteristics:**

VENTILATION COMPONENT	GENERAL REQUIREMENTS
BY VENT TYPE	**Vents shall be made of materials in accordance with CSD WIS Appendix A (Material Specifications).**
MESH	• Required on all vents *except* turbines. • Shall be made of corrosion-resistant metal only; non-metallic not allowed. • Weave on new attic or crawlspace vents shall be 1/8" to 1/4". • Replacement mesh with 1/4" weave shall be installed when: o Existing mesh has tears or gaps greater than 1". o The mesh is missing. o Additional NFVA is needed and existing mesh is too restrictive.
VAPOR BARRIER	• Vapor barriers shall be installed when required by Title 24 in conjunction with the installation of insulation. • A vapor retarder shall not be installed when ventilation is applied as a stand-alone measure. • Installation requirements are described in CSD WIS Section 20A (Ceiling Insulation) and 22A (Floor Insulation).

ATTIC VENTILATION INSTALLATION

4. AMOUNT OF ATTIC VENTING

- **Ventilation Requirement**
  - Attic venting shall conform to local building code requirements, or at a minimum, the requirements of Title 24.
  - Ventilation shall be installed in conjunction with insulation, or as a stand-alone measure, when Net Free Venting Area (NFVA) is insufficient.
  - Minimum venting NFVA shall comply with the criteria described below.



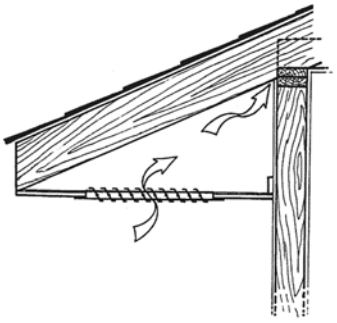
- **Venting Criteria**
  - 1 sq. ft. of Net Free Venting Area (NFVA) required per 150 sq. ft. of ceiling area with cross-ventilation (as defined in "Vent Placement" below).
  - 1 sq. ft. of Net Free Venting Area (NFVA) required per 300 sq. ft. of ceiling area is allowed when one or more of the following exceptions is applied with cross-ventilation.
    - *Exception 1*: 40-50% of venting is upper venting, with upper vents located within 3' of the ridge or highest point of the space. The balance of venting shall be lower venting (e.g., eave, soffit, or cornice venting).
    - *Exception 2*: In Climate Zones 14 and 16, when a Class I or II vapor retarder is installed toward the winter warm side.

5. ATTIC VENT PLACEMENT

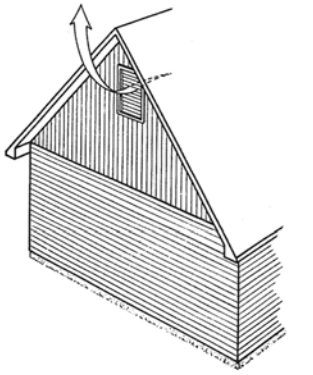
- **Vent Openings**
  - Vent openings shall (a) provide cross-ventilation, and (b) be covered with corrosion-resistant wire mesh with 1/16" to 1/4" weave.
  - The required NFVA shall be approximately evenly distributed along the lengths of at least two opposite sides (known as cross-ventilation).
    - Cross-ventilation does not require that both vents be upper vents, or that both be lower vents.

6. ATTIC VENTING PRECAUTIONS

- **Vents Adjacent to Insulation**
  - Insulation shall not obstruct or hamper proper operation of vents in accordance with the guidelines below.
- **Loose Fill Insulation**
  - Blocking of vents shall be installed as prescribed in CSD WIS Sections 20A (Ceiling Insulation) and 22A (Floor Insulation) for all vent types.



SOFFIT VENT
ABOVE SOLID WALL

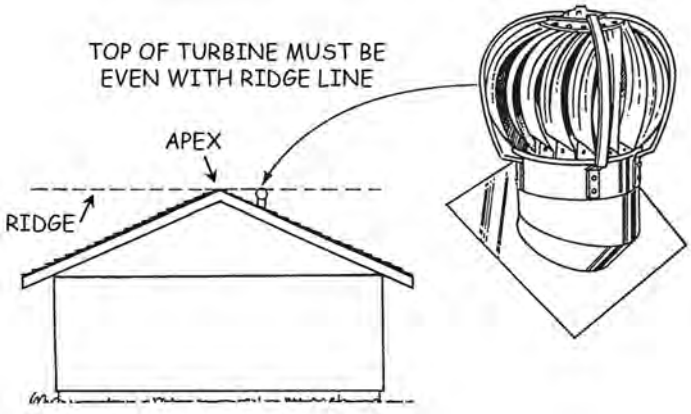


HIGH GABLE VENT
IN UPPER 1/3 OF GABLE WALL

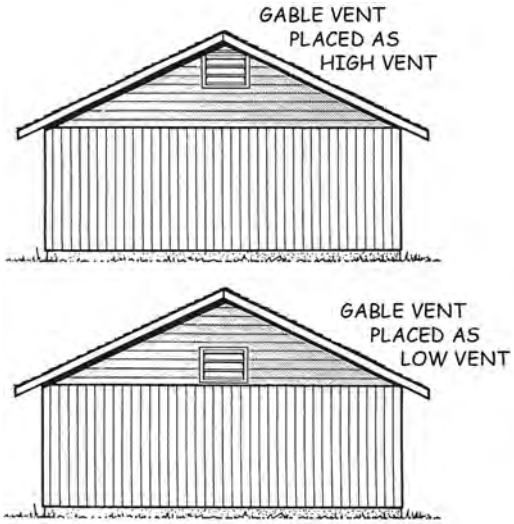
- **Flexible Insulation**
  - A 2-1/2" clearance (air path) required between insulation and the:
    - Roof sheathing.
    - Vent opening.

7. PLACEMENT AND INSTALLATION

- **All Vents**
  - Placement and installation shall be in conformance with manufacturer's instructions and applicable codes.
  - Placement of attic vents will be considered for proper air flow and prevention of entry of wind driven rain or snow.
- **Eave and Soffit Vents**
  - *Unless* replacing an existing vent, eave and soffit vents shall not be installed above an operable window when prohibited by local jurisdiction.
- **Gable Vents**
  - Shall be installed in the upper 1/3 of the gable wall when used as high vents.
  - Shall be installed in the lower 1/3 of an unvented gable wall to provide low venting.
  - It is acceptable to install a wood gable vent in an attic location only.
- **Turbine Ventilators**
  - Shall be installed between rafters.
  - Top of turbine shall not be below roof apex.
  - At least 2/3 of the upper base flange shall be secured underneath roofing material.
  - Turbine ventilators shall not be installed:
    - As low vents.
    - On roofs with a slope of *less* than 2-in-12.



- **Roof Jacks (Static Vents with Flanged Base)**
  - Type includes dormer, eyebrow, mushroom, and hood vents.
  - Shall be installed between rafters.
  - At least 2/3 of the upper base flange shall be secured underneath roofing material.
  - Shall not be installed on roofs with a slope of *less* than 2-in-12.
  - Not allowed for low vents when eave or soffit vents are feasible to be installed.



8. HIGH VENTS

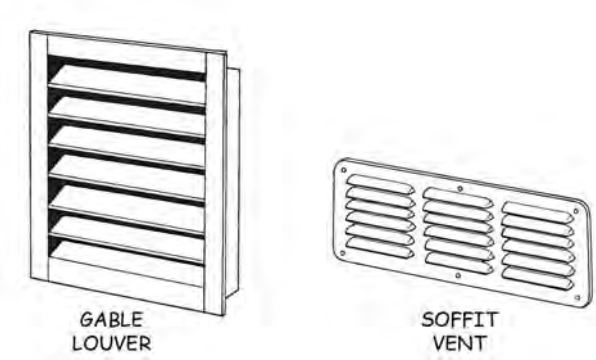
- **The following may be used as high vents:**
  - Gable vents.
  - Roof jacks (e.g., eyebrow, dormer, mushroom and hood).
  - Wind turbines.
  - Ridge vents.

9. LOW VENTS

- **Eave and soffit vents shall be used when possible.**
- **When eave or soffit vents cannot be installed:**
  - Eyebrow or dormer vents may be mounted low on the roof.
  - Gable vents may be mounted low on an unvented gable wall.

10. LOUVERS

- **Louvers shall be present on vents exposed to precipitation.**
- **Vertical Vents**
  - Louvers shall be angled downward.
- **Horizontal Vents**
  - Louvers shall be directed toward the wall.



11. VENT BAFFLING

- **Baffling for attic soffit vents will be installed to:**
  - Ensure proper air flow
  - Prevent wind washing of insulation
  - Allow maximum insulation coverage
- **Ensure baffle terminates above insulation**

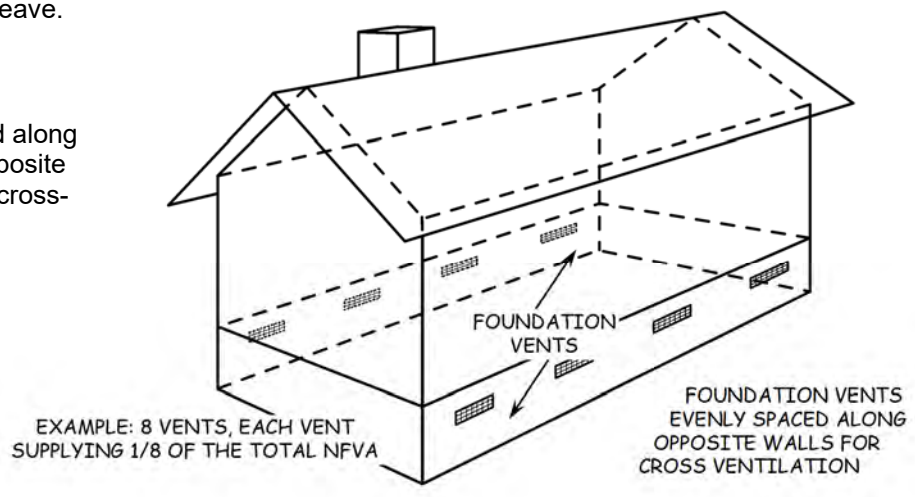
CRAWLSPACE VENTILATION INSTALLATION

12. AMOUNT OF CRAWLSPACE VENTILATION

- **Crawlspace**
  - Crawlspace shall be vented by means of openings in the foundation walls.
  - Ventilation shall be installed in conjunction with insulation, or as a stand-alone measure, when Net Free Venting Area (NFVA) is insufficient.
- **Total NFVA of the openings shall equal at least:**
  - 1 sq. ft. for each 150 sq. ft. of under-floor area (i.e., 1/150 ratio) with cross-ventilation.
  - 1 sq. ft. for each 1500 sq. ft. of under-floor area (i.e., 1/1500 ratio) with cross-ventilation. This alternate approach applies when:
    - *V*ents are installed within 3' of each corner.
    - The under-floor ground surface area is covered by an approved Class I vapor retarder; and vent openings provide cross-ventilation.

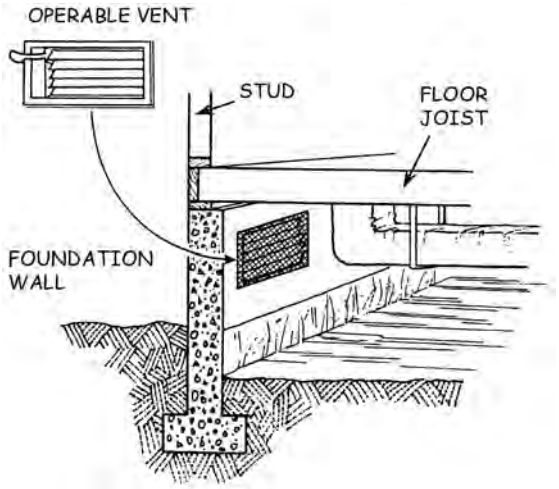
13. VENT PLACEMENT

- **Vent Openings**
  - Vent openings shall provide cross-ventilation, and be covered with corrosion-resistant wire mesh with 1/4" weave.
  - The required NFVA shall be approximately evenly distributed along the lengths of opposite sides (known as cross-ventilation).



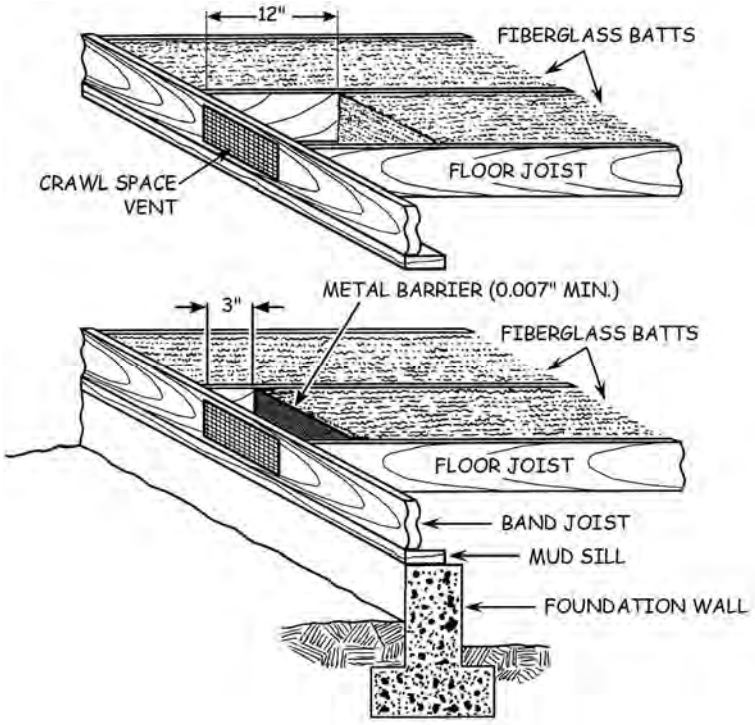
14. VENT COMPOSITION

- **Venting Requirements**
  - Crawlspace venting shall conform to local building code requirements, or at a minimum, the requirements of Title 24.
  - Minimum venting Net Free Venting Area (NFVA) shall comply with criteria described above.
  - Cross ventilation for each separate space is required.
- **Existing Vents**
  - All mesh weave sizes shall be acceptable (1/8" to 1/4" are best).
  - NFVA of vents with 1/16" mesh (insect screen) shall be calculated as no *more* than 50% of the gross opening area.
- **Installed Vents**
  - Installed in compliance with Title 24 requirements above.
  - Installation of operable vents for cold climates is preferred.



15. CLEARANCE FROM VENTS

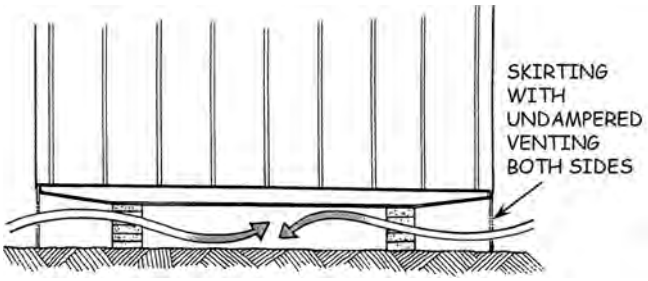
- **Foundation vents shall <u>not</u> be obstructed by insulation.**
- **Setback:**
  - 12" clearance without barrier.
  - 3" clearance with barrier made of minimum 0.007" sheet metal.
  - Minimum 3" clearance required between insulation and heat producing devices.



PART 2: MOBILE HOME CRITERIA

16. MOBILE HOME CRAWLSPACE VENTILATION

- **Skirted Mobile Home**
  - Crawlspace must be present before installing insulation.
  - Openings in the skirting shall provide 1 sq. ft. of venting for each 150 sq. ft. of enclosed area.
  - Venting ratio may be reduced to 1/300 when ground is covered with an approved ground cover in conformance with CSD WIS Section 22B (Floor/Undercarriage Insulation for Mobile Homes).
  - Installed vents shall be:
    - Non-operable *unless* ground cover is present.
    - Located within 3-feet of the building corners, as practical, and provide cross-ventilation from existing vents.
    - Distributed evenly along the length of at least two opposite sides.
    - Covered with 1/4" corrosion-resistant mesh.



PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

17. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

Not applicable to this measure.

PART 5: NET FREE VENTING AREA (NFVA) CHARTS

18. QUICK REFERENCE

1. The three charts below provide a quick reference for determining the amount of Net Free Venting Area (NFVA) required for an attic or crawlspace (or rectangular attic/crawlspace section).
2. Determine which ratio applies in accordance with the requirements in Item 4 (for attics) or Item 12 (for crawlspaces).
   a. Table 1 (1 to 150 ratio) applies when 1 sq. ft. NFVA is required per 150 sq. ft. of area; and
   b. Table 2 (1 to 300 ratio); applies when 1 sq. ft. NFVA is required per 300 sq. ft. of area; and
   c. Table 3 (1 to 1500 ratio); applies when 1 sq. ft. NFVA is required per 1500 sq. ft. of area.
      - In the applicable table, find the length of the attic/crawlspace (or section) in the left column.
      - Move across that row to the column representing the width (in the top row).
      - At the intersection of the length row and width column, the number in the table is the sq. ft. of NFVA required for an attic/crawlspace (or section) of that size.
      - If the house is not a simple rectangle, determine the NFVA required for each rectangular section, and add the amounts together to calculate total NFVA.
3. Example: For 1 sq. ft. NFVA per 150 sq. ft. of attic floor (1 to 150 ratio), use Table 1.
   a. For an attic 40' long and 30' wide, 8.0 sq. ft. NFVA is needed.
   b. For an L-shaped house with a 20' x 20' section and another 20' x 30' section, the NFVA amounts are 2.7 + 4.0 = 6.7 sq. ft. total NFVA.
   c. For dimensions not shown in the table, calculate the attic area, and divide that square footage by 150. ► For a 31' by 41' attic, the area is: 31' x 41' = 1271 sq. ft. 1271 ÷ 150 = 8.47, rounded up = 8.5 sq. ft. NFVA.

19. Table 1—NFVA (sq. ft.) for 1 to 150 Ratio

		Area Width															
		10'	**12'**	**14'**	**16'**	**18'**	**20'**	**22'**	**24'**	**26'**	**28'**	**30'**	**32'**	**34'**	**36'**	**38'**	**40'**
Area Length	**10'**	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.5	2.7
	12'	0.8	1.0	1.1	1.3	1.4	1.6	1.8	1.9	2.1	2.2	2.4	2.6	2.7	2.9	3.0	3.2
	14'	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.5	3.7
	16'	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.1	4.3
	18'	1.2	1.4	1.7	1.9	2.2	2.4	2.6	2.9	3.1	3.4	3.6	3.8	4.1	4.3	4.6	4.8
	20'	1.3	1.6	1.9	2.1	2.4	2.7	2.9	3.2	3.5	3.7	4.0	4.3	4.5	4.8	5.1	5.3
	22'	1.5	1.8	2.1	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.6	5.9
	24'	1.6	1.9	2.2	2.6	2.9	3.2	3.5	3.8	4.2	4.5	4.8	5.1	5.4	5.8	6.1	6.4
	26'	1.7	2.1	2.4	2.8	3.1	3.5	3.8	4.2	4.5	4.9	5.2	5.5	5.9	6.2	6.6	6.9
	28'	1.9	2.2	2.6	3.0	3.4	3.7	4.1	4.5	4.9	5.2	5.6	6.0	6.3	6.7	7.1	7.5
	30'	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.8	7.2	7.6	8.0
	32'	2.1	2.6	3.0	3.4	3.8	4.3	4.7	5.1	5.5	6.0	6.4	6.8	7.3	7.7	8.1	8.5
	34'	2.3	2.7	3.2	3.6	4.1	4.5	5.0	5.4	5.9	6.3	6.8	7.3	7.7	8.2	8.6	9.1
	36'	2.4	2.9	3.4	3.8	4.3	4.8	5.3	5.8	6.2	6.7	7.2	7.7	8.2	8.6	9.1	9.6
	38'	2.5	3.0	3.5	4.1	4.6	5.1	5.6	6.1	6.6	7.1	7.6	8.1	8.6	9.1	9.6	10.1
	40'	2.7	3.2	3.7	4.3	4.8	5.3	5.9	6.4	6.9	7.5	8.0	8.5	9.1	9.6	10.1	10.7

20. Table 2—NFVA (sq. ft.) for 1 to 300 Ratio

		Area Width															
		10'	12'	14'	16'	18'	20'	22'	24'	26'	28'	30'	32'	34'	36'	38'	40'
Area Length	10'	0.3	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.1	1.1	1.2	1.3	1.3
	12'	0.4	0.5	0.6	0.6	0.7	0.8	0.9	1.0	1.0	1.1	1.2	1.3	1.4	1.4	1.5	1.6
	14'	0.5	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9
	16'	0.5	0.6	0.7	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	1.9	2.0	2.1
	18'	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.4	1.6	1.7	1.8	1.9	2.0	2.2	2.3	2.4
	20'	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	2.5	2.7
	22'	0.7	0.9	1.0	1.2	1.3	1.5	1.6	1.8	1.9	2.1	2.2	2.3	2.5	2.6	2.8	2.9
	24'	0.8	1.0	1.1	1.3	1.4	1.6	1.8	1.9	2.1	2.2	2.4	2.6	2.7	2.9	3.0	3.2
	26'	0.9	1.0	1.2	1.4	1.6	1.7	1.9	2.1	2.3	2.4	2.6	2.8	2.9	3.1	3.3	3.5
	28'	0.9	1.1	1.3	1.5	1.7	1.9	2.1	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.5	3.7
	30'	1.0	1.2	1.4	1.6	1.8	2.0	2.2	2.4	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.0
	32'	1.1	1.3	1.5	1.7	1.9	2.1	2.3	2.6	2.8	3.0	3.2	3.4	3.6	3.8	4.1	4.3
	34'	1.1	1.4	1.6	1.8	2.0	2.3	2.5	2.7	2.9	3.2	3.4	3.6	3.9	4.1	4.3	4.5
	36'	1.2	1.4	1.7	1.9	2.2	2.4	2.6	2.9	3.1	3.4	3.6	3.8	4.1	4.3	4.6	4.8
	38'	1.3	1.5	1.8	2.0	2.3	2.5	2.8	3.0	3.3	3.5	3.8	4.1	4.3	4.6	4.8	5.1
	40'	1.3	1.6	1.9	2.1	2.4	2.7	2.9	3.2	3.5	3.7	4.0	4.3	4.5	4.8	5.1	5.3

21. Table 3—NFVA (sq. ft.) for 1 to 1500 Ratio

		Area Width															
		10'	12'	14'	16'	18'	20'	22'	24'	26'	28'	30'	32'	34'	36'	38'	40'
Area Length	10'	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3
	12'	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
	14'	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4
	16'	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4
	18'	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5
	20'	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.5
	22'	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6
	24'	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6
	26'	0.2	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	0.7	0.7
	28'	0.2	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.7
	30'	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8
	32'	0.2	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9
	34'	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.9
	36'	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0
	38'	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	0.9	1.0	1.0
	40'	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.9	0.9	1.0	1.0	1.1

22. SCREEN AND LOUVER REDUCTION FACTORS

1. The following table contains the "reduction factors" upon which the vent NFVA tables in this section are based.
2. In situations when the vent being evaluated does not "fit" an NFVA table, use the following table to calculate NFVA.
3. Example: An eave vent has ¼-inch screen (no louvers), with a vent opening (excluding the frame) that is 2.5″ x 17″. 2.5 x 17 = 42.5
   - The screened opening is 42.5 sq. in. The reduction factor from the following table is 0.90.
   - 42.5 x 0.90 = 38.25 sq. in.= NFVA. Divide square *inches* by 144 to calculate square *feet*.
   - 38.25 ÷ 144 = 0.27 sq. ft. NFVA

SCREEN AND LOUVER REDUCTION FACTORS

1/4" Screen, No Louvers	1/8" Screen, No Louvers	Metal Louvers, or Metal Louvers and 1/4" or 1/8" Screen	Wood Louvers, or Wood Louvers and 1/4" or 1/8" Screen
0.90 (90%)	0.75 (75%)	0.75 (75%)	.25 (25%)

Note: 1/16" screen must be replaced on vents included in NFVA calculations

23. VENT TABLE INSTRUCTIONS

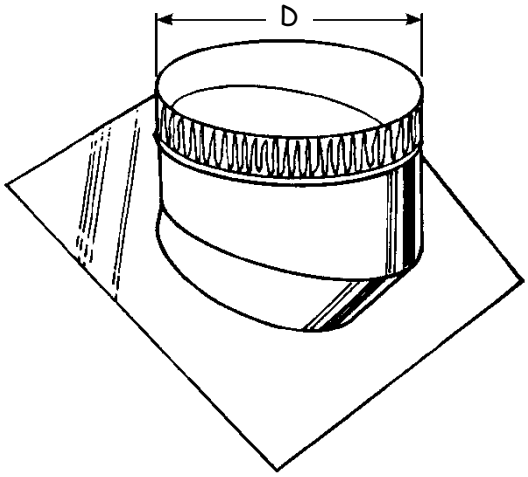
1. Using the Tables
   a. The tables on the following pages can be used to determine the Net Free Venting Area (NFVA) provided by a particular type and size of vent. The NFVA for that vent is given in **square feet**.
   b. When vent measurements are between the sizes listed, calculate manually.
2. Sample NFVA Table

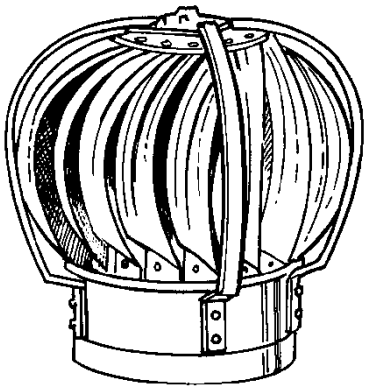
RECTANGULAR GABLE VENTS—1/4" or 1/8" SCREEN with METAL LOUVERS
(Reduction Factor = 0.75)

HEIGHT (Inches)	WIDTH (Inches) 12	14	16	18	20	22	24	26	28	30	32	34	36
12	0.75	0.88	1.00	1.13	1.25	1.38	1.50	1.63	1.75	1.88	2.00	2.13	2.25
14	0.88	1.02	1.17	1.31	1.46	1.60	1.75	1.90	2.04	2.19	2.33	2.48	2.63
16	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.17	2.33	2.50	2.67	2.83	3.00
18	1.13	1.31	1.50	1.69	1.88	2.06	2.25	2.44	2.63	2.81	3.00	3.19	3.38
20	1.25	1.46	1.67	1.88	2.08	2.29	2.50	2.71	2.92	3.13	3.33	3.54	3.75
22	1.38	1.60	1.83	2.06	2.29	2.52	2.75	2.98	3.21	3.44	3.67	3.90	4.13
24	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.25	3.50	3.75	4.00	4.25	4.50

3. Examples
   a. **Example 1:** If 16" *high* by 14" *wide* gable vents are to be installed, first find the 16" *height* in the left column. Move across that row to the column representing the 14" *width* (shown in the top row). At the intersection of the 16" height row and 14" width column, you find "**1.17**".
   ►The "1.17" means 1.17 sq. ft. of NFVA is provided by **1** vent.
   b. **Example 2:** If 18" *high* by 14" *wide* gable vents are to be installed, first find the 18" *height* in the left column. Move across that row to the column representing the 14" *width*. At the intersection of the 18" height row and 14" width column, you find "**1.31**".
   ►The "1.31" means 1.31 sq. ft. of NFVA is provided by **1** vent.

24. TURBINE VENTILATORS





TURBINE VENTILATORS

# of 12" Turbines	1		2		3		4		5	
# of 14" Turbines		1		2		3		4		5
Sq. Ft. of NFVA Provided	0.79	1.10	1.60	2.20	2.40	3.30	3.20	4.40	4.00	5.50

Several styles of turbine ventilators exist, each with different NFVA specifications. Use the actual product manufacturer's NFVA specifications when available. Use the above table only when the manufacturer's NFVA specifications are not available.

25. ROUND VENT HOLES

Bird Holes

BIRD HOLES—1/4" SCREEN, NO LOUVERS
(Reduction Factor = 0.90)

	DIAMETER (INCHES)						
	1.5	1.75	2	2.25	2.5	2.75	3
Sq. Ft. of NFVA Provided by 1 Vent	0.0110	0.0150	0.0196	0.0248	0.0307	0.0371	0.0442
# of Vents Needed for 1 Sq. Ft. NFVA	91	67	51	40	33	27	23

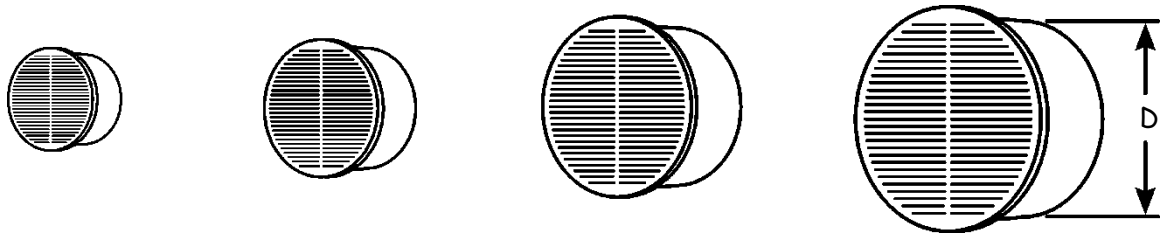
NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents).

BIRD HOLES—1/8" SCREEN, NO LOUVERS
(Reduction Factor = 0.75)

	DIAMETER (INCHES)						
	1.5	1.75	2	2.25	2.5	2.75	3
Sq. Ft. of NFVA Provided by 1 Vent	0.0092	0.0125	0.0164	0.0207	0.0256	0.0309	0.0368
# of Vents Needed for 1 Sq. Ft. NFVA	109	80	61	48	39	32	27

NFVA calculations are for vents screened with 1/8" (#8) weave mesh (found on some existing vents).

Mini-Circular Vents

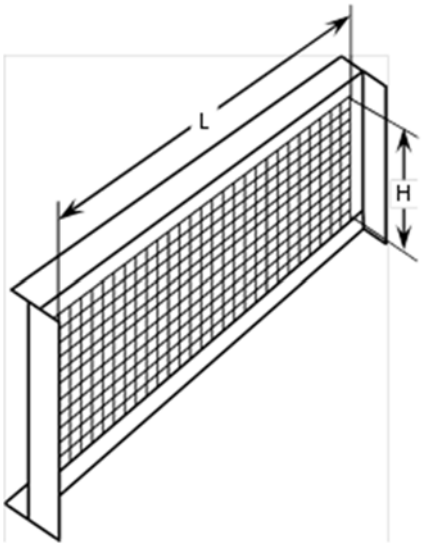


MINI-CIRCULAR VENTS

	DIAMETER (INCHES)								
	1	1.5	2	2.5	3	4	5	6	8
Sq. Ft. of NFVA Provided by 1 Vent	.0019	.0043	.0076	.0119	.0172	.0305	.0477	.0687	.1222
# of Vents Needed for 1 Sq. Ft. NFVA	524	233	131	84	58	33	21	15	8

Many styles of mini-circular vents exist, each with different NFVA specifications. Use the actual product manufacturer's NFVA specifications when available. Use the above table only when the manufacturer's NFVA specifications are not available.

26. EAVE VENTS—1/4" AND 1/8" SCREEN, NO LOUVERS



EAVE VENTS—1/4" SCREEN, NO LOUVERS
(Reduction Factor = 0.90)

		LENGTH (Inches)								
		10	12	13	14	14.5	16	18	21	22.5
HEIGHT (Inches)	3	0.19	0.23	0.24	0.26	0.27	0.30	0.34	0.39	0.42
	3.5	0.22	0.26	0.28	0.31	0.32	0.35	0.39	0.46	0.49
	4	0.25	0.30	0.33	0.35	0.36	0.40	0.45	0.53	0.56
	4.5	0.28	0.34	0.37	0.39	0.41	0.45	0.51	0.59	0.63
	5	0.31	0.38	0.41	0.44	0.45	0.50	0.56	0.66	0.70
	5.5	0.34	0.41	0.45	0.48	0.50	0.55	0.62	0.72	0.77

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents).

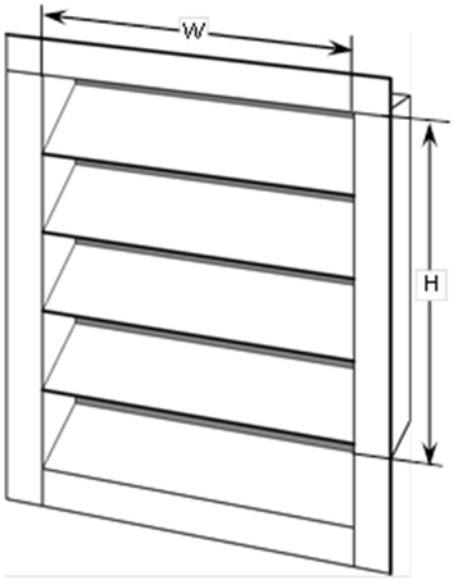
EAVE VENTS—1/8" SCREEN, NO LOUVERS
(Reduction Factor = 0.75)

		LENGTH (Inches)								
		10	12	13	14	14.5	16	18	21	22.5
HEIGHT (Inches)	3	0.16	0.19	0.20	0.22	0.23	0.25	0.28	0.33	0.35
	3.5	0.18	0.22	0.24	0.26	0.26	0.29	0.33	0.38	0.41
	4	0.21	0.25	0.27	0.29	0.30	0.33	0.38	0.44	0.47
	4.5	0.23	0.28	0.30	0.33	0.34	0.38	0.42	0.49	0.53
	5	0.26	0.31	0.34	0.36	0.38	0.42	0.47	0.55	0.59
	5.5	0.29	0.34	0.37	0.40	0.42	0.46	0.52	0.60	0.64

NFVA calculations are for vents screened with 1/8" (#8) weave mesh (found on some existing vents).

- Screens must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be *replaced* on vents included in NFVA calculations.

27. RECTANGULAR GABLE VENTS—1/4" OR 1/8" SCREEN WITH METAL LOUVERS



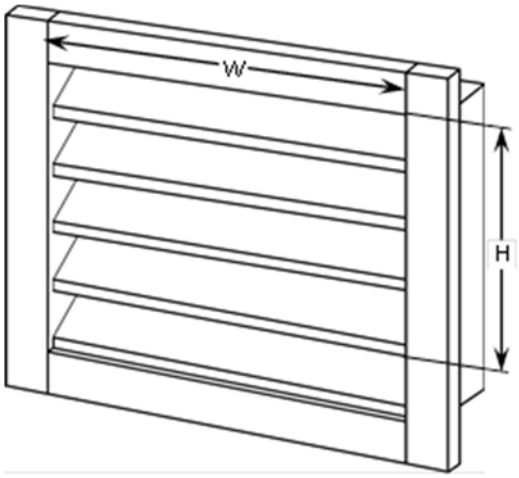
RECTANGULAR GABLE VENTS—1/4" or 1/8" SCREEN with METAL LOUVERS
(Reduction Factor = 0.75)

		WIDTH (Inches)									
		11	12	14	16	18	20	22	24	30	36
HEIGHT (Inches)	8	0.46	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.25	1.50
	10	0.57	0.63	0.73	0.83	0.94	1.04	1.15	1.25	1.56	1.88
	12	0.69	0.75	0.88	1.00	1.13	1.25	1.38	1.50	1.88	2.25
	14	0.80	0.88	1.02	1.17	1.31	1.46	1.60	1.75	2.19	2.63
	16	0.92	1.00	1.17	1.33	1.50	1.67	1.83	2.00	2.50	3.00
	18	1.03	1.13	1.31	1.50	1.69	1.88	2.06	2.25	2.81	3.38
	20	1.15	1.25	1.46	1.67	1.88	2.08	2.29	2.50	3.13	3.75
	22	1.26	1.38	1.60	1.83	2.06	2.29	2.52	2.75	3.44	4.13
	24	1.38	1.50	1.75	2.00	2.25	2.50	2.75	3.00	3.75	4.50
	26	1.49	1.63	1.90	2.17	2.44	2.71	2.98	3.25	4.06	4.88
	28	1.60	1.75	2.04	2.33	2.63	2.92	3.21	3.50	4.38	5.25
	30	1.72	1.88	2.19	2.50	2.81	3.13	3.44	3.75	4.69	5.63
	32	1.83	2.00	2.33	2.67	3.00	3.33	3.67	4.00	5.00	6.00
	34	1.95	2.13	2.48	2.83	3.19	3.54	3.90	4.25	5.31	6.38
	36	2.06	2.25	2.63	3.00	3.38	3.75	4.13	4.50	5.63	6.75

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents) or 1/8" (#8) weave mesh (found on some existing vents).

- Screens must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be replaced on vents included in NFVA calculations.

28. RECTANGULAR GABLE VENTS—1/4" OR 1/8" SCREEN WITH WOOD LOUVERS



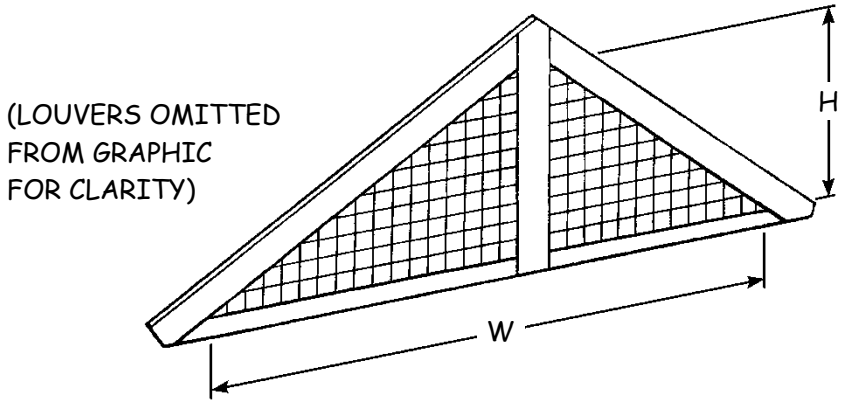
RECTANGULAR GABLE VENTS—1/4" or 1/8" SCREEN with WOOD LOUVERS
(Reduction Factor = 0.25)

HEIGHT (Inches)	WIDTH (Inches)								
	12	14	16	18	20	22	24	30	36
8	0.17	0.19	0.22	0.25	0.28	0.31	0.33	0.42	0.50
10	0.21	0.24	0.28	0.31	0.35	0.38	0.42	0.52	0.63
12	0.25	0.29	0.33	0.38	0.42	0.46	0.50	0.63	0.75
14	0.29	0.34	0.39	0.44	0.49	0.53	0.58	0.73	0.88
16	0.33	0.39	0.44	0.50	0.56	0.61	0.67	0.83	1.00
18	0.38	0.44	0.50	0.56	0.63	0.69	0.75	0.94	1.13
20	0.42	0.49	0.56	0.63	0.69	0.76	0.83	1.04	1.25
22	0.46	0.53	0.61	0.69	0.76	0.84	0.92	1.15	1.38
24	0.50	0.58	0.67	0.75	0.83	0.92	1.00	1.25	1.50
26	0.54	0.63	0.72	0.81	0.90	0.99	1.08	1.35	1.63
28	0.58	0.68	0.78	0.88	0.97	1.07	1.17	1.46	1.75
30	0.63	0.73	0.83	0.94	1.04	1.15	1.25	1.56	1.88
32	0.67	0.78	0.89	1.00	1.11	1.22	1.33	1.67	2.00
34	0.71	0.83	0.94	1.06	1.18	1.30	1.42	1.77	2.13
36	0.75	0.88	1.00	1.13	1.25	1.38	1.50	1.88	2.25

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents) or 1/8" (#8) weave mesh (found on some existing vents).

- Screens must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be replaced on vents included in NFVA calculations.

29. TRIANGULAR GABLE VENTS—1/4" OR 1/8" SCREEN WITH METAL LOUVERS



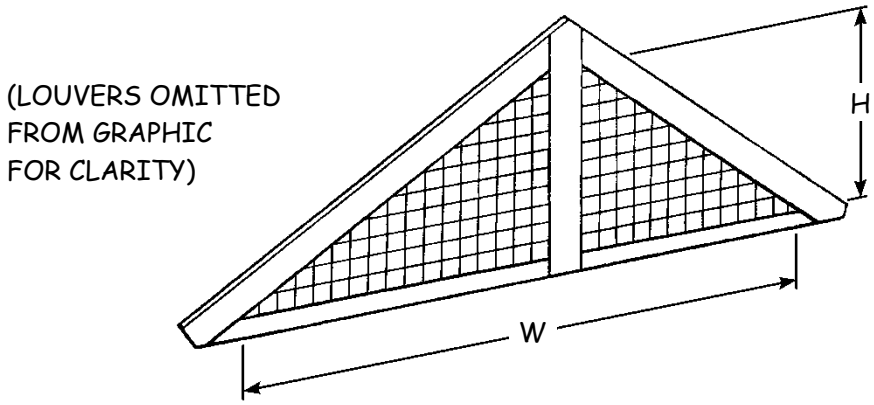
TRIANGULAR GABLE VENTS—1/4" or 1/8" SCREEN with METAL LOUVERS
(Reduction Factor = 0.75)

		WIDTH (Inches)							
		24	30	36	42	48	54	60	72
HEIGHT (Inches)	10	0.63	0.78	0.94	1.09	1.25	1.41	1.56	1.88
	12	0.75	0.94	1.13	1.31	1.50	1.69	1.88	2.25
	14	0.88	1.09	1.31	1.53	1.75	1.97	2.19	2.63
	16	1.00	1.25	1.50	1.75	2.00	2.25	2.50	3.00
	18	1.13	1.41	1.69	1.97	2.25	2.53	2.81	3.38
	20	1.25	1.56	1.88	2.19	2.50	2.81	3.13	3.75
	22	1.38	1.72	2.06	2.41	2.75	3.09	3.44	4.13
	24	1.50	1.88	2.25	2.63	3.00	3.38	3.75	4.50
	26	1.63	2.03	2.44	2.84	3.25	3.66	4.06	4.88
	28	1.75	2.19	2.63	3.06	3.50	3.94	4.38	5.25
	30	1.88	2.34	2.81	3.28	3.75	4.22	4.69	5.63
	32	2.00	2.50	3.00	3.50	4.00	4.50	5.00	6.00
	34	2.13	2.66	3.19	3.72	4.25	4.78	5.31	6.38
	36	2.25	2.81	3.38	3.94	4.50	5.06	5.63	6.75

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents) or 1/8" (#8) weave mesh (found on some existing vents).

- Screens must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be replaced on vents included in NFVA calculations.

30. TRIANGULAR GABLE VENTS—1/4" OR 1/8" SCREEN WITH WOOD LOUVERS



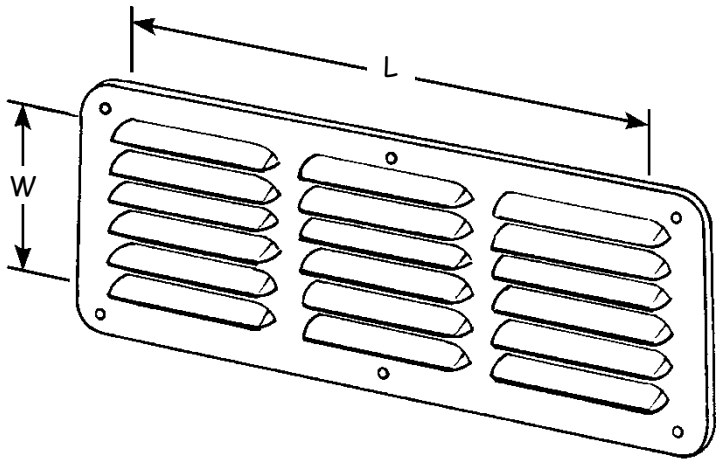
TRIANGULAR GABLE VENTS—1/4" or 1/8" SCREEN with WOOD LOUVERS
(Reduction Factor = 0.25)

		WIDTH (Inches)							
		24	30	36	42	48	54	60	72
HEIGHT (Inches)	10	0.21	0.26	0.31	0.36	0.42	0.47	0.52	0.63
	12	0.25	0.31	0.38	0.44	0.50	0.56	0.63	0.75
	14	0.29	0.36	0.44	0.51	0.58	0.66	0.73	0.88
	16	0.33	0.42	0.50	0.58	0.67	0.75	0.83	1.00
	18	0.38	0.47	0.56	0.66	0.75	0.84	0.94	1.13
	20	0.42	0.52	0.63	0.73	0.83	0.94	1.04	1.25
	22	0.46	0.57	0.69	0.80	0.92	1.03	1.15	1.38
	24	0.50	0.63	0.75	0.88	1.00	1.13	1.25	1.50
	26	0.54	0.68	0.81	0.95	1.08	1.22	1.35	1.63
	28	0.58	0.73	0.88	1.02	1.17	1.31	1.46	1.75
	30	0.63	0.78	0.94	1.09	1.25	1.41	1.56	1.88
	32	0.67	0.83	1.00	1.17	1.33	1.50	1.67	2.00
	34	0.71	0.89	1.06	1.24	1.42	1.59	1.77	2.13
	36	0.75	0.94	1.13	1.31	1.50	1.69	1.88	2.25

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents) or 1/8" (#8) weave mesh (found on some existing vents).

- Screens must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be replaced on vents included in NFVA calculations.

31. SOFFIT VENTS—1/4" OR 1/8" SCREEN WITH METAL LOUVERS



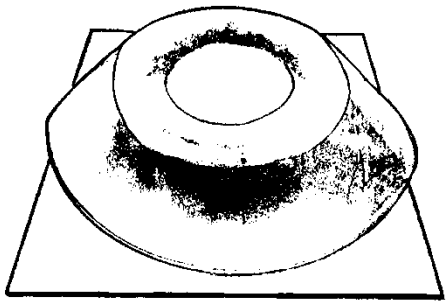
SOFFIT VENTS—1/4" OR 1/8" SCREEN with METAL LOUVERS
(Reduction Factor = 0.75)

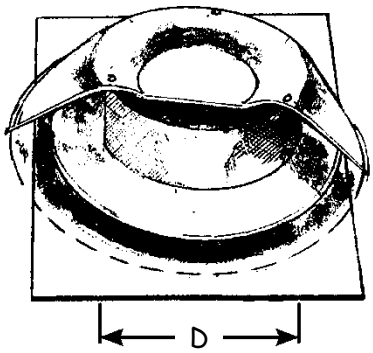
		LENGTH (Inches)								
		10	12	14	15	16	18	20	22	24
HEIGHT (Inches)	2	0.10	0.13	0.15	0.16	0.17	0.19	0.21	0.23	0.25
	3	0.16	0.19	0.22	0.23	0.25	0.28	0.31	0.34	0.38
	3.5	0.18	0.22	0.26	0.27	0.29	0.33	0.36	0.40	0.44
	4	0.21	0.25	0.29	0.31	0.33	0.38	0.42	0.46	0.50
	4.5	0.23	0.28	0.33	0.35	0.38	0.42	0.47	0.52	0.56
	5	0.26	0.31	0.36	0.39	0.42	0.47	0.52	0.57	0.63
	6	0.31	0.38	0.44	0.47	0.50	0.56	0.63	0.69	0.75
	8	0.42	0.50	0.58	0.63	0.67	0.75	0.83	0.92	1.00
	10	0.52	0.63	0.73	0.78	0.83	0.94	1.04	1.15	1.25

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents) or 1/8" (#8) weave mesh (found on some existing vents).

- Screens must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be replaced on vents included in NFVA calculations.

32. MUSHROOM VENTS—1/4" AND 1/8" SCREEN





(Reduction Factor = 0.90)

	DIAMETER (Inches)									
	6	7	8	9	10	11	12	13	14	15
Sq. Ft. NFVA	0.18	0.24	0.31	0.40	0.49	0.59	0.71	0.83	0.96	1.10

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents).

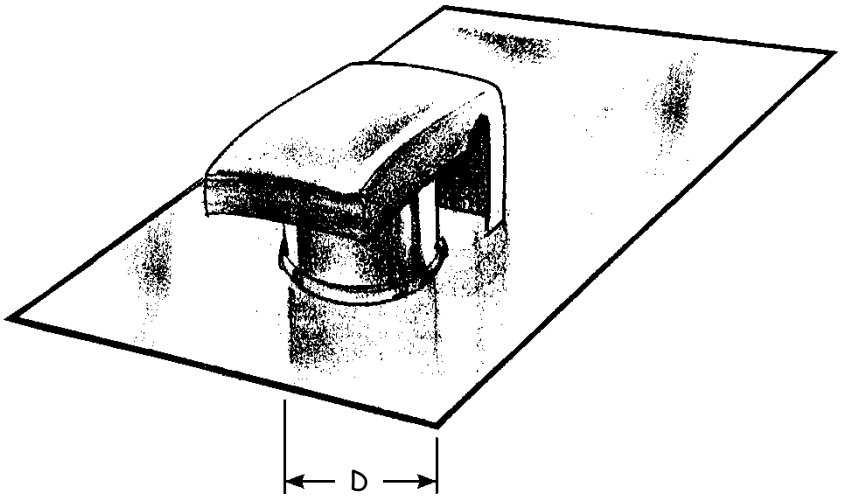
MUSHROOM VENTS—1/8" SCREEN
(Reduction Factor = 0.75)

	DIAMETER (Inches)									
	6	7	8	9	10	11	12	13	14	15
Sq. Ft. NFVA	0.15	0.20	0.26	0.33	0.41	0.49	0.59	0.69	0.80	0.92

NFVA calculations are for vents screened with 1/8" (#8) weave mesh (found on some existing vents).

- Screens must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be replaced on vents included in NFVA calculations.

33. HOOD VENTS & ROOF JACKS—1/4" AND 1/8" SCREEN



HOOD VENTS & ROOF JACKS—1/4" SCREEN
(Reduction Factor =0.90)

	DIAMETER (Inches)									
	6	7	8	9	10	11	12	13	14	15
Sq. Ft. NFVA	0.18	0.24	0.31	0.40	0.49	0.59	0.71	0.83	0.96	1.10

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents).

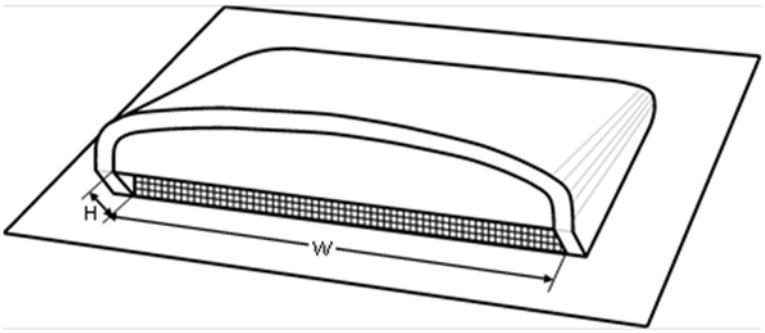
HOOD VENTS & ROOF JACKS—1/8" SCREEN
(Reduction Factor =0.75)

	DIAMETER (Inches)									
	6	7	8	9	10	11	12	13	14	15
Sq. Ft. NFVA	0.15	0.20	0.26	0.33	0.41	0.49	0.59	0.69	0.80	0.92

NFVA calculations are for vents screened with 1/8" (#8) weave mesh (found on some existing vents).

- Screens/louvers must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be replaced on vents included in NFVA calculations.

34. EYEBROW VENTS



EYEBROW VENTS—1/4" SCREEN, NO LOUVERS
(Reduction Factor = 0.90)

		WIDTH (Inches)							
		10	12	14	15	16	18	20	22
HEIGHT (Inches)	3	0.19	0.23	0.26	0.28	0.30	0.34	0.38	0.41
	5	0.31	0.38	0.44	0.47	0.50	0.56	0.63	0.69
	6	0.38	0.45	0.53	0.56	0.60	0.68	0.75	0.83
	7	0.44	0.53	0.61	0.66	0.70	0.79	0.88	0.96
	7.5	0.47	0.56	0.66	0.70	0.75	0.84	0.94	1.03
	8	0.50	0.60	0.70	0.75	0.80	0.90	1.00	1.10
	8.5	0.53	0.64	0.74	0.80	0.85	0.96	1.06	1.17
	9	0.56	0.68	0.79	0.84	0.90	1.01	1.13	1.24

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents).

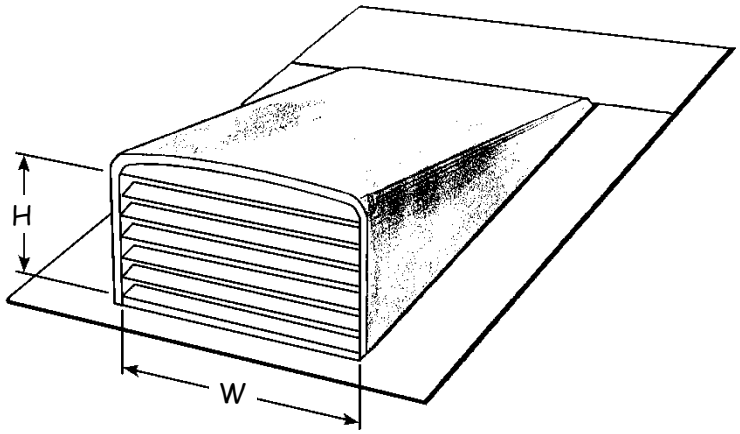
EYEBROW VENTS—1/4" OR 1/8" SCREEN with LOUVERS
(Reduction Factor = 0.75)

		WIDTH (Inches)							
		10	12	14	15	16	18	20	22
HEIGHT (Inches)	3	0.16	0.19	0.22	0.23	0.25	0.28	0.31	0.34
	5	0.26	0.31	0.36	0.39	0.42	0.47	0.52	0.57
	6	0.31	0.38	0.44	0.47	0.50	0.56	0.63	0.69
	7	0.36	0.44	0.51	0.55	0.58	0.66	0.73	0.80
	7.5	0.39	0.47	0.55	0.59	0.63	0.70	0.78	0.86
	8	0.42	0.50	0.58	0.63	0.67	0.75	0.83	0.92
	8.5	0.44	0.53	0.62	0.66	0.71	0.80	0.89	0.97
	9	0.47	0.56	0.66	0.70	0.75	0.84	0.94	1.03

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents) or 1/8" (#8) weave mesh (found on some existing vents).

- Screens must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be replaced on vents included in NFVA calculations.

35. DORMER VENTS—1/4" OR 1/8" SCREEN WITH METAL LOUVERS



DORMER VENTS—1/4" or 1/8" SCREEN with METAL LOUVERS
(Reduction Factor =0.75)

		WIDTH (Inches)							
		10	12	14	15	16	18	20	22
HEIGHT (Inches)	5	0.26	0.31	0.36	0.39	0.42	0.47	0.52	0.57
	6	0.31	0.38	0.44	0.47	0.50	0.56	0.63	0.69
	7	0.36	0.44	0.51	0.55	0.58	0.66	0.73	0.80
	7.5	0.39	0.47	0.55	0.59	0.63	0.70	0.78	0.86
	8	0.42	0.50	0.58	0.63	0.67	0.75	0.83	0.92
	8.5	0.44	0.53	0.62	0.66	0.71	0.80	0.89	0.97
	9	0.47	0.56	0.66	0.70	0.75	0.84	0.94	1.03

NFVA calculations are for vents screened with 1/4" (#4) weave mesh (required on new vents) or 1/8" (#8) weave mesh (found on some existing vents).

- Screens must be clean, and vents must be free of insulation and other obstructions.
- Tight weave (1/16" mesh) insect screen must be replaced on vents included in NFVA calculations

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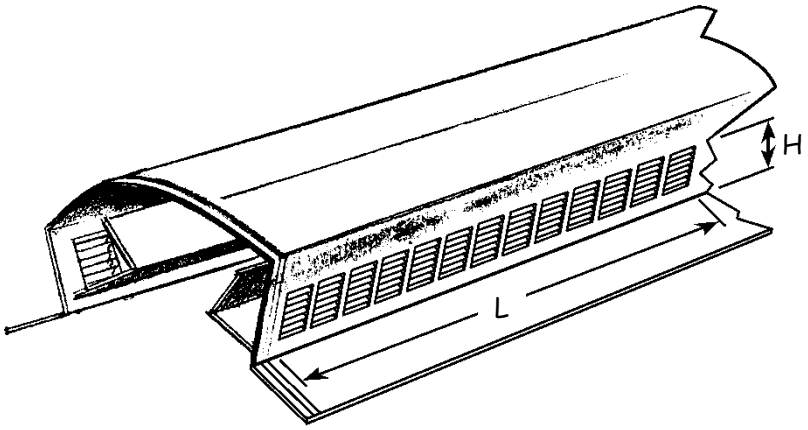
36. ROOF RIDGE VENT



ROOF RIDGE VENT with LOUVERS
(Reduction Factor = 0.50)

		LENGTH (INCHES)								
		12	120	144	168	192	216	240	264	288
HEIGHT (INCHES)	1	0.04	0.42	0.50	0.58	0.67	0.75	0.83	0.92	1.00
	1.5	0.06	0.63	0.75	0.88	1.00	1.13	1.25	1.38	1.50
	2	0.08	0.83	1.00	1.17	1.33	1.50	1.67	1.83	2.00
	2.5	0.10	1.04	1.25	1.46	1.67	1.88	2.08	2.29	2.50
	3	0.13	1.25	1.50	1.75	2.00	2.25	2.50	2.75	3.00
	3.5	0.15	1.46	1.75	2.04	2.33	2.63	2.92	3.21	3.50

Several styles of ridge vent exist, each with different NFVA specifications. Use the actual product manufacturer's NFVA specifications when available. When possible, measure the openings and apply reduction factor **0.50**. The last option is to use the above table only when the manufacturer's NFVA specifications are not available.

FLOOR INSULATION FOR CONVENTIONAL HOMES

Lead Paint Risk Factor
NONE-HIGH

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FLOOR INSULATION FOR CONVENTIONAL HOMES

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

FLOOR INSULATION REPAIR

Not applicable to this measure.

CRAWLSPACE PREPARATION

1. PRE-INSTALLATION—PREPARATION OF CRAWLSPACE

- **The following conditions shall be corrected (by client where noted, or by contractor when within the program scope) before the installation of floor insulation is allowed. If correction is not feasible for one or more of these issues, the measure is not feasible.**
  - Fuel leaks
  - Electrical hazards
  - Structural defects
    - Note: If materials suspected to contain asbestos or lead content are present, dwelling shall be assessed in accordance with the CSD Asbestos Policy and WIS Section 2 Lead-Safe Weatherization Requirements. If client arranges for hazardous material to be removed by a licensed abatement contractor in accordance with EPA regulations, installation of floor insulation may be feasible.
  - Repair or replacement of HVAC appliance systems located in the crawlspace, when applicable. Note: Crawlspace repairs (sealing and installation of insulation) shall only be performed after HVAC work has been completed and inspected by the local jurisdiction.
  - Mold issues (not feasible to correct within the program)
  - Plumbing leaks, both supply and waste lines (not feasible to correct within the program)
  - Pest and termite infestation (not feasible to correct within the program)
  - Standing water beyond incidental repair correction (not feasible to correct within the program)
- **Debris Removal and Disposal**
  - All vegetation and organic material, unnecessary material, and debris greater than 1" shall be removed from the crawlspace (e.g., rake the crawl space) and disposed of according to type and local jurisdiction requirements.

2. SEALING

- **Thermal Bypasses**
  - Seal all feasible leakage locations (including duct and shell leaks, and thermal bypasses in the floor) before insulation is installed.
  - If unfeasible to seal thermal bypasses, installation of insulation will not be automatically prohibited unless the bypass source is documented to cause condensation and moisture damage in the attic (and where the issue cannot be corrected within the program scope).

FLOOR INSULATION INSTALLATION

3. SQUARE FOOTAGE CALCULATION

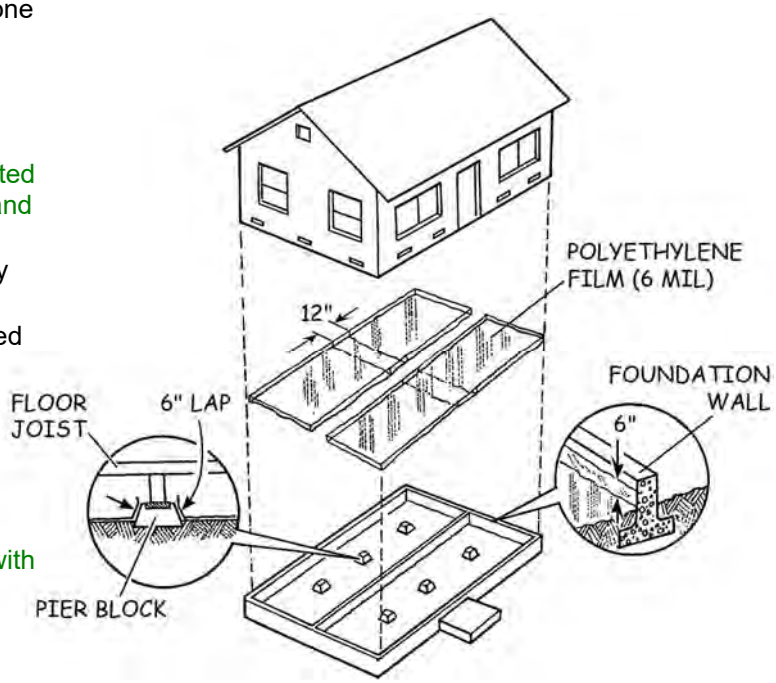
- **Measurements**
  - Square footage is based on exterior measurements.
  - Measurements of length and width are to be rounded off to the nearest foot; i.e., 12'5" = 12' (feet) and 12'6" = 13' (feet).

4. CRAWLSPACE VENTING

- **Venting Requirement**
  - Crawlspace ventilation shall conform to local building code requirements and CSD WIS Section 21 (Attic and Crawlspace Ventilation).
  - Required ventilation shall be installed before insulation is installed.

5. VAPOR RETARDER/GROUND COVER

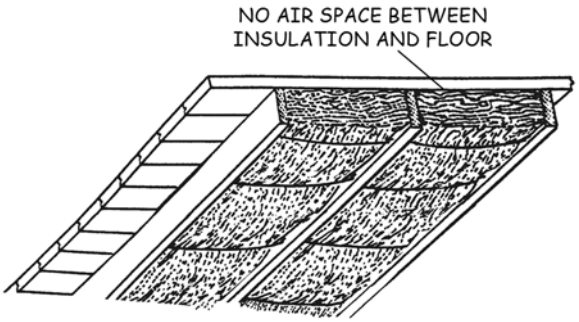
- **All Ground Cover Materials**
  - Vapor retarders shall be installed when required by the local jurisdiction.
  - Installation of a vapor retarder is not required when ventilation is installed as a stand-alone measure.
- **Existing Vapor Retarder**
  - Existing undamaged ground cover acceptable if at least 4 mil thick and in good condition after insulation is installed.
- **Location**
  - When installation of a ground cover is required:
    - A Class I or Class II vapor retarder shall be installed over the earth in the crawlspace, with 100% coverage, when floor insulation is installed.
      - *Exception 1*: Basements with exposed soil floor shall have ground cover over soil, *unless* vented and dry, or excluded by local code.
      - *Exception 2*: A vapor retarder shall not be installed when crawlspace ventilation is installed as a stand-alone measure.
- **Installation of Vapor Retarder**
  - The ground cover shall be installed after all work in the crawlspace has been completed (after performing air sealing and insulation is installed).
  - Material shall not obstruct any combustion air supply.
  - Minimum 3" clearance required from heat producing devices.
  - Joints shall be lapped 12" using “reverse” or “upslope lapping” technique.
  - Seams will be sealed with a durable sealant, compatible with the retarder.
  - The ground vapor retarder will not interfere with the established drainage pattern.



  - Interior drainage collection points will be accessible from above and below the ground vapor retarder.
  - Vapor retarder shall extend 6" up the foundation wall.
  - Contact shall not be made with wood members.
  - For wall to floor connection, the wall moisture barrier will be installed under the ground moisture barrier.
  - Retarder shall be secured in place with brick, earth, or durable fasteners every 8' minimum.
  - If tape is used to secure polyethylene:
    - Sheeting shall first be wiped clean.
    - Tape shall be capable of adhering to polyethylene.

6. INSULATION LOCATION AND COVERAGE

- **R-value**
  - R-value shall be determined in accordance with CSD WIS Appendix A (Material Specifications) and CSD Field Guide.
- **Floor Insulation Materials**
  - Insulation shall be installed only between conditioned and unconditioned spaces.
  - Insulation shall not be installed in floors over heated space.
  - Coverage shall be complete with no gaps on sides or ends.



7. PLACEMENT OF INSULATION

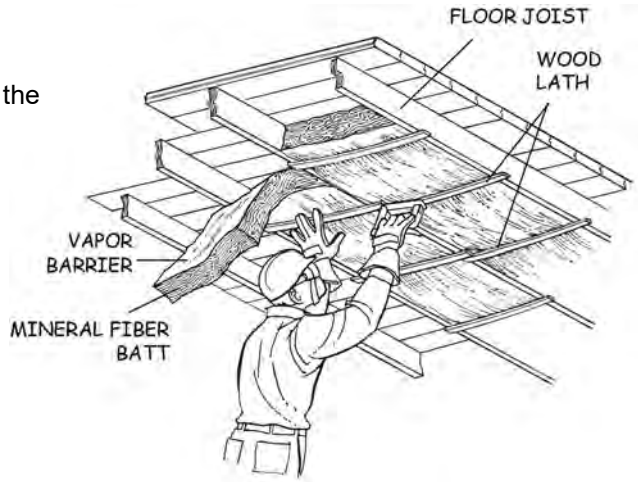
- **All Insulation Materials**
  - Insulation shall be in substantial contact with subfloor without gaps, voids, compressions, misalignments, or wind intrusions.
  - If kraft-faced batts are used, they shall be installed with kraft facing to the subfloor.
  - Insulation shall not obstruct combustion air supply openings or foundation vents.
  - Minimum 3" clearance required between insulation and heat producing devices.

8. KNOB-AND-TUBE WIRING

- **All Insulation Materials**
  - Insulation shall not be installed over knob-and-tube wiring *unless* the wiring is certified safe and proper overcurrent protection is in place (see CSD WIS Appendix F).

9. ALL SUPPORTS AND ANCHORS

- **Material Selection**
  - Materials shall be in conformance with the CSD WIS Appendix A (Materials Specifications).

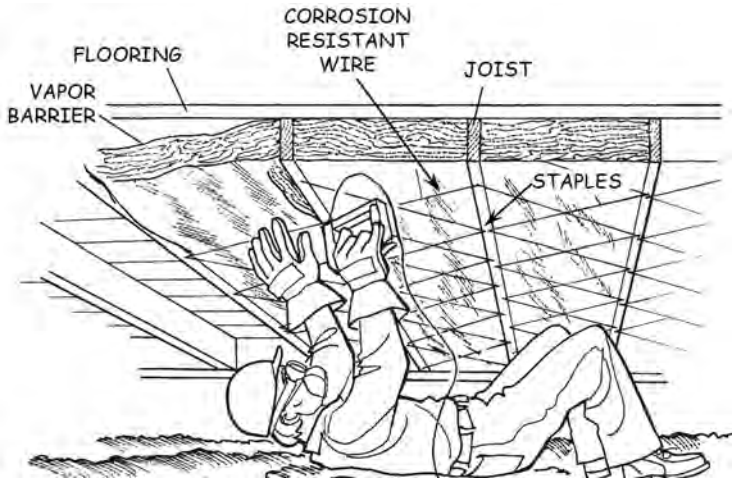


10. WOOD LATH SUPPORTS

- **Flexible Insulation**
  - Lath shall be spaced 18" OC maximum.
  - Lath shall be sized and spaced so insulation does not sag.
  - Lath may be attached with galvanized nails or corrosion-resistant staples.
  - 10% maximum compression of insulation.

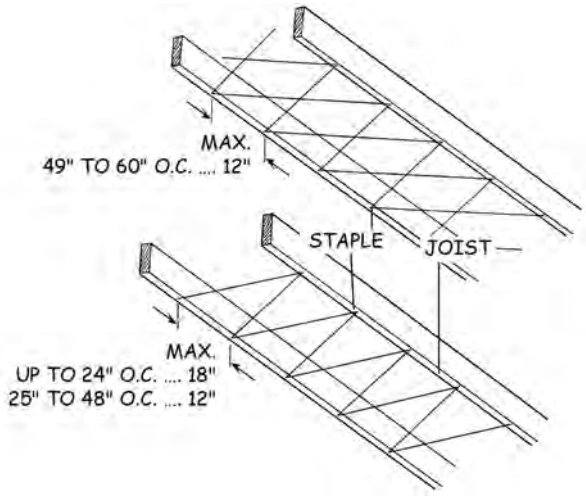
11. WIRE SUPPORT

- **Flexible Insulation**
  - All Wire Supports
    - Wire shall be:
      - Corrosion-resistant material.
      - Minimum 20 gauge.
    - Maximum 10% compression of insulation.



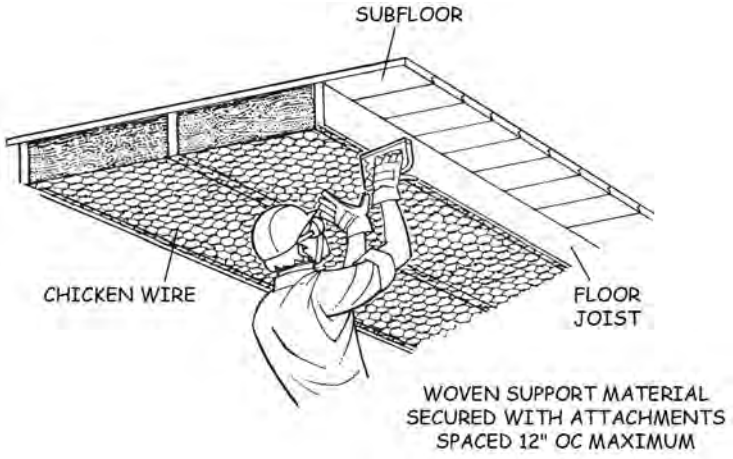
12. WIRE SPAN AND ANCHOR POINTS

- **Flexible Insulation**
  - Joists to 24" OC
    - Wire shall span twice in 18", with anchor points spaced maximum 18" apart.
  - Joists 25" to 48" OC
    - Wire shall span twice in 12", with anchor points spaced maximum 12" apart.
  - Joists 49" to 60" OC
    - Wire shall span four times between anchor points (crisscross pattern), with anchor points spaced maximum 12" apart.
    - Facing shall be stapled to subfloor.



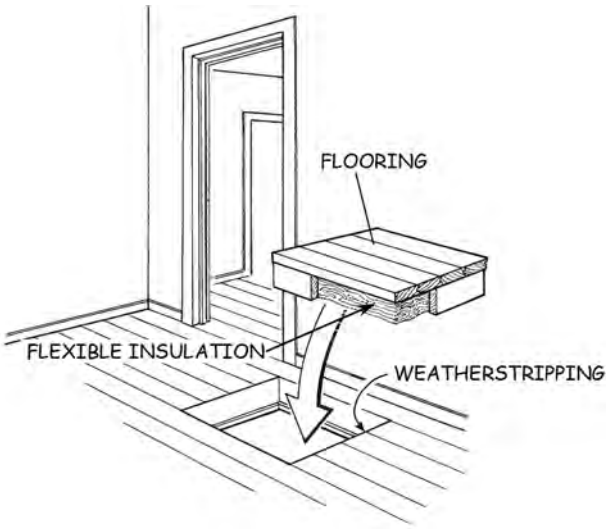
13. WOVEN WIRE OR NETTING SUPPORT

- **Flexible Insulation**
  - Woven wire support shall be anchored to joist every 12".
  - 10% maximum overall compression of insulation.
  - Support shall not sag more than 1" per 24" of span in any direction.



14. CRAWLSPACE ACCESS FROM CONDITIONED SPACE

- **All Insulation Materials**
  - Access cover/door shall be insulated:
    - If horizontal, compliant with floor insulation level (R-19).
    - If vertical, compliant with wall insulation level (R-13).
  - Access cover/door shall be weatherstripped.
    - Horizontal openings: Hollow vinyl tube or self-adhesive foam tape.
    - Vertical openings: Weatherstripping shall comply with CSD WIS Section 9 (Weatherstripping).



15. WATER PIPES IN CRAWLSPACE

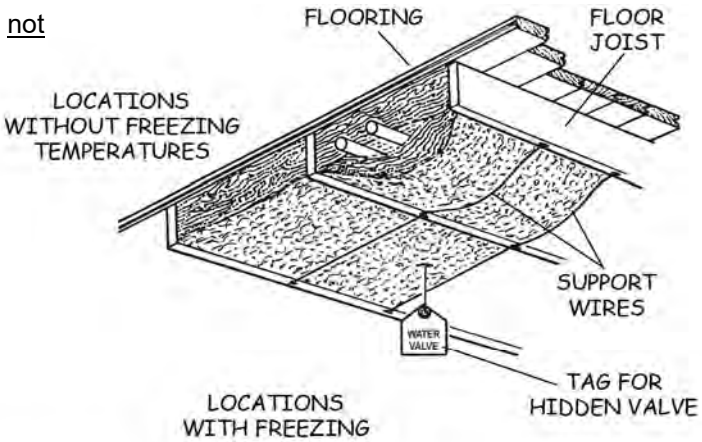
- **All Insulation Materials**
  - Pipes shall <u>not</u> be isolated from the heated side.
    - In locations without freezing temperatures, pipes may be surrounded with insulation.
    - In locations with freezing temperatures, insulation shall be placed between pipes and cold side.
    - Locations with freezing temperatures are those with winter design temperature listed at or below 32°F in the California Energy Commission Residential Manual, or per ASHRAE.

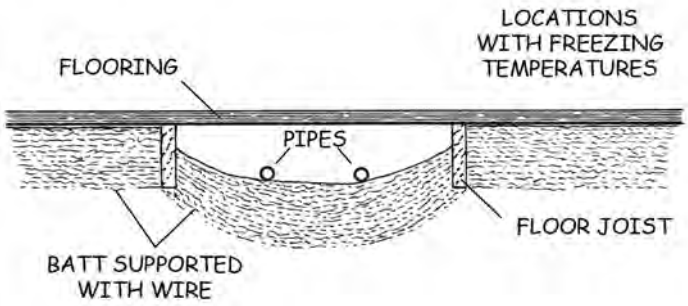
16. COVERED WATER VALVES

- **All Insulation Materials**
  - Valve shall be tagged if covered.

17. WATER PIPE HEATERS

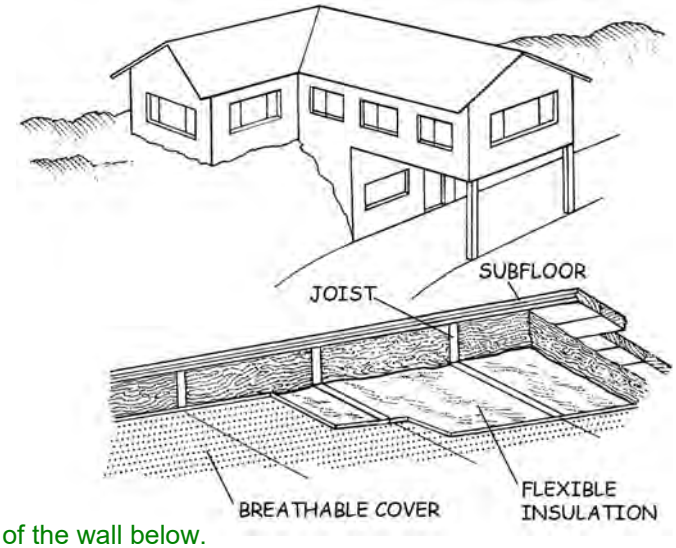
- **All Insulation Materials**
  - Installation of water pipe heaters is <u>not</u> allowed.





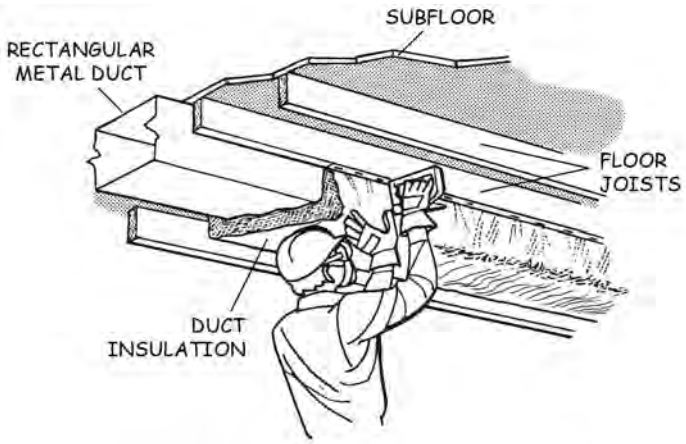
18. UNDERFLOOR INSULATION, WHERE NO FOUNDATION WALL EXISTS

- **All Insulation Materials**
  - If exposed to precipitation (i.e., rain, snow, etc.), do not insulate unless the exposure can be corrected within the scope of the weatherization program.
  - If exposed to wind and animals:
    - Insulate with flexible mineral fiber or foil clad-foam board.
    - Support flexible mineral fiber with woven wire or minimum 70 perm breathable cover.
    - Exterior soffit material shall be installed and sealed.
  - Recessed lights and other heat producing devices:
    - 3" clearance required.
  - Air barrier (if required by local jurisdiction):
    - Air barrier will be installed between joists and sealed.
    - Air barrier will be placed to the most interior edge of the top plate of the wall below.
  - Installation
    - Air barrier will be insulated between joists from top plate of the wall below to subfloor above.



19. HVAC DUCTS

- **All Insulation Materials**
  - Ducts located within joist cavities shall be insulated in conformance with CSD WIS Section 19 (Duct Insulation).
  - Vapor retarder, when present, shall be on the exterior of the duct insulation.

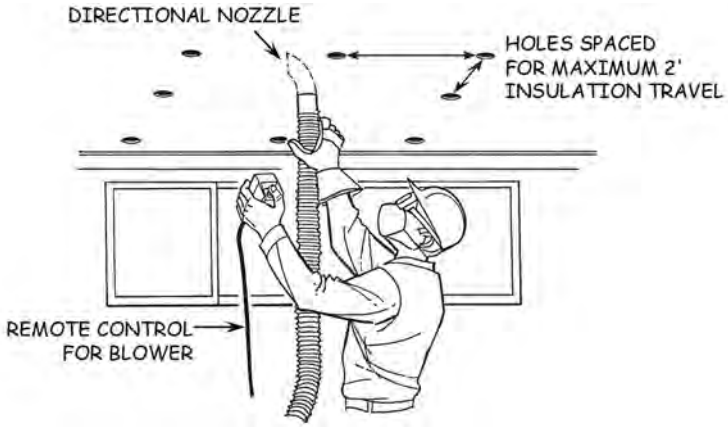


20. GAS APPLIANCES IN CRAWLSPACE

- **All Insulation Materials**
  - Minimum 3" horizontal clearance from flue/vent pipe and draft hood.
  - Minimum 12" vertical clearance above draft hood.

21. FINISHED FLOOR CAVITIES (BLIND FILL)

- **Loose Fill**
  - Cavities shall be drilled and pressure-filled using a directional nozzle or fill tube.
  - Holes shall be spaced for maximum 2' horizontal insulation travel beyond the injector.



- **HPD Clearance**
  - Minimum 3" clearance required for recessed lights, vent pipes, and other heat producing devices.
  - When 3" clearance cannot be achieved, the cavity containing the HPD shall not be insulated.
- **Coverage and Finishing**
  - All portions of all fillable cavities shall be completely filled to required density as prescribed by insulation manufacturer.
    Holes shall be plugged and patched as prescribed in CSD WIS Section 23 (Wall Insulation).

22. PIER CONSTRUCTION SUBFLOOR INSULATION—WITH RIGID BARRIER

- **Loose Fill**
  - Subfloor preparation
    - Sealing between house and crawlspace will be completed before insulating.
  - Rigid Air Barrier
    - A rigid air barrier will be mechanically fastened to underside of floor assembly, providing 100% coverage of the floor assembly.
    - Seams and penetrations will be sealed.
  - Installation
    - Loose fill insulation will be installed between air barrier and subfloor according to manufacturer specifications.
    - Insulation will be installed to prescribed R-value in CSD WIS Appendix A (Material Specifications).
- **Dense Pack**
  - Dense pack insulation will be installed between air barrier and subfloor according to manufacturer specifications.

CRAWLSPACE PERIMETER INSULATION—INTERIOR

23. CRITERIA

- **Perimeter insulation shall be installed in conditioned basements and in unvented crawl spaces as an alternative to floor insulation.**

24. VAPOR RETARDER

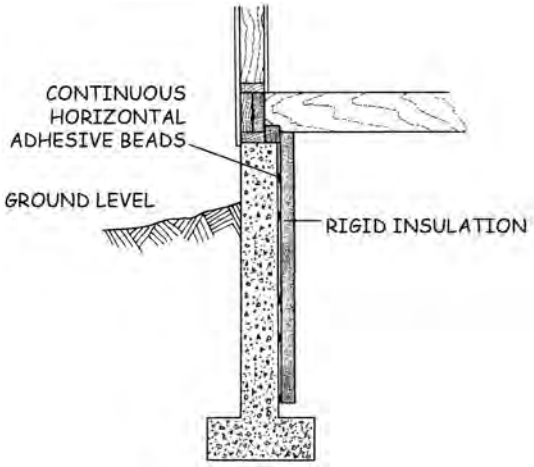
- **Install in accordance with Item 5.**

25. FLEXIBLE INSULATION

- **Installation Requirements**
  - Shall cover band and header joists.
  - Shall extend 3' away from the walls on top of ground cover.
  - Seams shall be continuously taped or stapled at intervals not to exceed 6".
  - No gaps allowed between batts.
  - Facing shall meet applicable code requirements for flame spread and smoke density.
- **Foundation Vents**
  - Vents shall not be blocked.
  - Operable vents shall exist, so they can be closed during adverse weather.

26. RIGID INSULATION

- **Installation Requirements**
  - Band and header joists shall be insulated.
  - A minimum of one continuous horizontal bead of adhesive shall be installed on the foundation wall to block insect infestation.
  - Foundation wall shall be cleaned before adhesive is applied.
  - Mechanical fasteners, such as expansion bolts or suitable nails with washers, shall be used to permanently secure the insulation to the foundation wall.
  - Foam insulation shall be a code-approved fire-rated material.



27. INSTALLATION OF RIGID INSULATION

- **Termite Inspection Gap**
  - Where termite presence exists, a 3" inspection gap will be maintained from the top of the insulation to the bottom of any wood.
- **Attachment**
  - Insulation will be attached with a durable connection equal to or better than manufacturer specifications, whichever is more durable.
- **Band Joist And Wood Foundation Walls**
  - A vapor-diffuse insulation shall be installed.
  - Where termite presence exists, removable band joist insulation will be installed.
  - In cold climates, insulation will be installed with a vapor barrier on the warm side of the insulation. (Note: Cold climates are those locations with winter design temperature listed at or below 32ºF in the Title 24 Residential Manual or per ASHRAE).

28. BASEMENT WALL INSULATION

- **No ground water leakage shall be present, for insulation to be feasible.**
- **Air Barrier**
  - A continuous air barrier shall be installed on the warm side of the insulation.
- **Vapor Permeability**
  - When absorbent insulation materials are installed, assembly will remain vapor permeable to the interior in all climate zones. .

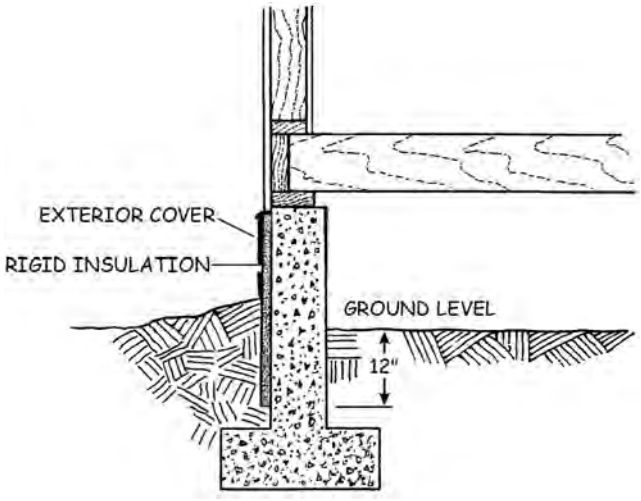
PERIMETER INSULATION—EXTERIOR

29. INSTALLATION CRITERIA

- **Limitations**
  - Shall only be installed for slab-on-grade construction when proved cost effective (SIR of 1.0 or greater) and approved by CSD in advance of work.

30. RIGID INSULATION PLACEMENT

- **Installation Requirements**
  - Band and header joists shall be insulated.
  - Insulation shall extend 12" below grade or below frost line, but not below footing.
  - If footing is less than 12" below grade, insulation shall extend horizontally from footing to a total of 12" of insulation below grade.
  - Only rigid polystyrene insulation is allowed.
  - That portion extending above grade shall be covered.
- **Foundation Vents**
  - Shall not be blocked.
  - Operable vents shall exist.



31. ATTACHMENT OF RIGID INSULATION

- **Installation Requirements**
  - A minimum of one continuous horizontal bead of adhesive shall be installed on the foundation wall to block insect infestation.
  - Foundation wall shall be cleaned before adhesive is applied.
  - Mechanical fasteners, such as expansion bolts or suitable nails with washers, shall be used to permanently secure the insulation to the foundation wall.

PART 2: MOBILE HOME CRITERIA

See CSD WIS Section 22B (Floor/Undercarriage Insulation for Mobile Homes).

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

32. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - This measure shall only be installed when the whole building is being served.
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

33. QUALITY OF INSTALLATION

- **Level Installation**
  - Completed floor insulation sections shall be confirmed to have an even level of insulation at the prescribed R-value in conformance with the CSD Field Guide and CSD WIS Appendix A (Material Specifications).
  - Installation shall have no voids or un-insulated areas behind framing members.
  - Once installed, insulation shall not be compressed or scattered to impact the efficiency of the insulation R-value.
  - Clearance zone for HPDs and floor foundation ventilation shall be cleared of over-blown insulation.

34. CLEAN-UP

- **Required Practices**
  - When crawlspace access is indoors, the pathway from the entrance door to the access shall be protected with runners.
  - When entry is through an access inside a closet, the clothing and other personal property shall be removed or protected.
  - All cutting of fiberglass batts and blankets shall occur outside the living space or inside the crawlspace.
- **Access from Inside Home**
  - All areas between an indoor access and the home entrance shall be vacuumed.
  - The area between the home entrance and the insulation truck shall be cleaned (swept or vacuumed).
- **Access Outside the Living Space**
  - All areas between the access and the insulation truck shall be cleaned (swept or vacuumed).
  - A HEPA vacuum is required when fiberglass insulation is installed, and should be used for all other types of insulation.

35. CLIENT EDUCATION

- **When floor insulation is feasible:**
  - Client shall be advised that all plastic vapor retarder (moisture barrier) is biodegradable and: 1) will have a life span much shorter than the home (approximately 5 years), and 2) it will need to be replaced to remain effective.
  - Crawlspace Sign Requirement
    - A durable (10-year life expectancy), easily seen sign (minimum 8-1/2" x 11") shall be posted at all accesses to the crawlspace when floor insulation and/or a vapor retarder is installed.
  - Crawlspace Sign Content
    - Those entering the crawlspace will be cautioned not to damage the air barrier, ground moisture barrier, insulation, and mechanical components specific to the crawlspace type.
    - Anyone entering the crawlspace will be alerted that immediate repairs are needed in case of damage.
    - Installer contact information will be included on the sign in case there are questions or needs for repairs.
    - Hazard Warning: Language prohibiting storage of hazardous and flammable materials shall be stated on the sign.

36. INSULATION CERTIFICATE

- **Required Documentation**
  - Manufacturer's information, and total installed R-value, shall be documented in the posted Insulation Certificate (CSD 610 Form).
  - In accordance with Title 24, when insulation is installed (ceiling, wall, or floor), completion of the insulation certificate (CSD 610 Form) shall be required and a copy provided to the client.
  - The certificate shall be completed and signed by the contractor responsible for installing the insulation. The manufacturer, brand, R-value, etc. Of the insulation installed in the roof/ceiling, walls, floor and slab edge are documented. The installer also verifies compliance with the applicable mandatory measures (i.e. Infiltration and exfiltration) for the building envelope.

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NOTES

FLOOR / UNDERCARRIAGE INSULATION FOR MOBILE HOMES

Lead Paint Risk Factor
NONE

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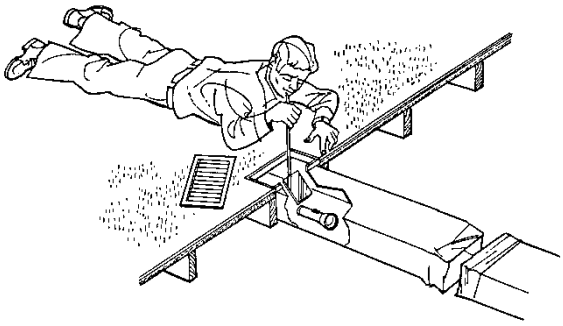
FLOOR/UNDERCARRIAGE INSULATION FOR MOBILE HOMES

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

See CSD WIS Section 22A (Floor Insulation for Conventional Homes).

PART 2: MOBILE HOME CRITERIA



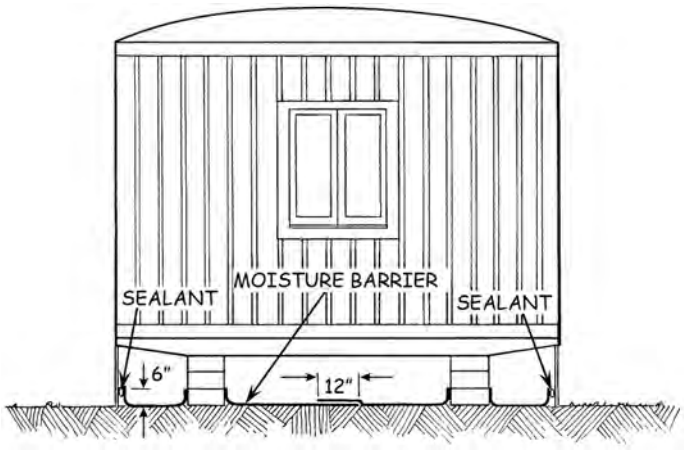
1. PRE-INSTALLATION—PREPARATION OF CRAWLSPACE

- **The following conditions shall be corrected (by client, or by contractor when within the program scope) before the installation of floor insulation is allowed:**
  - Fuel leaks
  - Electrical hazards
  - Structural defects
    - Note: If materials suspected to contain asbestos or lead content are present, dwelling shall be assessed in accordance with the CSD Asbestos Policy. If client arranges for hazardous material to be removed by a licensed abatement contractor in accordance with EPA regulations, installation of floor insulation may be feasible.
  - Repair or replacement of HVAC systems located in the crawlspace, when applicable. Note: Crawlspace repairs (sealing and installation of insulation) shall only be performed after HVAC work has been completed and inspected by the local jurisdiction. Any combustion air opening located in the floor of an appliance enclosure shall be ducted through the bellyboard before the cavity is insulated.
  - Mold issues (not feasible to correct within the program)
  - Plumbing leaks, both supply and waste lines (not feasible to correct within the program)
  - Pest and termite infestation (not feasible to correct within the program)
  - Non-correctable standing water: installation of floor insulation is not feasible.
- **Debris Removal and Disposal**
  - Clean floor cavities, remove remnants of previous insulation, and belly board. All vegetation and organic material, unnecessary material, and debris greater than 1" will be removed from the crawlspace (e.g., rake the crawl space) and disposed of according to type and local jurisdiction requirements.
- **Additional Preparation**
  - Secure gas, water, and electrical lines at least every 4' to a floor joist or framing member.
  - Slope waste lines at 1/4" per foot.
  - Water pipes shall not be isolated from the warm side of the added insulation.
  - Mobile home skirting shall be repaired/installed to prevent animal intrusion.
  - Bellyboard shall be intact and free from holes and capable of supporting the insulation.

2. SEALING

- **Thermal Bypasses**
  - Seal all feasible leakage locations (including duct and shell leaks, and thermal bypasses in the floor) before insulation is installed.
  - If unfeasible to seal thermal bypasses, installation of insulation in the area will not be automatically prohibited, unless the bypass source is documented to cause condensation and moisture damage, and cannot be corrected within the program scope.
- **Repair and sealing of ducts in conformance with CSD WIS Section 6 (Duct System Repair and Sealing).**
- **Abandonment of an existing belly return, and installation of a central ducted return in conformance with the CSD Field Guide, Appendix B.**

3. VAPOR RETARDER



- **All Mobile Homes**
  - Moisture barrier shall be installed when required by the local jurisdiction, in accordance with CSD WIS Section 22A (Floor Insulation for Conventional Homes).
  - Vapor retarder shall be installed before floor insulation is installed (*Exception*: When crawlspace ventilation is installed as a stand-alone measure, a vapor barrier shall not be installed).
  - Acceptable materials shall be utilized in conformance with CSD WIS Appendix A (Material Specifications).
  - Installation Requirements
    - Vapor retarder shall be installed in conformance with CSD WIS Section 22A (Floor Insulation for Conventional Homes) and the specifications in this Item.
    - Properly installed skirting shall be in place around the entire perimeter.
    - All plumbing leaks and pooling moisture shall be repaired before a vapor retarder is feasible.
    - Earth shall be covered 100%.
    - All joints shall overlap a minimum of 12" using “reverse” or “up-slope lapping” technique.
    - Flaps at piers shall extend a minimum of 6" up the sides of the support foundation.
    - Vapor retarder/ground moisture barrier will be fastened to ground with durable fasteners or ballast(s).
    - Extremities shall extend a minimum of 6" up the inside of the existing skirting.
    - Edge attachment to existing skirting with adhesive caulk or mechanical means recommended.
    - Overlaps should be secured with outward clinch (“stitch”) staples and/or adhesive, or with material placed on top to weigh down the upper flap.
- **Pier and Skirting Foundations**
  - Coverage
    - When required by the local jurisdiction, a vapor retarder that covers the crawlspace ground shall be installed with allowances for structural supports (piers) and accessibility.

4. CRAWLSPACE VENTILATION

- **Crawlspace shall be properly ventilated in conformance with CSD WIS Section 21 (Attic and Crawlspace Ventilation).**
- **Pier and Skirting Foundations**
  - Crawlspace shall be vented in accordance with local climate conditions and local code as required.
  - Required ventilation shall be installed before insulation and vapor retarder (when required) in conformance with CSD WIS Section 21.

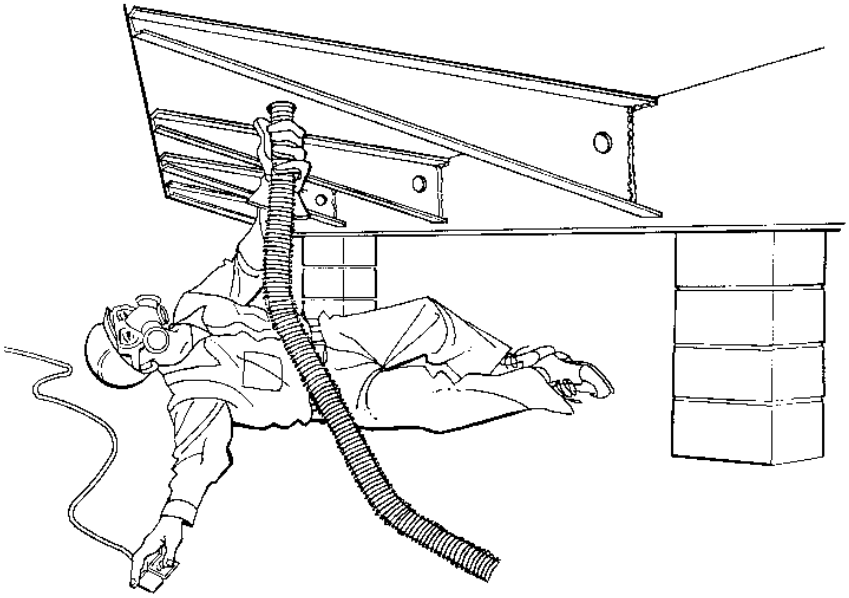
5. PROHIBITED INSTALLATION METHODS

- **All Mobile Homes**
  - Rigid or flexible insulation shall not be attached under the bellyboard.

6. APPROVED INSTALLATION METHODS

- **Approved floor/undercarriage installation methods are:**

METHOD	REQUIREMENTS FOR APPROVED METHODS
All Methods	• Shall be installed only on floors beneath conditioned space.
Cavity Fill	• Belly cavity fill through the bellyboard (rodent barrier) is the preferred insulation method. • Shall be installed in any mobile home with: - A structure capable of supporting the added insulation and blowing pressure. • R-value shall be R-19.
Rim Joist Injection	• Rim joist injection through ends or sides of mobile home is acceptable. • All interior areas not accessible from the outside perimeter shall be accessed through the belly. • R-value shall be R-19.
Flexible (Batt) Replacement	• Damaged and missing flexible insulation shall be replaced installing new flexible insulation and restoring or replacing the rodent barrier.



Section 22B

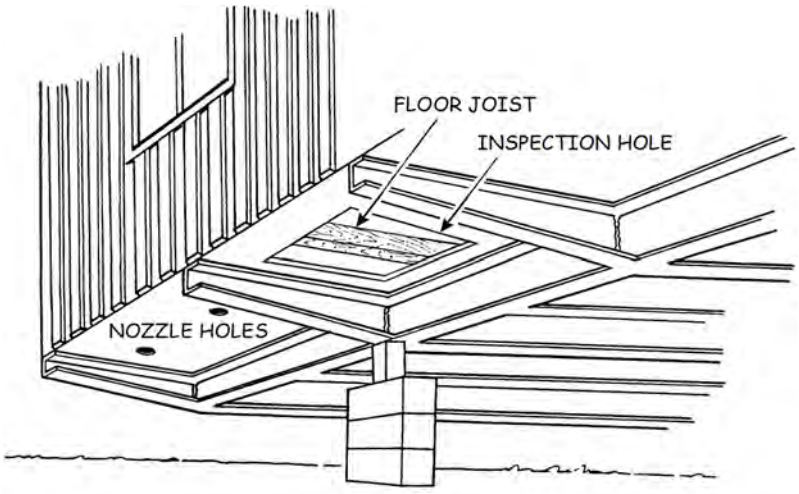
CAVITY FILL INSTALLATION METHOD

7. CAVITY FILL INSTALLATION CRITERIA

- **Coverage**
  - All areas shall be insulated except those occupied by ducts, plenums, combustion air intakes, or other obstructions.
  - All regulations restricting placement of insulation in cavities containing aluminum wiring shall be observed.

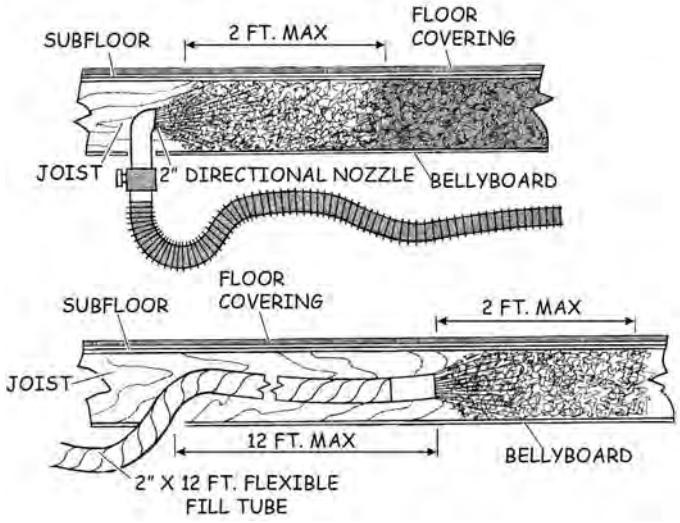
8. CAVITY FILL ACCESS

- **Method of Access**
  - Bellyboard penetration:
    - Is preferred in all cases.
    - Is required to insulate all interior areas not accessible through the rim joists.
- **Access Holes**
  - Holes cut for inspection purposes shall also be used for fill tube.
  - Existing damage holes shall be used for fill tube access when feasible.
  - Additional penetrations shall be made, as needed, to achieve complete coverage.
- **Hole Spacing**
  - Holes shall be spaced to accommodate the directional nozzle or fill tube utilized.
    - Maximum insulation travel beyond fill tube or nozzle shall be 2'.
- **Hole Size**
  - Holes shall be of sufficient size to properly accommodate the directional nozzle and/or fill tube.



9. NOZZLE SIZE AND TYPE

- **Cavity Fill Method**
  - Nozzle and fill tube diameter
    - 2" recommended.
    - 1-1/2" minimum inside diameter.
- **Fill Tube**
  - Flexible fill tube shall be no more than 2' shorter than the length of the cavity being filled.
  - Directional nozzle shall access a maximum of 2' of cavity depth in each direction.

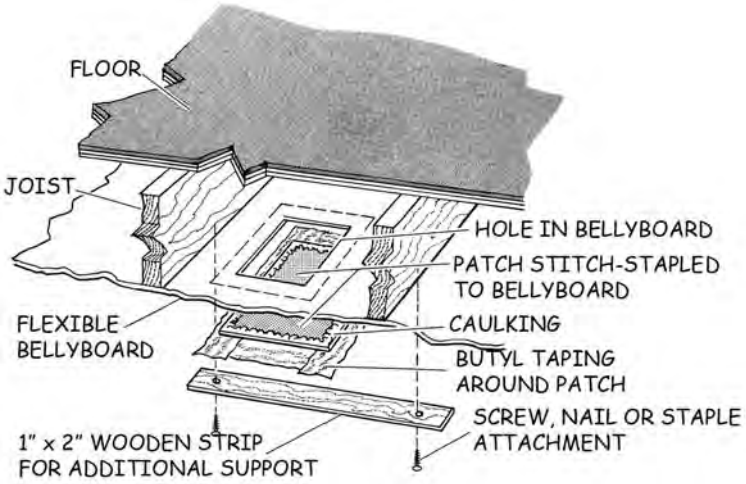


10. BLOWER CONTROLS

- **All Undercarriage Insulation**
  - Installer shall be equipped with a remote control switch to control the blowing machine.

11. INSULATION HOLE REPAIR

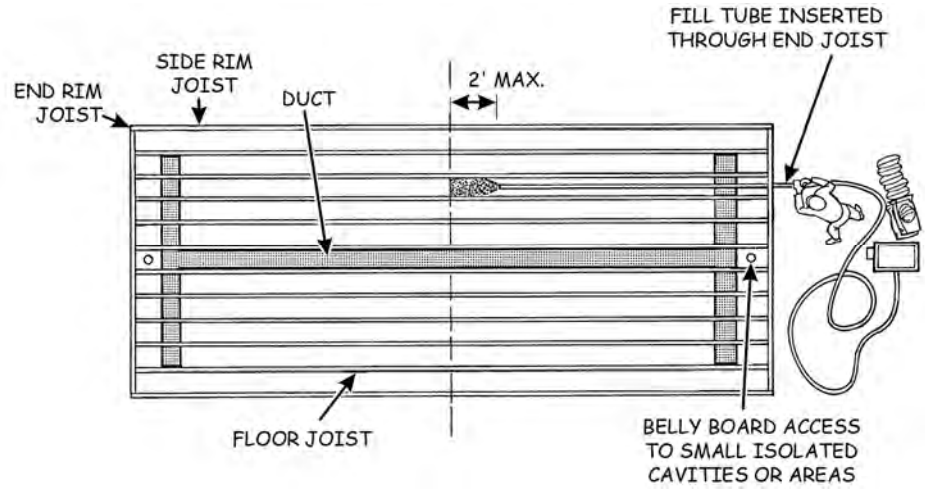
- **Bellyboard**
  - All holes shall be repaired with material equivalent or superior to the existing bellyboard.
  - All patches shall be securely and permanently attached and create a complete and permanent seal.



RIM JOIST INSTALLATION METHOD

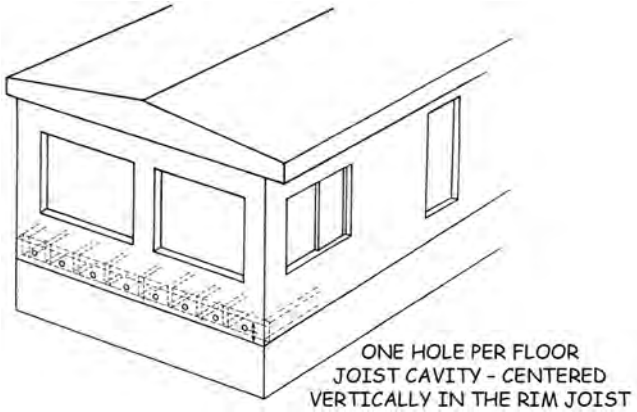
12. RIM JOIST INSTALLATION CRITERIA

- **Rim Joist Penetration**
  - Acceptable method when joist size and condition allow for safe and proper installation.
  - Used to insulate joist cavities or portions of cavities which have unobstructed access from the outside perimeter.
- **Access Selection**
  - Penetration points shall be those which are most feasible.
  - A combination of cavity fill (belly) and joist penetrations shall be used as needed to achieve optimum results.



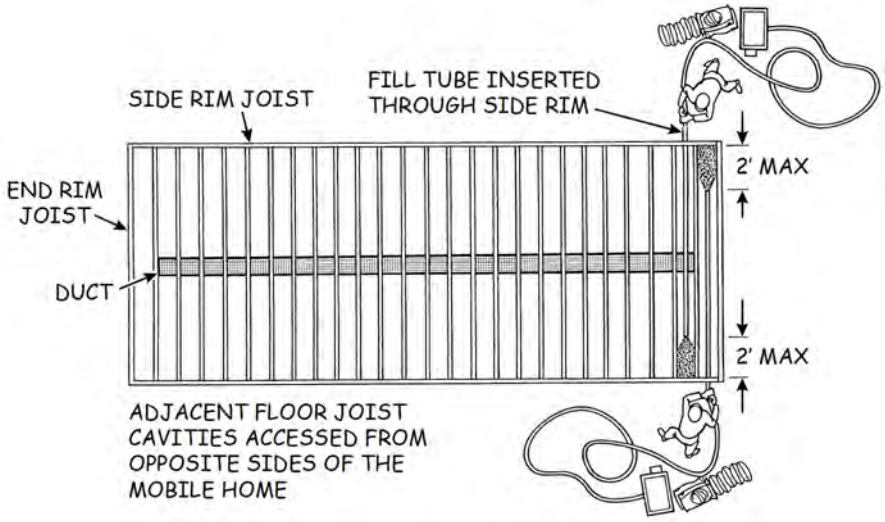
13. RIM JOIST ACCESS

- **Rim Joists**
  - Bottom wall trim shall be removed to expose the rim joist.
  - Exterior siding shall be unfastened and carefully pulled back only when necessary.
  - Rim joist access shall be considered not feasible if it will result in visible damage to the siding.
- **Hole Location**
  - End and Side Joists
    - One hole shall be drilled for each floor joist cavity.
    - Holes shall be located as close as possible to the vertical center of the rim joist to minimize structural weakening.
    - Care shall be exercised in hole placement to avoid damage to plumbing and electrical lines attached or adjacent to the rim joist.
  - Side Rim Joists
    - Adjacent joist cavities shall be accessed alternately from opposite sides of the mobile home, as feasible, to minimize the number of holes in each rim joist.



- **Hole Size**
  - Holes shall not exceed the following limitations:

JOIST SIZE	MAXIMUM HOLE SIZE
2" x 8"	2-1/2"
2" x 6"	2"
2" x 4"	Not allowed

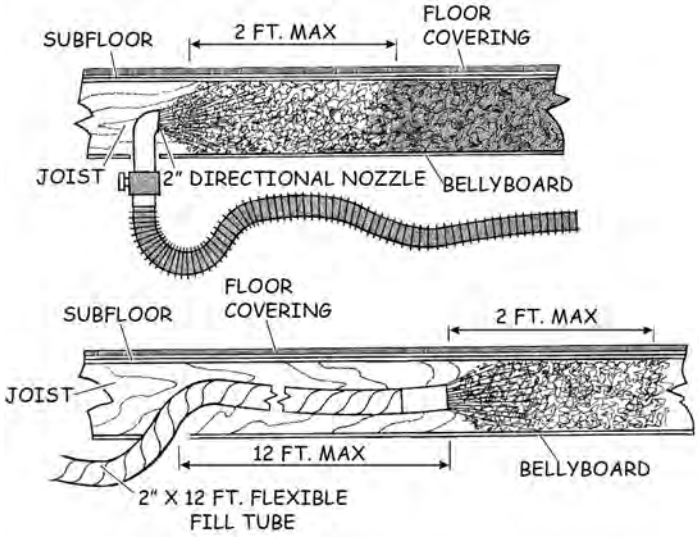


14. NOZZLE SIZE AND TYPE

- **Rim Joist Fill Method**
  - Nozzle and fill tube diameter
    - 2" recommended.
    - 1-1/2" minimum inside diameter.
- **Tube Length**
  - Rigid or flexible fill tube shall be no more than 2' shorter than the length of the cavity being filled.

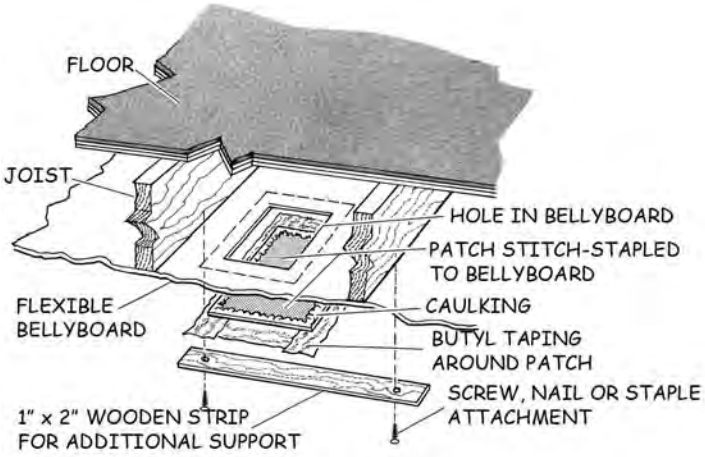
15. BLOWER CONTROLS

- **All Undercarriage Insulation**
  - Installer shall be equipped with a remote control switch to control the blowing machine.



16. RIM JOIST HOLE REPAIR

- **Plugs**
  - Solid wood plugs shall be installed in all fill holes.
  - Plugs shall be secured with exterior-rated glue or sealant.



FLEXIBLE BATT INSTALLATION METHOD

17. FLEXIBLE (BATT)

- **Installation Criteria**
  - Damaged and missing flexible insulation shall be replaced with flexible insulation of equal or greater R-value, and
  - Exposed HVAC ducts shall be protected with insulation and rodent barrier.
  - If insulation has facing, facing will be in contact with the heated side.
  - Insulation will be in contact with subfloor.
  - Insulation will not have gaps, voids, or be compressed.
  - Insulation will be supported (e.g., metal insulation supports) to maintain a permanent contact with subfloor.
  - Insulation will be notched around all wires, pipes, and blocks.
  - Ducts and water lines will be insulated for climate conditions.
  - Water lines will be located above the warm side of the insulation (toward the conditioned space), when feasible.

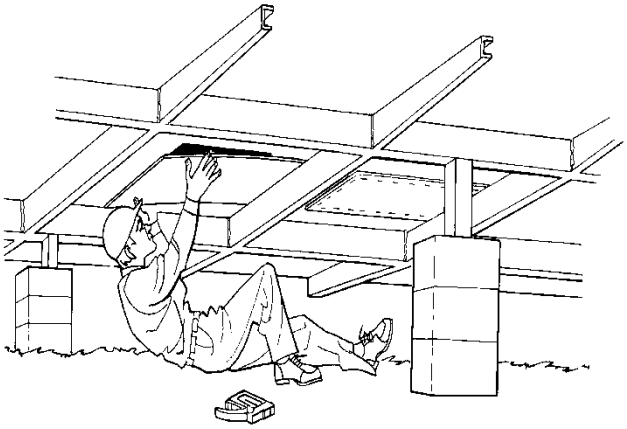
RODENT BARRIER REPAIR

18. FLEXIBLE AND RIGID RODENT BARRIER

- **All Rodent Barriers**
  - Rodent barriers shall be restored (repaired or replaced), in accordance with this section.
  - After insulation is installed and insulation penetrations are sealed, the rodent barrier shall be restored (repaired or replaced), in accordance with this section.
- **Patches in Flexible Rodent Barrier**
  - All patches shall be secured and sealed by means of self-adhesive backing, caulk, or other suitable adhesive sealant.

- Patches shall be additionally secured mechanically, as needed to ensure permanence, with one or more of the following:
  - Outward clinch ("stitch") staples, or equivalent, spaced appropriately to permanently and securely attach the patch directly to the existing bellyboard.
  - Fasteners penetrating the wooden joists a minimum of 1/2" and spaced a maximum of 4" OC.
  - Wooden strips attached with screws into floor joists, or wedged above adjacent girders, or otherwise permanently secured.
- Butyl tape or other sealant shall be placed around the perimeter, as needed, to ensure a complete and permanent seal.

- **Patches in Rigid Rodent Barrier**
  - Patches shall be sealed with suitable caulk and secured mechanically.
  - Approved mechanical attachments include:
    - Fasteners that penetrate the wooden joists a minimum of 3/4" and are spaced a maximum of 6" OC.
    - Wooden strip supports that span beyond the patch and secure mechanically into the framework above.
    - Wedging of patching material between the existing bellyboard and the metal framing of the undercarriage.



    - Fasteners that penetrate only the existing bellyboard, for small patches in high density material.
    - A combination of methods which will provide a stable, permanent repair.
- **Penetrations in the Belly Board Patch (Ducts and Pipes)**
  - Penetrations shall be sealed with butyl tape or equivalent.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

19. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

20. QUALITY OF INSTALLATION

- **Level Installation**
  - Completed floor insulation sections shall be confirmed to have an even level of insulation at the prescribed R-value in conformance with the CSD Field Guide.
  - Installation shall have no voids or uninsulated areas behind framing members.
  - Once installed, insulation shall not be compressed or scattered to negatively impact the efficiency of the insulation R-value.
  - Clearance zone for HPDs and floor foundation ventilation shall be cleared of excess insulation.

- **Quantity of Insulation**
  - The number of bags of insulation installed shall be confirmed and must match the number required on the coverage chart.

21. CLEAN-UP

- **Required Practices**
  - When crawlspace access is indoors, the pathway from the entrance door to the access shall be protected with runners.
  - When entry is through an access inside a closet, the clothing and other personal property shall be removed or protected.
  - All cutting of fiberglass batts and blankets shall occur outside the living space or inside the crawlspace.
- **Access from Inside Home**
  - All areas between an indoor access and the home entrance shall be vacuumed.
  - A HEPA vacuum shall be used.
- **Access Outside the Living Space**
  - All areas between the access and the insulation truck shall be cleaned (swept or vacuumed).
  - A HEPA vacuum shall be used.

22. CLIENT EDUCATION (FLOOR INSULATION)

- **When venting is installed:**
  - Clients will be educated on the purpose, operation, and maintenance of vents.
- **When floor insulation is feasible:**
  - Client shall be advised that all plastic vapor retarder (moisture barrier) is biodegradable and: 1) will have a life span much shorter than the home (approximately 5 years), and 2) it will need to be replaced to remain effective.
  - Crawlspace Sign Requirement
    - A durable (10-year life expectancy), easily seen sign (minimum 8 ½" x 11") shall be installed at all accesses to the crawlspace when floor insulation and/or a vapor retarder is installed.
  - Crawlspace Sign Content
    - Those entering the crawlspace will be cautioned not to damage the air barrier, ground moisture barrier, insulation, and mechanical components specific to the crawlspace type.
    - Anyone entering the crawlspace will be alerted that immediate repairs are needed in case of damage.
    - Installer contact information shall be included on the sign in case there are questions or needs for repairs.
    - Hazard Warning: Language prohibiting storage of hazardous and flammable materials shall be stated on the sign.

23. INSULATION CERTIFICATE

- **Required Documentation**
  - Manufacturer's information, and total installed R-value, shall be documented in the posted Insulation Certificate (CSD 610 Form).
  - In accordance with Title 24, when insulation is installed (ceiling, wall, or floor), completion of the insulation certificate (CSD 610 Form) shall be required and a copy provided to the client.
  - The certificate shall be completed and signed by the contractor responsible for installing the insulation. The manufacturer, brand, R-value, etc. Of the insulation installed in the roof/ ceiling, walls, floor and slab edge are documented. The installer also verifies compliance with the applicable mandatory measures (i.e. Infiltration and exfiltration) for the building envelope.

WALL INSULATION

Lead Paint Risk Factor
HIGH

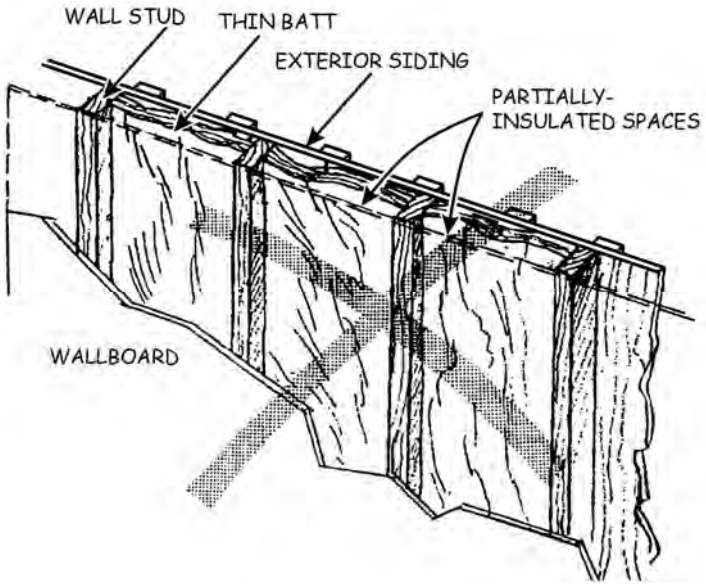
TABLE OF CONTENTS

WALL INSULATION

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

WALL INSULATION REPAIR

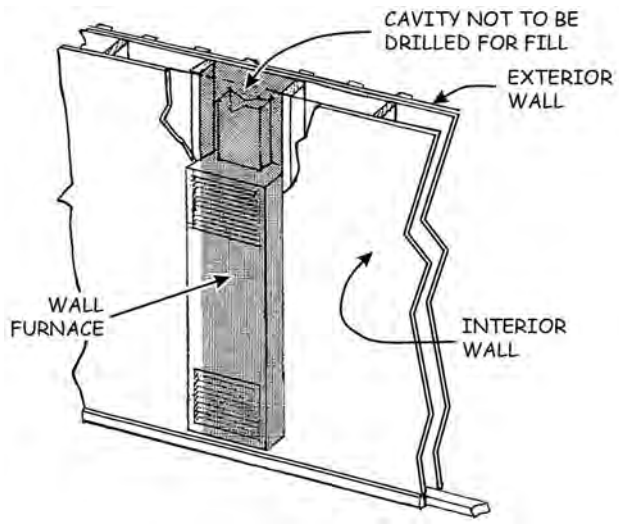
Not allowed for this measure.

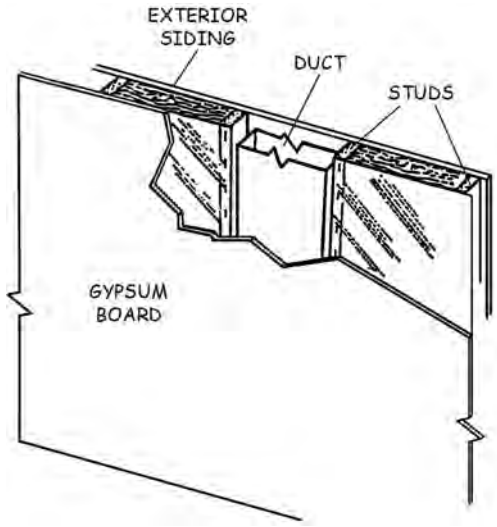


WALL INSULATION RESTRICTIONS

1. DO NOT INSULATE

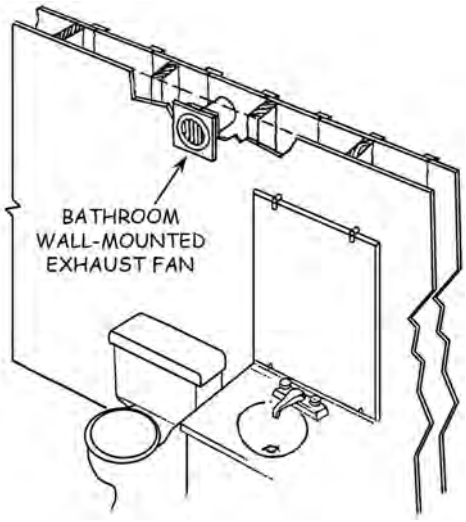
- **The following wall cavities shall not be insulated:**
  - Insulated or partially insulated walls, *except* some mobile home walls (see Part 2 of this section).
  - Asbestos-containing siding is present (see CSD WIS Section 1 (Health and Safety Requirements).
  - Knob-and-Tube (K&T) wiring is present in the enclosed cavity.
  - Cavities used as, or containing, HVAC ducts.
  - Cavities containing gas wall furnaces.
  - Cavities containing electric wall heaters and other heat producing devices—*unless* the HPD is protected by:
    - Full-dimensional blocking, or
    - A sealed protective pan.

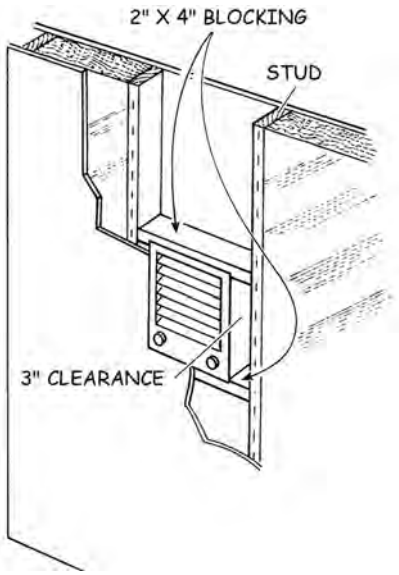




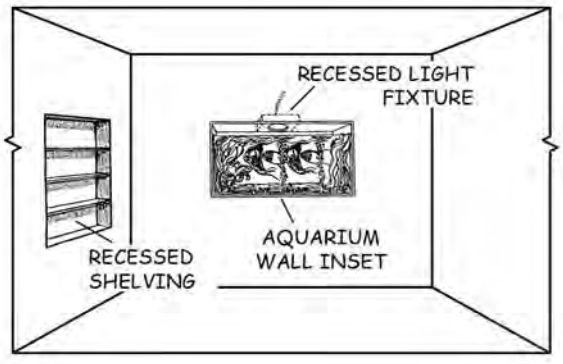
1. DO NOT INSULATE (cont.)

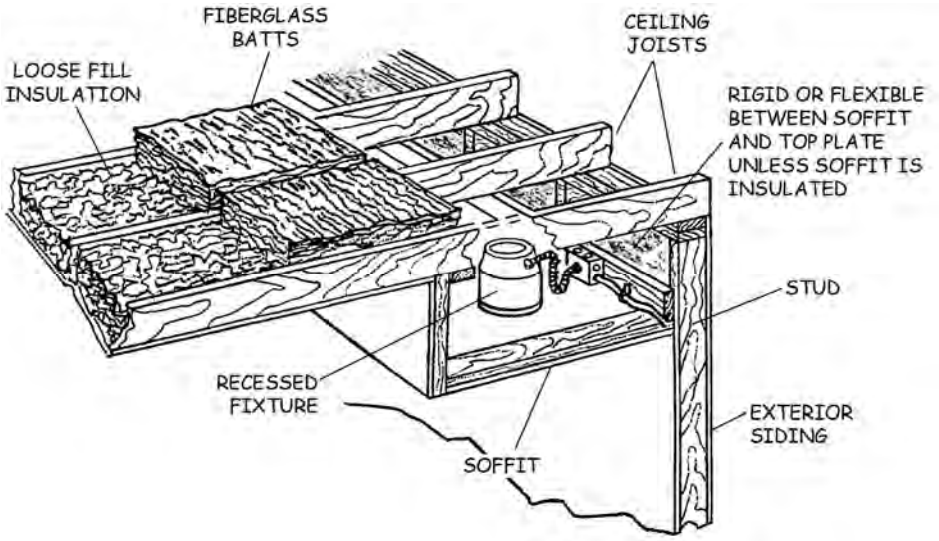
- **The following wall cavities shall not be insulated (cont.):**
  - Cavities containing wall-mounted exhaust fans—*unless* the fan housing within the wall cavity is a sealed unit.





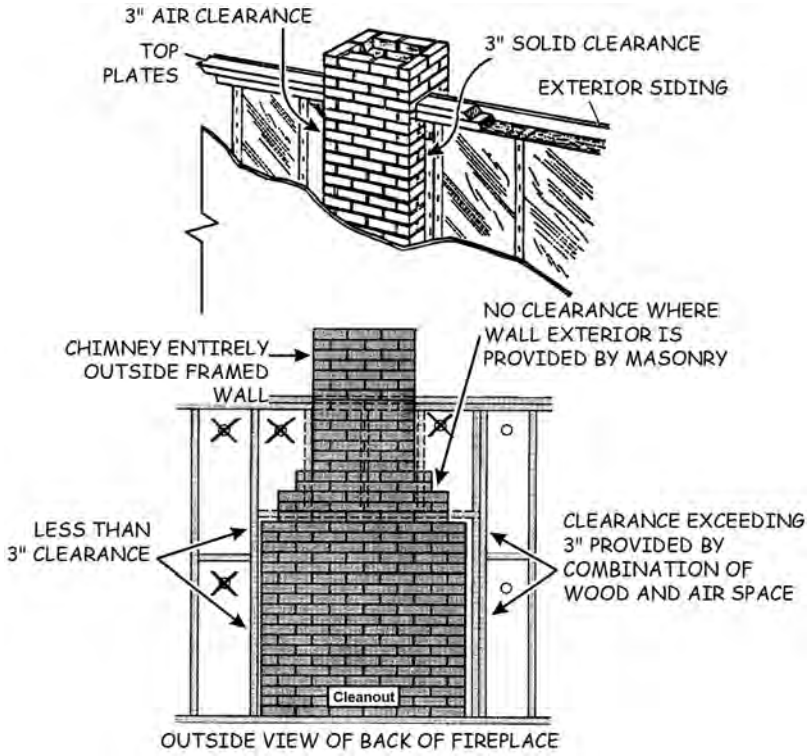
  - Cavities containing recessed light fixtures—*unless* a barrier with a 3" clearance zone exists.
  - Walls open to uninsulated soffits containing recessed light fixtures—*unless* loose fill is kept away from the HPDs and off of the soffit by one of the following methods.
    - Top Fill Method—cavities are:
      - Filled from the top with loose fill up to the soffit, and
      - Insulated the remaining distance to the top plate with flexible or rigid material.
    - Top Seal Method—cavities are:
      - Securely sealed at the soffit/ceiling level, and
      - Pressure-filled from below, and
      - Insulated the remaining distance to the top plate with flexible or rigid material.





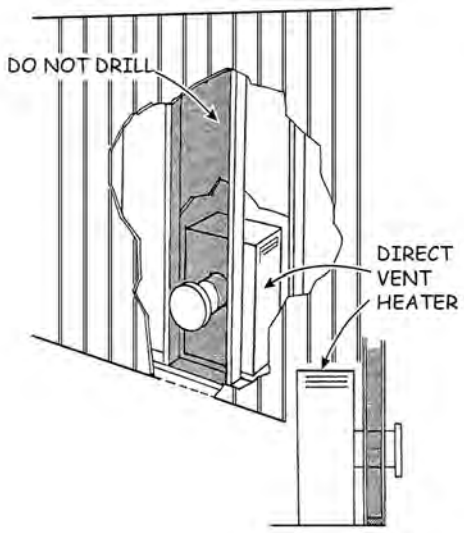
1. DO <u>NOT</u> INSULATE (cont.)

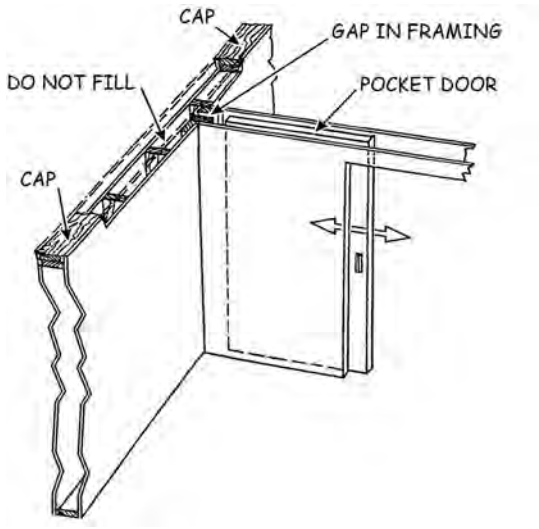
- **The following wall cavities shall <u>not</u> be insulated (cont.):**
  - Cavities containing a masonry fireplace or chimney—*unless* proper clearance is provided.
    - For cellulose:
      - 3" clearance must exist between cellulose and masonry.
      - Clearance must be provided by solid wood or a combination of wood and air space.
    - For fiberglass and rock wool, no clearance is required.
    - Cavities with metal chimneys or flues—*unless* a solid barrier with a 3" clearance zone exists.



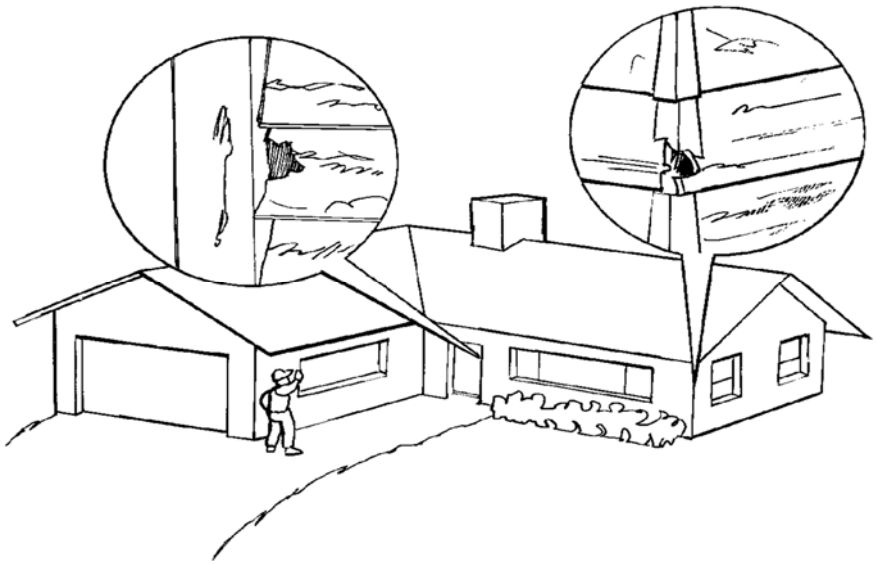
1. DO NOT INSULATE (cont.)

- **The following wall cavities shall not be insulated (cont.):**
  - Wall cavities connecting with unprotected pocket door cavities (i.e., locations where blown insulation can enter the door pocket).
  - Cavities with recessed shelves (insulate only *above and below* shelving unit).





  - Walls in need of interior or exterior repair (e.g., deteriorated, damaged, loose, etc.).
  - Leaking walls.
  - Walls with substandard interior sheathing (such as 1/4" gypsum, 1/8" paneling 16" OC, 1/4" paneling 24" OC, etc.).
  - Walls with substandard exterior sheathing (such as deteriorated lap siding, or other condition that cannot safely withstand pressure of blown insulation).



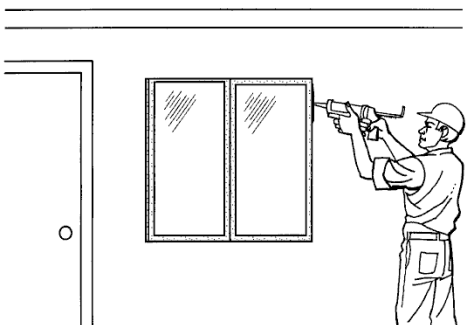
WALL INSULATION GENERAL REQUIREMENTS

2. PREPARATION OF HOME

- **Clean Work Requirements**
  - When insulation shall be installed from indoors, the pathway from the entrance door to the points of insulation shall be protected with runners.
  - When access is inside a closet, the clothing and other personal property must be removed or covered.
  - Care shall be taken to prevent damage to the home and furnishing by the insulation hose, ladders, etc.
  - All cutting of mineral fiber batts for blocking or baffling purposes shall occur outside the living space or inside the attic.

3. INDOOR PREPARATION

- **Home Inspection**
  - Prior to installing insulation, all walls to be insulated shall be thoroughly inspected on the inside for any areas where insulation might blow into the home
- **Drilling Restriction**
  - Only gypsum (drywall) and wooden wall sheathing shall be drilled.
  - Safety practices prescribed in the CSD Field Guide shall be followed when ACM or lead-based paint is known or suspected to be present in/on wall sheathing.
- **Home Furnishings**
  - Move furniture and home furnishings as needed to access the interior side of the walls (after obtaining occupant's permission).
  - It is not necessary to move furniture that:
    - Is heavy and very difficult to move.
    - Contains delicate belongings (e.g., a china hutch), *unless* the occupant removes the items that could be easily damaged.
- **Cupboards and Closets**
  - Access as needed to pressure-fill wall cavities inside them.
  - Personal belongings must be removed by the occupants to allow access (or by crew with permission from the occupant).
- **Wall Preparation**
  - Remove wall hangings and other items that may be jarred loose during pressure-fill.
  - Inspect all interior wall covering and trim to make sure they are securely fastened to the wall.
    - Re-set any loose nails and screws.
    - Identify any areas of weakness, where care must be taken while installing insulation.
  - Caulk cracks and small holes, including plumbing and electrical penetrations, and repair large holes in interior surfaces, to prevent indoor air from entering the wall cavity.



CRACKS AND HOLES CAULKED/REPAIRED TO PREVENT MOIST AIR FROM ENTERING WALL CAVITIES

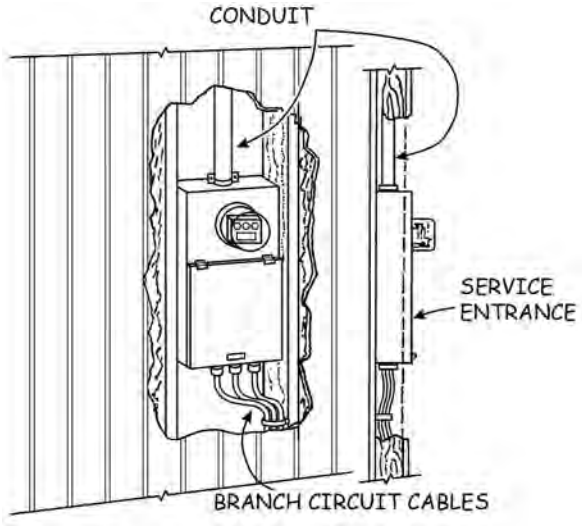
- **Electrical Wiring**
  - Look for evidence of substandard wiring in walls to be insulated.
  - Check at service entrance and subpanels.
  - Remove at least one cover plate on each wall, and check for evidence of unsafe wiring.
- **Unfeasible Wall Cavities**
  - Areas of wall weakness and electrical concerns:
    - Identify each location where it is unsafe to pressure-fill insulation.
    - Mark the cavity on the outside as being not safe to insulate.

- Describe location and explain reason for not insulating that cavity in the job paperwork.

- **Indoor Drill and Fill Precautions**
  - Cover furniture, appliances, electronic devices, etc. to protect them from dust.
  - Take all reasonable precautions to minimize generation of dust inside the home, and to capture dust that is created.
  - Drilling:
    - Place a means/mechanism beneath the drill to catch falling debris as the holes are drilled.
    - Vacuumed away dust as it occurs.
  - Filling:
    - Hole ID must match nozzle OD as closely as possible.
    - Wrap a cloth or other protective material around the nozzle to catch duct that blows out around the nozzle.
    - After each cavity fills, turn off the blower, and close the nozzle valve, before removing nozzle from the wall.
- **Mobile Home Requirements**
  - See Part 2: Mobile Home Criteria.

4. OUTDOOR PREPARATION

- **Vegetation**
  - Carefully tie back shrubs/bushes as needed to access bottoms of all wall cavities.
  - When a flower/plant garden is next to the home, make all feasible preparations to avoid damaging the plants (e.g., laying down planks to walk on, covering plants with plastic, etc.).
- **Ground Cover**
  - To catch debris, place a cover (plastic sheeting, tarps, etc.) over the ground, starting at the edge of the wall and extending outward at least 12'.
  - If not truck-mounted, place the blowing machine and bags of insulation on tarps.
- **Unfeasible Wall Cavities**
  - Areas of wall weakness and other concerns:
    - Identify each location where it is unsafe to pressure-fill insulation.
    - Mark the cavity as being not safe to insulate.
    - Describe location and explain reason for not insulating that cavity in the job paperwork.
- **Mobile Home Requirements**
  - See Part 2: Mobile Home Criteria.



5. OUTDOOR DRILLING RESTRICTIONS

- **Electrical Equipment**
  - Cavities containing service entrance, meter base, and/or distribution panel shall be drilled using a drill stop to prevent the bit from penetrating beyond the inside surface of the exterior sheathing.
- **Sheathing Restrictions**
  - The following shall not be drilled:
    - Asbestos shingles and siding.
    - Metal siding.
    - Vinyl siding.
    - Brick.
    - Stone.
    - Adobe.
    - Exposed surfaces of wood shingles.
      - It is acceptable to remove the outermost shingle, drill and patch the weather-protected surface below, and reinstall or replace the outer shingle.

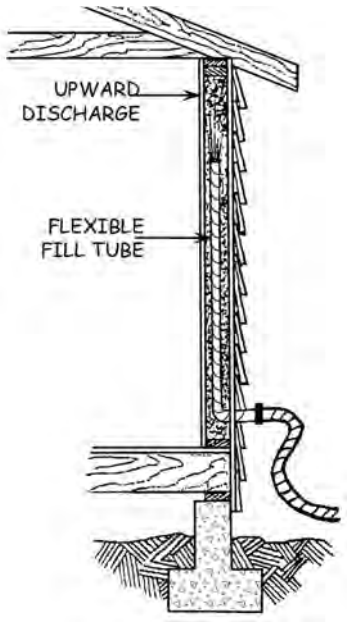
6. EQUIPMENT PREPARATION

- **Insulation Blower Setup**
  - On-site electrical supply for blower shall be verified to be adequate prior to beginning work.
  - If electrical supply is inadequate, a portable generator shall be used.
  - Blowing machine pressure test shall be performed with air on full, feed off, agitator running, and gate closed
  - Hose outlet pressure will be at least 80 IWC or 2.9 psi for cellulose insulation; for other types of dense pack insulation, check manufacturer's specification for blowing machine set-up.

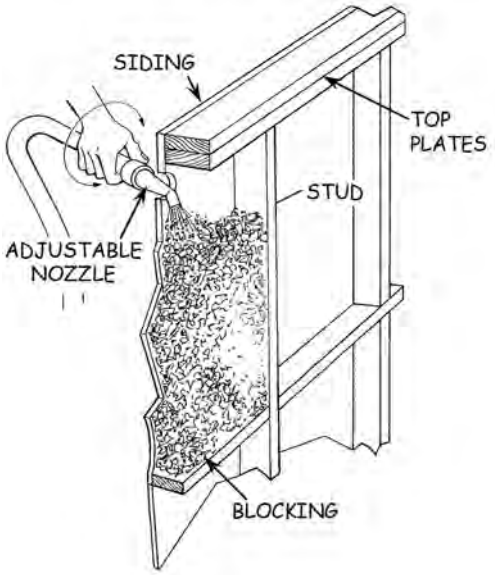
PRESSURE-FILL INSULATION REQUIREMENTS

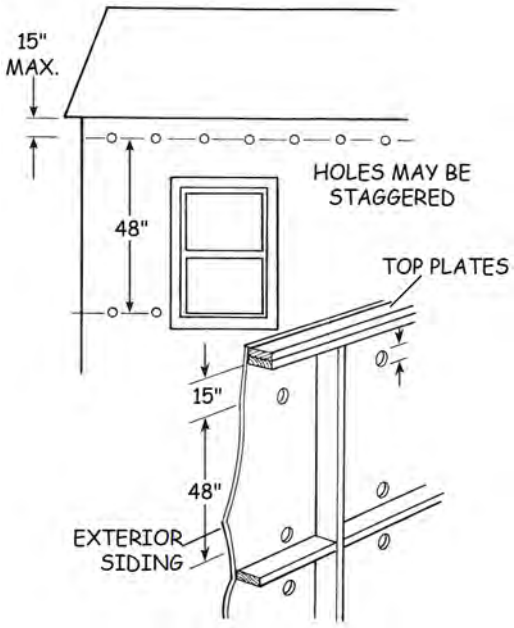
7. CONVENTIONAL HOME PRESSURE FILL METHODS

METHOD	REQUIREMENTS FOR APPROVED METHODS
Fill Tube Method	• Required when insulation travel must exceed nozzle-fill insulation travel maximums. • Top-fill and bottom-fill are equally acceptable, • All portions of all fillable cavities shall be completely filled. • Hole size shall be no more than 1/2" larger than fill tube OD. • Cavities shall be filled to required density, as prescribed by insulation manufacturer, to achieve required R-value. • Required R-value - As determined by Energy Audit, or - R-13 in 2-by-4 walls - R-19 in 2-b-6 walls • Dense Pack Requirements - Cellulose material shall be installed to a minimum density of 3.5 pounds at 50 pascals per cubic foot, as measured using BPI- 102 "Standard for Air Resistance of Thermal Insulation Used in Retrofit Cavity Applications – Material Specification" or ASTM C 522, E 283, or E 2178. - Loose fiberglass material shall be installed and will be specifically approved for airflow resistance to a minimum density of 1.5 to 2 pounds per cubic foot. - The number of bags installed will be confirmed and will match the number required on the coverage chart.



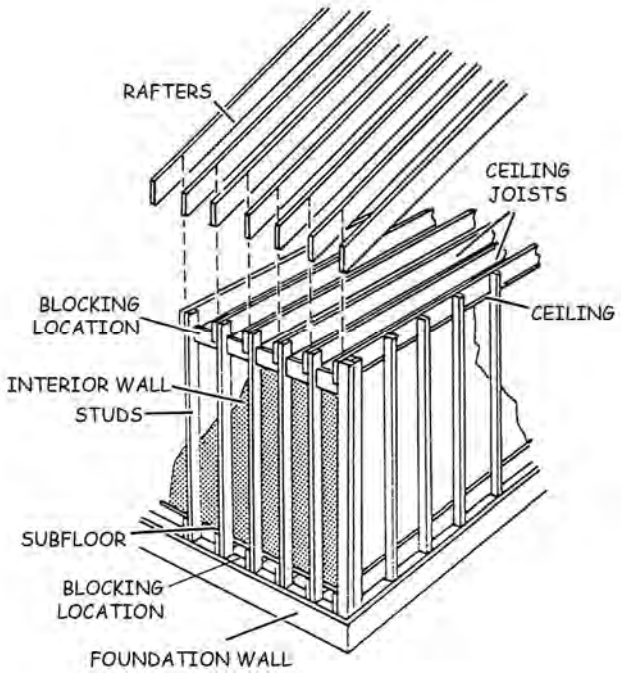
7. CONVENTIONAL HOME PRESSURE FILL METHODS (cont.)

METHOD	REQUIREMENTS FOR APPROVED METHODS
Nozzle-Fill Method	• All Materials - A directional nozzle shall be used to direct the flow of insulation. - *Exception*: A straight nozzle is allowed when, due to the characteristics of the blowing equipment, a higher density fill can be achieved with a straight nozzle than with a directional nozzle. - All portions of all fillable cavities shall be completely filled to required density, as prescribed by insulation manufacturer to achieve the required R-value. • Fill Hole Size - Holes shall be in conformance with manufacturer's specifications. • Insulation Travel Maximums - Downward 48". - Upward 15". • Minimum Cavity Size - All cavities large enough to be drilled shall be filled. • Required R-value - See Fill Tube Method above. 



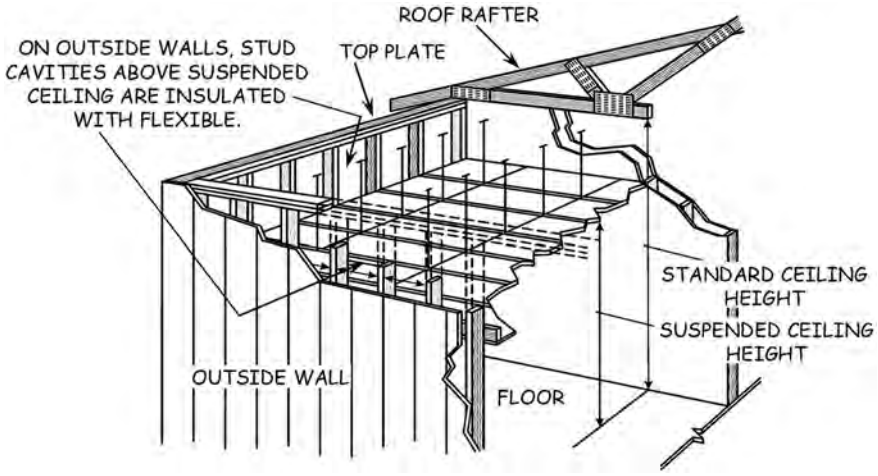
8. BALLOON FRAMED WALLS

- **Walls Without Bottom or Top Plates**
  - Cavities shall be blocked with flexible batt material:
    - At both top and bottom, prior to injecting insulation through the side of the wall.
    - At the bottom prior to injecting insulation by fill tube through the open top.
  - Bottom blocking shall be permanently secured to prevent insulation leakage.
- **Walls With Bottom Plate Only**
  - Cavities shall be blocked at the top with flexible batt material prior to injecting insulation through the side of the wall.



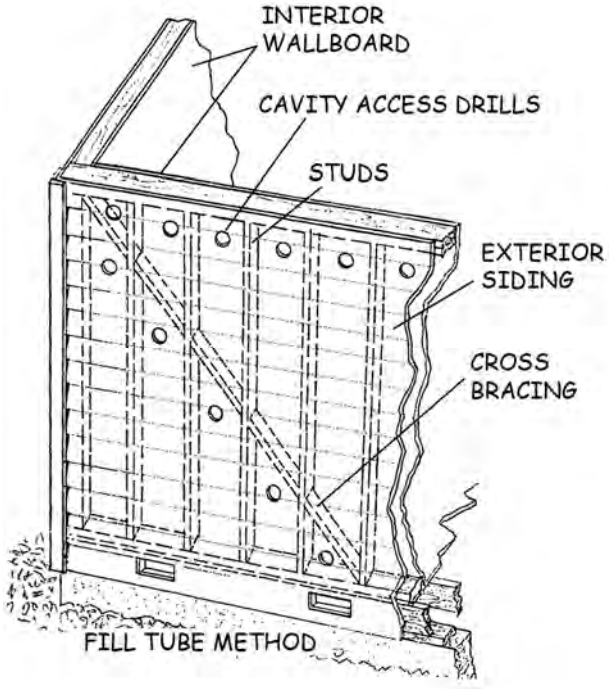
9. WALLS OPEN TO SUSPENDED CEILINGS

- **Walls Below Suspended Ceiling**
  - That portion of the wall extending from the floor to the suspended ceiling shall be insulated with loose fill material.
    - It is acceptable to fill cavities through the open top with a fill tube.
    - Cavities also may be filled through side holes, when blocked at suspended ceiling level to prevent loose fill from blowing onto the suspended ceiling.
- **Walls Above Suspended Ceiling**
  - That portion of the wall extending above uninsulated suspended ceiling shall be insulated with flexible batt material installed in conformance with this section.



10. CAVITIES CREATED BY FIRE BLOCKS AND BRACING

- **All Materials and Methods**
  - Holes shall be provided above and below all fire blocks and full dimension cross braces to ensure that all cavities are filled.
- **Nozzle Method**
  - A minimum of 2 holes are required for each cavity exceeding 63" in height.
- **Fill Tube Method**
  - A single hole may be drilled at the top or bottom of each cavity.

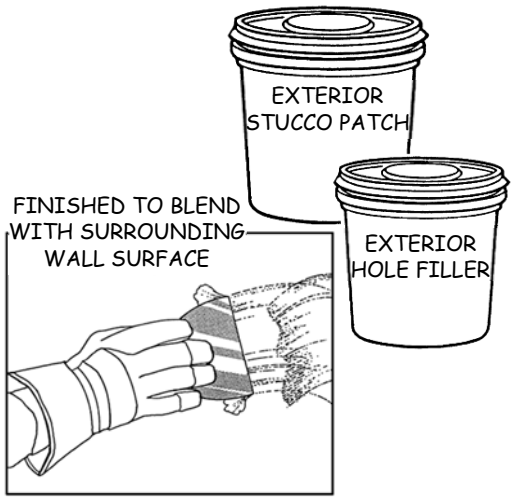


11. CAVITIES IN WALLS WITH WOOD SIDING

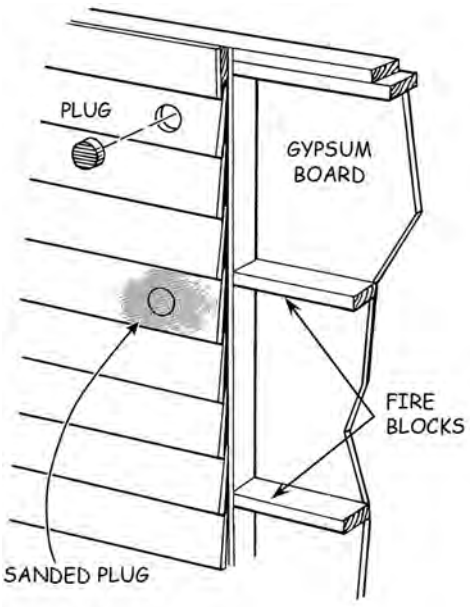
- **Access**
  - Cavities with T-111, OSB, or Plywood Siding
    - Access to exterior wall cavities will be gained and sheathing will be drilled as needed and probed to locate each cavity, wall studs, and blockers.
    - Drilled holes will be large enough to accommodate an appropriately sized fill tube.
    - Holes will be drilled around the perimeter of the home, parallel to the bottom plate and an equal distance apart.
    - The line of holes will be located under the lowest window sill when possible.
  - Cavities with Lap Siding
    - Course of siding will be unhooked or removed.
    - Holes sufficiently large for the fill tube will be drilled in every wall cavity.
- **Inspect**
  - Inspect the cavities to determine moisture damage, pests, wiring, obstructions, existing insulation, etc.

12. PRESSURE FILL HOLE FILLS AND PATCHING

- **Hole Plugs and Filler**
  - Materials shall be:
    - Appropriate for the application.
    - Exterior grade for all exterior applications.
    - Compatible with the surrounding material.
    - Installed in conformance with manufacturer's instructions.
    - Finished to blend with the surrounding wall surface.
  - Painted Exterior Walls
    - Filler/patch shall be sealed with an appropriate primer.
    - Application of a separate primer is not required when a program-approved, self-priming filler is used.



- **Stucco, Plaster, and Gypsum Walls**
  - Backing material shall be installed in each hole to control patch depth and isolate patch from insulation.
    - Backing shall be cork plugs, foam backer rod, or equivalent.
    - Patch depth shall conform to manufacturer's specifications.
  - Holes shall be patched and primed.
  - Holes in interior unpainted gypsum (e.g., garage walls):
    - Primer is not required for filler material.
    - Flush mount plastic plugs are allowed, when approved by the owner.



- **Wood Walls**
  - Painted Walls
    - Plugs shall be:
      - Made of wood or cork.
      - Recessed at least 1/8", or depth specified my filler manufacturer.
      - Covered with filler and primed.
  - Natural Finish Walls
    - Plugs are required and shall be:
      - Made of wood which is compatible with siding.
      - Installed flush with the siding or sanded flush.
      - Secured permanently with exterior grade adhesive.
      - Sealed against water damage.
  - Wood and Cork Plugs
    - Plugs shall not be vented.
    - Plugs shall be resistant to shrinkage and expansion.

13. PRESSURE FILL HOLES IN SHEATHING, FACING, AND TRIM

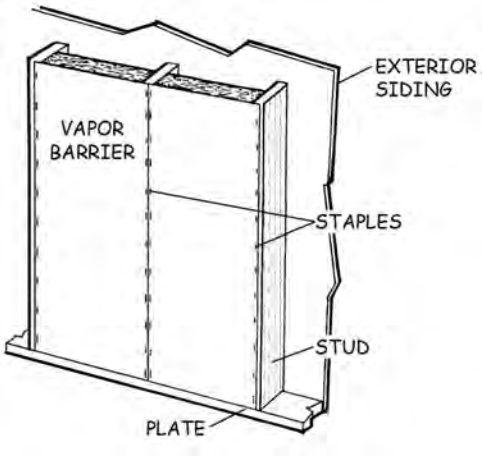
- **Sheathing**
  - When siding is removed, all breaches in moisture barrier shall be patched.
  - Patching material shall have equivalent perm rating.
  - Holes will be plugged and sealed.
- **T-111 and Equivalent Siding**
  - A primed trim board will be centered and installed over the holes.
  - Height of the trim will span from 1” above to 1” below the hole.
  - A continuous caulk seal will be applied between the trim and siding.
  - Caulk seal will be above the holes.
  - Top edge of the trim will be sealed to the siding with a continuous caulk seal.
- **Lap Siding**
  - Siding will be reattached without bulges or wrinkles.
  - Siding will be hooked into the original position.
- **Fill Holes in Facing and Trim**
  - Holes shall never be drilled in shutters, facing, or trim.

14. POST-INSTALLATION REQUIREMENTS

- **See Part 4: Measure-Specific Post-Installation Requirements.**

UNFINISHED FRAMED WALLS—ABOVE GRADE

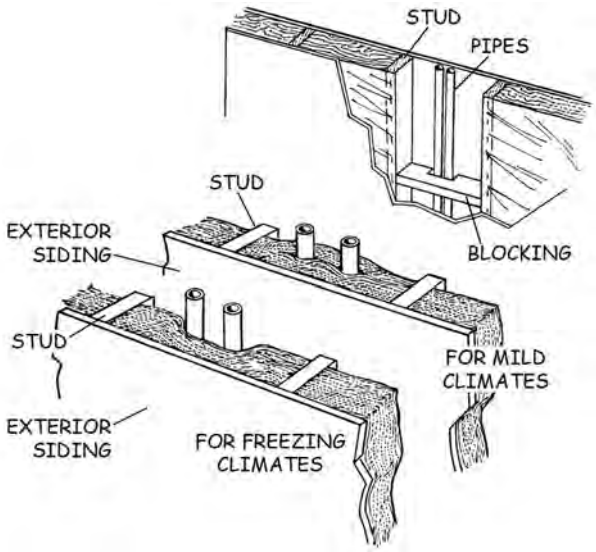
15. FLEXIBLE & RIGID MINERAL FIBER, AND RIGID FOAM



- **R-Value**
  - As determined by Energy Audit, or
  - R-13 in 2-by-4 walls
  - R-19 in 2-by-6 walls
- **Placement And Attachment**
  - Batts shall completely fill each cavity.
  - Friction batts are acceptable to install without staples.
  - Batts with stapling flange shall be face stapled.
  - Batts shall not be compressed.
  - After installing batt insulation in this application, it is not required to install drywall *unless* required by local jurisdiction.

16. VAPOR BARRIER

- **Placement**
  - Vapor barrier shall be placed on the winter warm side when required by the local jurisdiction.



17. INSULATION OF SMALL CAVITIES

- **Flexible and Rigid Mineral Fiber and Rigid Foam**
  - All cavities around windows and doors shall be insulated.
  - Insulation shall be cut to fit snugly without compression.
  - Cavities containing sash weights shall not be insulated.

18. INSULATION AROUND PIPES

- **Flexible and Rigid Mineral Fiber and Rigid Foam**
  - Pipes shall not be isolated from the heated side.
  - In locations without freezing temperatures, pipes may be surrounded with insulation.
  - In locations with freezing temperatures, insulation shall be placed between pipes and cold side.
  - Locations with freezing temperatures are those with winter design temperature listed at or below 32°F in the California Energy Commission Residential Manual or per ASHRAE.

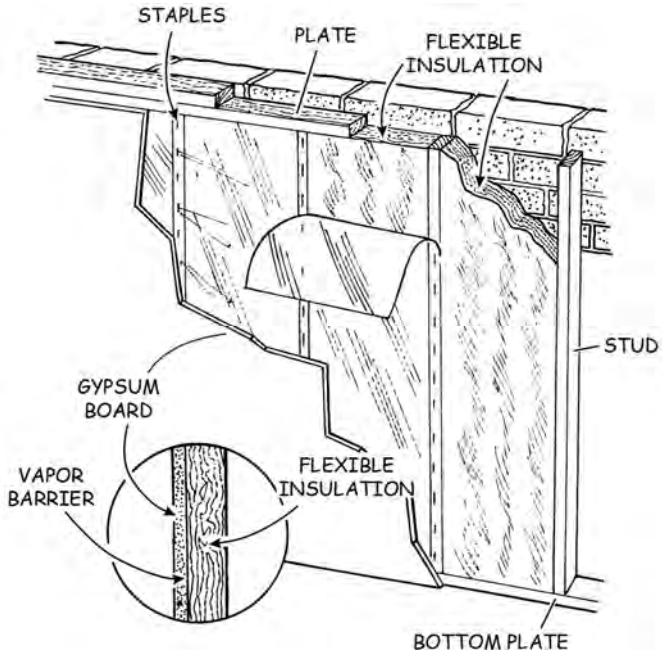
19. POST-INSTALLATION REQUIREMENTS

- **See Part 4: Measure-Specific Post-Installation Requirements.**

UNFINISHED WALLS—BELOW GRADE

20. VAPOR BARRIER

- **Below-Grade Walls (Heated Basement, etc.)**
  - Placement of vapor barrier shall:
    - Be determined by site-specific analysis of factors governing moisture migration.
    - Be in conformance with the local jurisdiction.



21. POST-INSTALLATION REQUIREMENTS

- **See Part 4: Measure-Specific Post-Installation Requirements.**

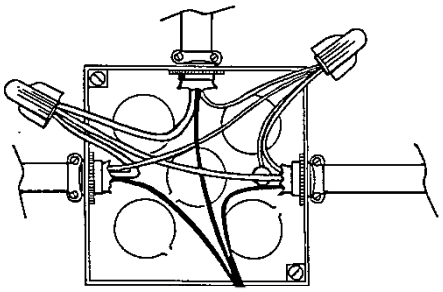
PART 2: MOBILE HOME CRITERIA

22. MOBILE HOME WALL TYPES

- **Wood Siding**
  - Follow applicable criteria in Part 1: Installation Requirements for Conventional Homes.
- **Metal Siding**
  - Installation shall be attempted only when depth of the stud cavity allows for installation of new 3.5″ thick high density fiberglass blankets/batts.
  - See assessment criteria in the CSD Field Guide Appendix D for instructions on proper assessment of wall cavities.
  - Until it has been determined that wall insulation is feasible for the mobile home, siding removal shall be limited to that which is necessary to establish feasibility.
    - Mobile homes built after 1976 have 3.5" thick wall studs, which can accept retrofit 3.5" thick batts.
    - Pre-1976 mobile homes *may* have 2.5" thick wall studs and/or ventilated metal siding.
      - Shall not be insulated when ventilated metal siding is present
      - When installed, new insulation will be compressed to less than R-13.
      - Existing insulation shall be removed only when necessary to allow for installation of new high-density batts.
    - Very old mobile homes may have 1.5" thick studs and/or ventilated metal siding—retrofit wall insulation is not feasible.

23. MOBILE HOME PREPARATION

- **General Requirements**
  - All applicable criteria in Items 1 and 2 shall be followed.
  - Cavities shall be free of hazards, intact, and able to support dense pack pressures.
  - Drilling hazards (e.g., wiring, venting, fuel piping) shall be identified.
  - Problems will be corrected before work begins.
- **Electrical Wiring Verification**
  - To the extent possible, inspect for unsafe wiring before removing metal siding beyond what is needed for inspection/evaluation, and before removing existing insulation (when doing so is necessary to install new insulation).



CHECK FOR ELECTRICAL WIRING AND BOXES THAT CAN PREVENT INSERTION OF NEW FIBERGLASS BATTS

23. MOBILE HOME PREPARATION (cont.)

- **Electrical Wiring Verification (cont.)**
  - Indoors: Remove at least one receptacle and one switch cover plate on each wall.
    - Inspect wiring for loose connections, faulty conductors, or other unsafe conditions.
    - Leave cover plates off until new insulation has been installed.
  - Outdoors:
    - Remove a sufficient number of fasteners to allow for inspection per Item 25.
    - Inspect wiring by pulling back siding and pushing existing insulation out of the way from below.
    - If the cavity will be insulated, leave fasteners out.
    - If cavity cannot feasibly be insulated, install new fasteners to secure the siding (pre-existing screws are not reinstalled).
  - If there is evidence of unsafe or hazardous wiring:
    - Do not install new insulation in that cavity, *and* do not remove existing insulation (when doing so is necessary to install new insulation).
    - Mark the cavity on the outside as being not safe to insulate.
    - Explain reason for not insulating that cavity in the job paperwork.
- **Indoor Preparation for Mobile Home Insulation**
  - After obtaining client's permission, move furniture as needed to access the interior side of all walls to be insulated.
  - It is not necessary to move furniture that:
    - Is heavy and very difficult to move.
    - Contains delicate belongings (e.g., a china hutch), unless the client removes the items that could be easily damaged.
  - Mask areas that may cause dust to spread on the interior.
  - Remove wall hangings and nails, screws, hooks, etc. that penetrate wall paneling.
  - Inspect all paneling and trim to make sure they are securely fastened to the wall.
    - Drive home any loose nails and screws.
    - Identify any areas of weakness, where care must be taken while installing insulation.
    - Identify each location where it is unsafe to install insulation.
      - Mark the cavity on the outside as being not safe to insulate.
      - Describe location and explain reason for not insulating that cavity in the job paperwork.
      - Caulk cracks and small holes, including plumbing and electrical penetrations, and repair large holes in interior surfaces, to prevent indoor air from entering the wall cavity.

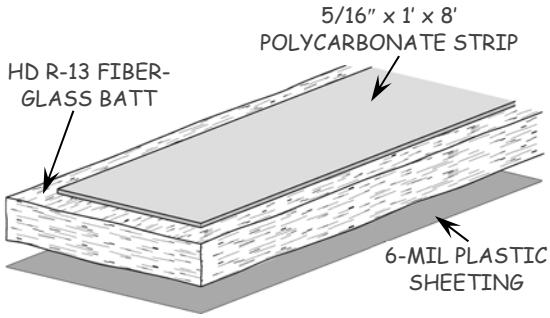
AFTER NAILS/SCREWS REMOVED, CRACKS AND HOLES CAULKED/REPAIRED TO PREVENT MOIST AIR FROM ENTERING WALL CAVITIES

  - Electrical Boxes (Switch and Receptacle)
    - Determine if they can be easily removed, and remove them if feasible, until after insulation has been installed.
    - Remove screws from the boxes, and pull the boxes temporarily out of the wall, so they will not obstruct batt stuffing.
    - Do not remove boxes that cannot be re-installed and securely re-fastened.
- **Blocking**
  - Blocking shall be installed around:
    - All openings to inside of the crawlspace and basement for fibrous material.
    - High temperature fire-rated materials.
    - Wiring and electrical hazards.
    - Heat-producing devices.

- **Blowing**
  - Electricity supply will be confirmed and will support blowing machine power demand.
  - Blowing machine pressure test will be performed with air on highest level, feed off, and gate closed.
  - Hose outlet pressure will be at least 80 IWC or 2.9 psi for cellulose insulation; for other types of dense pack insulation, check manufacturer specification for blowing machine set up.
- **Outdoor Preparation for Mobile Home Insulation**
  - Accessing Wall Cavities
    - Access to exterior wall cavities will be gained; sheathing will be drilled as needed and probed to locate each cavity, wall studs, and blockers.
    - When accessing wall cavities, the interior will be masked to control dust during drilling.
  - Carefully tie back shrubs/bushes as needed to access bottoms of all wall cavities.
  - When a flower/plant garden is next to the mobile home, make all feasible preparations to avoid damaging plants (e.g., laying down planks to walk on, covering plants with plastic, etc.
  - When outdoor steps for an entrance door interfere with siding access, temporarily remove the steps, if permission is given by the client.
  - If a deck or other obstruction prevents access to any siding panels:
    - Bypass those panels, and
    - Describe location and explain reason for not insulating those cavities in the job paperwork.
  - To catch debris, place a cover (plastic sheeting, tarps, etc.) over the ground, starting at the edge of the skirting and extending outward at least 12'.
  - If not truck-mounted, place the blowing machine and bags of insulation on tarps.

24. MOBILE HOME INSTALLATION METHODS

- **Wall Cavity Pressure-Fill Methods**
  - Follow applicable criteria in Part 1: Installation Requirements for Conventional Homes.
  - Install only fiberglass blowing wool.
- **Dense Packing**
  - Using fill tube, 100% of each cavity will be filled to a consistent density:
    - Blown fiberglass, mineral fiber, or spray foam used in an enclosed cavity will be installed at or above the manufacturer recommended density to limit air flow that corresponds to an air permeance value of 3.5 cubic feet per minute per square foot at 50 Pascals.
    - Cellulose material will be installed to a minimum density of 3.5 pounds per cubic foot when the wall sheathing and interior cladding will endure this level of pressure.
    - Loose fiberglass material will be installed and will be specifically approved for air flow resistance to a minimum density in accordance with manufacturer specifications.
    - The number of bags installed will be confirmed and will match the number to achieve 1.5–1.6 pounds per cubic foot.
    - Insulation will be verified to prevent visible air movement using chemical smoke at 50 Pascals of pressure difference.
- **Batt "Stuffing" Method**
  - Installs high-density R-13 fiberglass blankets (or minimum 8-foot-long batts), sized for 16" OC (or actual stud spacing, if different).
  - Stuffing Tool: Fabricate a stuffing tool (used to push the fiberglass insulation into an enclosed wall cavity).
    - Made with a strip of sturdy, flexible material, such as:
      - Polycarbonate (e.g., Lexan), or
      - Galvanized metal, 20 gage.
    - Dimensions:
      - 1' wide by 8' long for full-length cavities

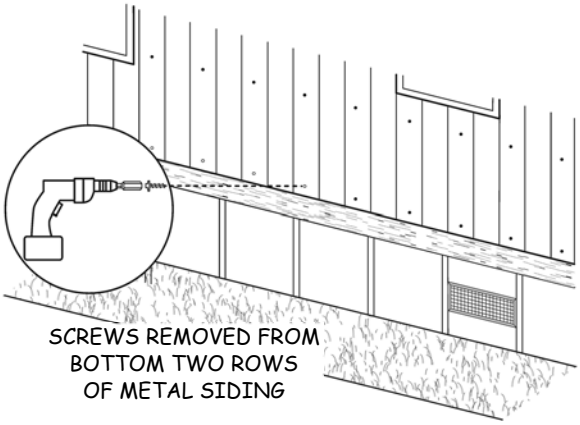


BATT STUFFING METHOD = FIBERGLASS BATT OVER PLASTIC SHEET, AND POLYCARBONATE STRIP ON TOP

- 1' wide by 4' long for shorter cavities (under windows, etc.).
- Thickness: Approximately 5/16" plastic or 20 gage metal.
- Bent at a slight angle 7 ½″ to 12″ from one end.
  - For plastic, apply indirect heat at bend location to achieve the angle.
  - Bent end should be at a 5° to 15° angle, to help clear obstructions inside the wall cavity.

25. REMOVAL OF FASTENERS

- **Access Bottom of Metal Siding—Vertical Panels**
  - Remove metal siding fasteners (to facilitate pulling the bottom 4' of each siding panel away from the framing).
    - Remove bottom two rows of screws.
    - When full-length panels are secured to framing with staples (approximately 4' up the wall cavity), also remove staples with long pry bar.
  - Fasten adjacent panels together at the bottom with one 1/2" sheet metal screw on each side.
    - These screws keep panels from pulling apart sideways when they are pried away from the framing to insert insulation.
    - Especially important for interlocking panels.

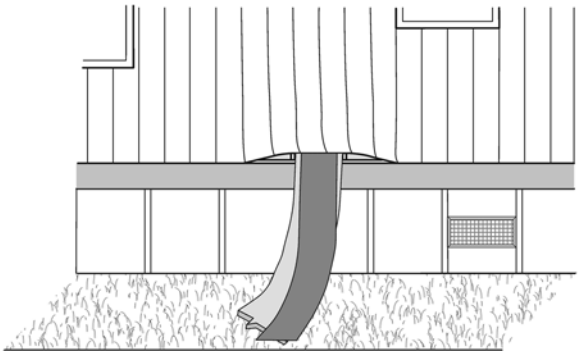


  - Remove perimeter flashing (fascia strip) below bottom of siding.
    - Remove the flashing if it is secured with screws removed from the bottom of siding panels, and if removal is necessary to facilitate installation of new insulation batts.
    - If removed, mark each piece so it can be replaced in the location from which it was removed.
- **Access Bottom of Metal Siding—Horizontal Panels**
  - Remove the bottom section of siding to gain access to the wall cavities.
  - If subsheathing is present under the siding, access through the subsheathing will be required.
- **Examine Wall Cavities**
  - Before installing new insulation, inspect the interior of each wall cavity for damage, deterioration, obstructions, and inadequate accessibility.
  - If framing and paneling are intact, and electrical wiring or water pipes do not pose a problem, proceed with insulation procedure.
  - All interior surfaces of exterior walls will be inspected for loose paneling joints, occupant wall hangings, location of switches and outlets, and other wall obstructions.
  - Objects will be removed from the interior surfaces of the walls being insulated.
  - Interior paneling will be repaired as necessary.
  - If a condition in the wall cavity makes it unsafe or unfeasible to safely and properly install new batts:
    - Bypass that cavity, and
    - Describe location and explain reason for not insulating it in the job paperwork.

26. INSTALLATION OF NEW BLANKET/BATT

- **Blanket/Batt Insertion**
  - Insulation Length: 8" longer than the height of the cavity being stuffed.
  - Thickness: Thickness of the batt will fill the void without deforming siding or damaging structure.
  - A poly-encased fiberglass batt may be used in place of the fiberglass batt and membrane assembly.

- The membrane will be installed in contact with the side of the wall that is compatible with the local climate zone.
- Plastic sheeting:
  - Cut the plastic sheeting 2" wider than the cavity and 1' longer than the batt (it is required to facilitate sliding the batts up into the wall cavities).
  - Place the blanket/batt on top of the plastic strip.
- Place the appropriate-length stuffing tool on top of the batt, angled end facing upward.
- Fold the first 6" of plastic strip and fiberglass batt over the angled end of the stuffing tool.
- Pull the metal siding and existing insulation outward and away from wall framing.
- Put the side of the batt with plastic sheeting against the interior paneling (stuffing tool is on the outer surface of the batt).
- Using the stuffing tool to push the batt upward:
  - Stuff the insulation into the wall cavity all the way to the top.
  - Existing insulation should be compressed against the siding as the new batt is pushed upward.
  - If obstructions impede movement, work the tool to get past them.
- After batt reaches the top of the cavity, pull the stuffing tool back down and out of the wall.



METAL SIDING PULLED AWAY FROM FRAME, AND STUFFING TOOL USED TO PUSH FIBERGLASS BATT ALL THE WAY TO TOP OF WALL CAVITY

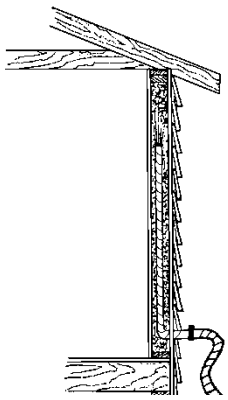
- Allow the extra length of batt to hang below the siding, to identify cavities that have been stuffed. (Do not stuff bottom ends of batts into wall cavities until after all cavities have been insulated.)
- Repeat the stuffing procedure for each accessible cavity.

- **Pressure-Fill Limited Access Cavities**
  - Follow procedures outlined in Item 27.
- **Interior Observation**
  - As insulation is stuffed into a cavity, or the cavity is pressure-filled, the location must be observed from the inside, so appropriate action can be taken if paneling is being bulged out or pushed loose.
- **Wall Closure After Insulation Is Completed**
  - At each wall cavity where extra length of batt is hanging below the siding, push the batt into the bottom of the wall cavity, to fill and insulate it.
  - Press siding panels back into place, making sure they interlock as designed.
  - Replace perimeter flashing (fascia strip), if removed.
  - Install new screws in all screw locations to tightly secure the panels in place. (The original screws are not reused.)
  - Siding will be reattached without bulges or wrinkles.

27. PRESSURE-FILL FOR LIMITED-ACCESS LOCATIONS

- **Purpose**
  - To fill cavities in which batt stuffing is not feasible (too narrow, obstructed, or inaccessible), such as:
    - Cavities near corners and doors, where siding is difficult to loosen and pull back.
    - Cavities that are particularly tight due to belt rails, wiring, and other obstructions.
- **Procedure**
  - If skirting overlaps siding, remove skirting.
  - Loosen the bottom of the wall panel(s) enough for fill tube access.

- Temporary fasteners will be installed near the bottom of the siding panels at the seams.
- If subsheathing is present under the siding, access through the subsheathing will be required.
- Insert a fill tube up to the top of the cavity.
  - Position the tube so its natural curvature presses the top of its angle-cut tip against the interior paneling.
  - If the tube hits a belt rail or other obstruction, twist the tube slightly to help get it past the obstruction.
- If the wall cavity is known to contain electrical wiring or plumbing, care must be taken to avoid snagging the tube or causing damage.
- Place a short piece of batt to block the bottom of the panel access and prevent loose-fill from blowing out.
- Carefully pressure-fill the wall cavity, using less pressure than for conventional home wall cavity fill.
- Insulation will be installed to a density of 1.5 to-1.6 pounds per cubic foot.



FILL TUBE PUSHED TO TOP OF CAVITY, THEN SLOWLY PULLED OUT AS CAVITY FILLS

- Using fill tube, 100% of each cavity will be filled to a consistent density.
- An observer must be stationed indoors during the filling process, to watch for paneling bulges and loosening of the edges/trim.
- Draw the fill tube downward about 6" at a time when:
  - The blower fan slows down due to back-pressure, and/or
  - Insulation flow through the hose slows down, and/or
  - There is slight bulging of the exterior siding or interior paneling.
- Immediately turn off the blower or withdraw the tube, if insulation flow stops and/or excessive bulging occurs.
- Special precaution will be taken not to overfill the bottom of the cavity.
- Fill tube will be inserted from the bottom of the wall cavity within 6” of the top of the cavity between the interior paneling and any existing insulation.
- Subsheathing will be patched or repaired as necessary.
- If skirting was removed, skirting will be reinstalled to shed water to the outside of the skirting
- Avoid over-filling the bottom of the cavity, and stuff in the blocking batt to insulate that area.
- Remove any loose fill from outer edges of the studs before re-securing metal siding to them.
- Siding will be reattached with new fasteners.
- Siding will be reattached without bulges or wrinkles.

28. LIMITED ACCESS PROCEDURES

- **Cavities with Electrical Wiring and Plumbing**
  - Insulate the cavity only when wiring and plumbing defects are *not* present.
  - Take appropriate precautions to avoid damaging wiring or piping.
- **Cavities with Window, Fan, or Other Obstruction**
  - Stuff insulation up to the obstruction.
  - When the bottom of siding panels above a window/obstruction can be accessed (screws removed and paneling pulled away) *without* removing the window/obstruction, fill those cavities the same as siding panels accessed from floor level.
  - When siding panels above a window /obstruction cannot feasibly accessed from the bottom:
    - Remove screws at the top of the panels.
    - Remove drip edge and/or other components as needed to access the cavities from the top.
    - Pull back the panels, and stuff batts downward to fill the cavities.
    - Reinstall components that were removed.
    - Secure siding and components with new screws that are longer and thicker than the original screws.
    - Apply sealant as needed to ensure a watertight seal in all seams/joints/screws where components were removed and replaced.

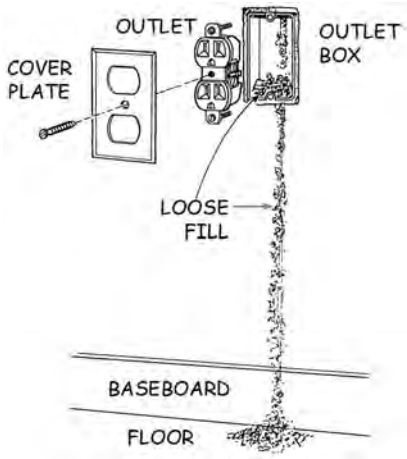
PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

29. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.
- **Whole-Building Measure**
  - To install wall insulation, access to every unit within the multi-family building must be obtained.
  - Wall locations to be insulated shall be determined by whole building energy audit or priority table, by climate zone.
- **Single-story and Two-story Buildings**
  - See Part 1: Installation Requirements for Conventional Homes.
- **Buildings of 3-Stories or Higher**
  - Wall insulation shall be installed from the building interior only.
  - See Part 1: Installation Requirements for Conventional Homes (methods for interior installation only).

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

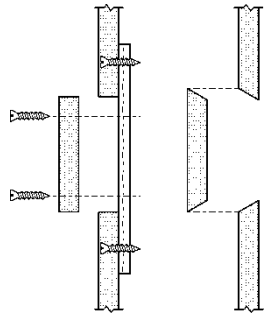
30. QUALITY OF INSTALLATION—ALL HOMES



- **Pressure-Fill Insulation**
  - Completed wall insulation cavities shall be confirmed to have an even level of insulation at the prescribed R-value in conformance with the CSD Field Guide.
  - During installation, the interior of the home shall be re-checked for accidental leakage of insulation material.
  - During and after installation, a representative sample of utility switch/outlet boxes shall be checked for loose fill.
  - If loose fill insulation is found, check all accessible boxes and remove the insulation.
  - The interior of the home shall be checked for wall damage and for insulation inside the home.
  - All damage, interior and exterior, shall be repaired.
  - Interior closets and cupboards shall be checked for loose fill material.
  - All loose fill material accidentally blown into the home shall be removed.
  - Any interior damage (e.g., walls, cupboards) caused by insulating shall be repaired.
  - Electrical cover plates:
    - Those removed for inspection shall be reinstalled.
    - Any cover plates damaged or broken shall be replaced.
- **Dense Pack Verification**
  - The number of bags installed shall be confirmed and shall match the number required on the coverage chart.
  - Insulation density shall be verified by bag count, core sampling, or infrared camera (when equipment is approved by CSD) with the blower door at 50 pascals to prevent visible air movement using chemical smoke at 50 pascals of pressure difference.
  - Any voids or low density areas shall be drilled and re-packed.

31. QUALITY OF INSTALLATION—MOBILE HOMES

- **Inspect Paneling and Trim**
  - Ensure all paneling and trim are in place and properly secured.
  - Drive in loose nails and screws used to hold the materials in place.
  - Replace with longer nails/screws, if existing anchors do not properly secure the materials.
- **Replace indoor items moved before insulating, including:**
  - Wall hangings and nails, screws, or hooks.
  - Electrical boxes and cover plates.
- **Patch Inspection Holes**
  - If an inspection hole was cut to examine wall depth and insulation thickness, close it using a technique such as one of the following:
    - Reinstall the removed piece, secure it in place (e.g., with a wood strip attached to the back of it with small screws), and seal with compatible caulk.
    - Cover the hole with compatible material (e.g., similar paneling), secure it in place with small screws, and seal with caulk (applied to the back of the cover before it's installed, or around the perimeter afterward).



HOLES CUT FOR CAVITY INSPEC TION ARE COVERED AND SEALED

32. CLEAN-UP REQUIREMENTS

- **All Units**
  - Upon completion, the residence shall be returned to its original condition and left free of job-related dust and debris, inside and out.
  - A HEPA vacuum shall be used when mineral fiber insulation is installed (fiberglass or rock wool) and all other insulations.
- **Access Inside the Living Space**
  - All areas between an indoor access and home entrance shall be vacuumed.
  - The area between the home entrance and the insulation truck shall be cleaned (swept or vacuumed).
- **Access Outside the Living Space**
  - All areas between the access and the insulation truck shall be cleaned (swept or vacuumed).

33. RETURN DWELLING TO ORIGINAL STATE—ALL HOMES

- **Indoors**
  - Remove coverings (e.g., plastic sheeting) from furniture, appliances, electronic devices, etc.
  - Remove scraps and debris, and vacuum clean all areas affected by the insulation process.
  - Return to their original position household furnishings moved to perform the job.
- **Outdoors**
  - Untie bushes, etc., and return them to their original condition.
  - Remove plastic covers from plants and walking planks from garden beds.
  - For mobile homes, replace outdoor steps, etc. moved to gain access to siding.
  - Clean-up work site—remove:
    - All leftover insulation, packaging materials, plastic sheeting, insulation scraps, and debris.
    - Ground covers/tarps, and all tools and equipment.
  - All clean-up materials, including scraps, debris, duct, etc., shall be removed from the premises.

34. INSULATION CERTIFICATE

- **Required Documentation**
  - Manufacturer's information, and total installed R-value, shall be documented in the posted Insulation Certificate (CSD 610 Form).
  - In accordance with Title 24, when insulation is installed (ceiling, wall, or floor), completion of the insulation certificate (CSD 610 Form) shall be required and a copy provided to the client.
  - The certificate shall be completed and signed by the contractor responsible for installing the insulation. The manufacturer, brand, R-value, etc. Of the insulation installed in the roof/ ceiling, walls, floor and slab edge are documented. The installer also verifies compliance with the applicable mandatory measures (i.e. Infiltration and exfiltration) for the building envelope.

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NOTES

FURNACE—CENTRAL FORCED AIR

Lead Paint Risk Factor
LOW

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FURNACE—CENTRAL FORCED AIR

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

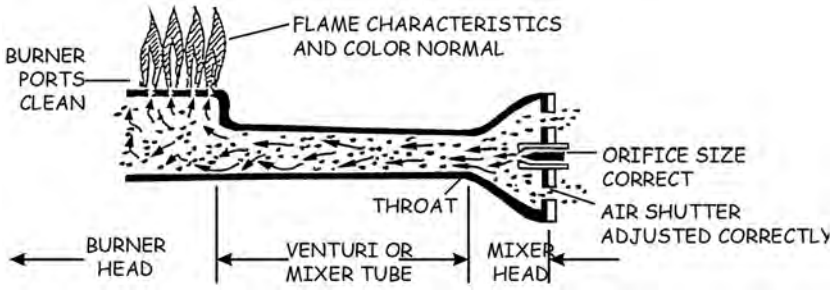
1. DOCUMENTATION REQUIREMENTS

- **All Appliance Repairs and Replacements**
  - Following the assessment by an agency assessor, combustion appliance operational or safety issues with an existing appliance shall be diagnosed by a qualified technician and fully described in writing for the agency before any repair or replacement work shall be allowed. The agency also shall accept or decline this scope of work in writing. These additional documents shall become part of the assessment record.

FURNACE REPAIRS

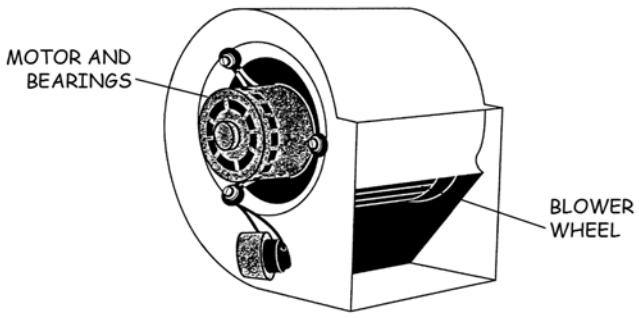
2. PRE-CAS TESTING

- **Pre-CAS Testing shall identify combustion appliance operational defects, as defined in the CSD Field Guide Appendix A (CAS Protocol).**
- **Checks for Combustion Problems**
  - The furnace shall be checked for evidence of all CAS Hazards and CAS Fails, such as those listed in the CSD Field Guide Appendix A. All identified and necessary corrections shall be made when within the scope of the weatherization program.



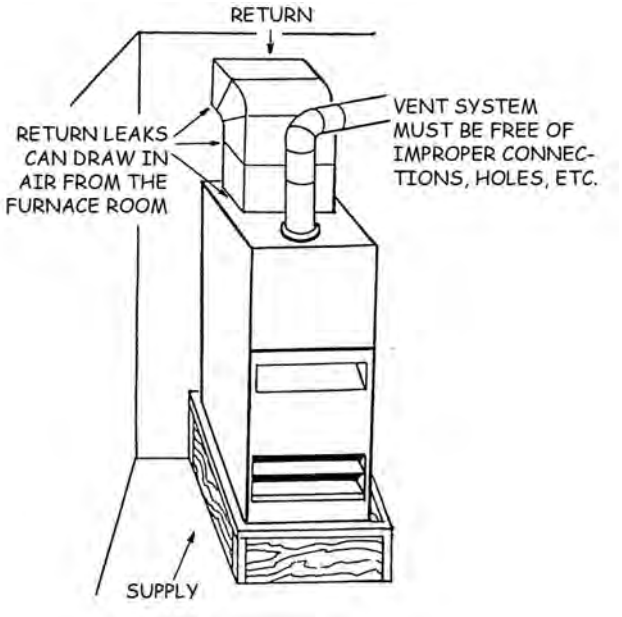
3. OTHER REPAIRS

- **The scope of repairs must also take into consideration, but are not limited to, the following operational repairs:**
  - Heating Unit Integrity
    - Loose items shall be tightened (e.g., screws, bolts, panels, etc.).
    - Missing/damaged components critical to proper operation shall be replaced/repaired (e.g., access doors, roll-out shield, etc.).
    - Improper alterations that adversely affect unit operation shall be corrected.
  - Appliance Filter(s)
    - Dirty, defective, or missing furnace filter shall be corrected.
    - Improperly supported filter shall be properly supported to prevent being drawn toward the air handler, per CSD WIS Section 28 (Air Filters).
  - Blower Chamber
    - Dirty blower chamber and fan blades shall be cleaned and bearings shall be lubricated.
    - Bearings in need of repair shall be replaced.
  - Evaporator Coil Box
    - Dirty or damaged evaporator coil shall be cleaned or repaired.
    - Air leaks at plumbing or wiring penetrations shall be sealed (i.e., with cork tape).



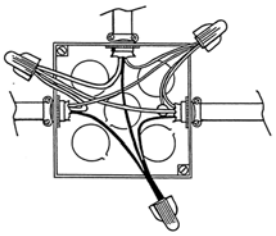
4. RETURN AND SUPPLY

- **Duct System Testing**
  - See CSD Field Guide Appendix B (Duct Leakage Test Protocol).
- **Duct System Sealing**
  - See CSD WIS Section 6 (Duct System Repair and Sealing).
  - Return leaks in plenum/cabinet/duct that could draw in combustion products or other pollutants shall be repaired as Duct Sealing.
  - Furnace-to-floor/plenum gaps/leaks shall be sealed.



5. APPLIANCE ELECTRICAL SYSTEM

- **All Units**
  - Electrical disconnection or defects shall be repaired (e.g., frayed or burned wires, loose or improper connections, etc.).
- **Wiring splices shall be:**
  - Located in junction boxes.
  - Secured with pressure splicing connectors (e.g., wire nuts).
- **Aluminum-to-Copper Wiring Splices**
  - Shall not be made *unless:*
    - Splicing connectors used are identified for that purpose, and
    - Conditions of use are met (e.g., application of antioxidant).



SPLICES IN JUNCTION BOX SECURED WITH WIRE NUTS

ANTIOXIDANT AND ELECTRICIAN'S TAPE

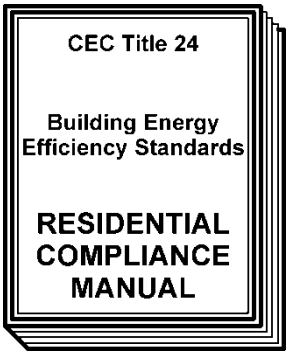
6. THERMOSTATS AND CONTROLS

- **Wall thermostat shall function properly:**
  - Anticipator shall be correctly set to 24-volt heating control circuit amperage, when applicable.
  - Wiring connections shall be correct and tight.
  - Unit shall be level and securely installed.
- **Furnace Controls**
  - Controls, including limit switch and blower fan switch, shall operate in accordance with manufacturer's specifications.
  - Improperly adjusted controls shall be corrected.
- **Power switches shall function properly, including:**
  - Blower access lockout/safety switch.
  - Switch controlling power to the unit (disconnect).
  - Blower speed control switch.

FURNACE (CENTRAL) INSTALLATION

7. GENERAL REQUIREMENTS

- **All Installations**
  - Installation shall be in compliance with:
    - Manufacturer's instructions and specifications.
    - Current California Electrical Code (CEC) and California Mechanical Code (CMC).
    - Local building code and Title 24 regulations regarding air distribution system, seismic precautions, zoning, noise abatement, access, etc. (See http://www.energy.ca.gov/title24/.)



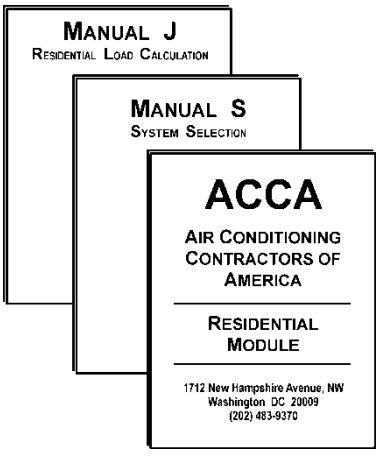
- **Equipment**
  - Equipment selection shall be made in accordance with ANSI/ACCA Manual S and manufacturer specifications; and CSD WIS Appendix A (Material Specifications).

8. TITLE 24 REQUIREMENTS[1]

- **The following Title 24 HVAC requirements[2] must be met and verified by a HERS Rater when applicable:**
  - Duct Leakage Verification (all climate zones)
    - In all climate zones, when a package unit, air handler, A/C condenser, A/C evaporator coil, heating coil, furnace heat exchanger or more than 40' of ducts in unconditioned space are replaced, duct leakage must be verified by a HERS rater by one of the CEC-approved methods.
  - Refrigerant Charge Measurement (CEC Climate Zones 2 and 8–15)
    - When new or replacement air conditioner or heat pump is installed, or when the condenser coil or a refrigerant-containing component is installed, correct refrigerant charge must be measured by the installer and verified by a HERS Rater in CEC Climate Zones 2 and 8–15.
  - Minimum Airflow and Maximum Fan Wattage
    - In all climate zones, when an entirely new space-conditioning system is installed (all equipment and ducts replaced) or 75% of the duct system is replaced, minimum airflow and maximum fan watt draw must be verified.

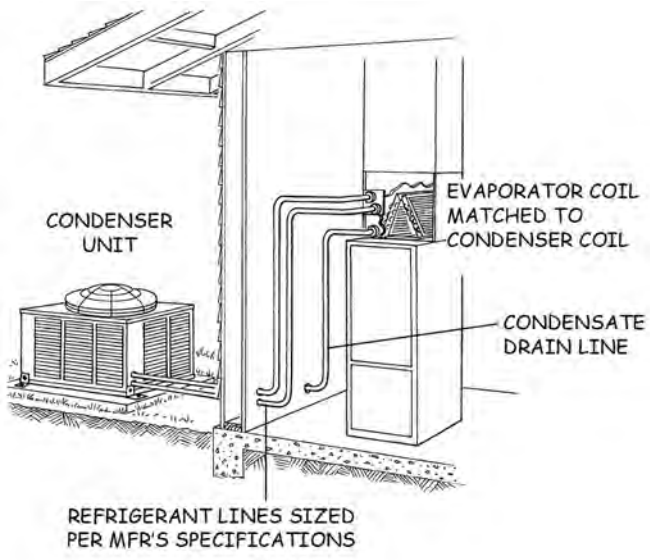
9. SYSTEM DESIGN AND PERFORMANCE

- **All Installations**
  - Unit shall be properly sized in accordance with Title 24 or local code whichever is more stringent.[3]
  - Building heating load, which is used for equipment sizing and selection, shall be determined using a method based on one of the following:
    - ACCA Manual J, or
    - SMACNA Residential Comfort System Installation Standards Manual, or
    - ASHRAE Handbook (Equipment, Applications and Fundamentals Volumes).
  - Heating capacity of the new system shall be sized to meet the minimum requirements but <u>not</u> *larger* than necessary.[4]
  - Distribution system shall be in conformance with HVAC manufacturer's specifications and local code.



Before installation of any furnace, agency shall confirm that appliance venting, combustion ventilation air, gas piping, and all feasibility criteria will be met for the replacement unit.

- **Combined Furnace and Air Conditioner Installation ("Package Unit")**
  - Air conditioning units shall be sized and installed in accordance with:
    - Manufacturer's instructions, and
    - CSD WIS Section 31 (Air Conditioner and Heat Pumps—Central System).

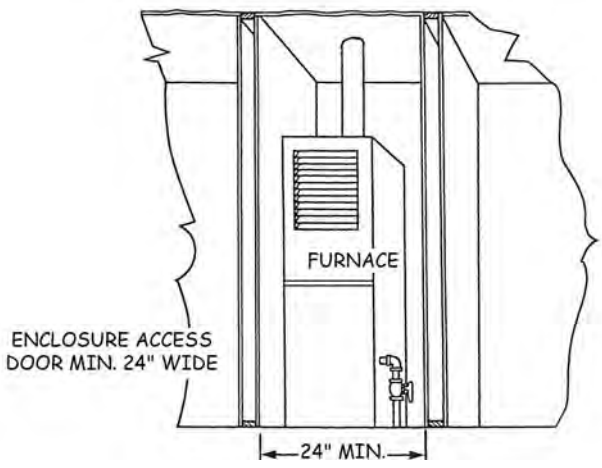


10. LOCATION

- **FAU Enclosure**
  - Access and service space shall be provided in accordance with local code.[5]
  - Minimum access, clearances, and enclosure size for required clearances and adequate combustion air venting shall be provided in accordance with Items 11 and 12.
  - Enclosure shall provide adequate service space for:
    - A 120V receptacle, and
    - An appliance line valve.

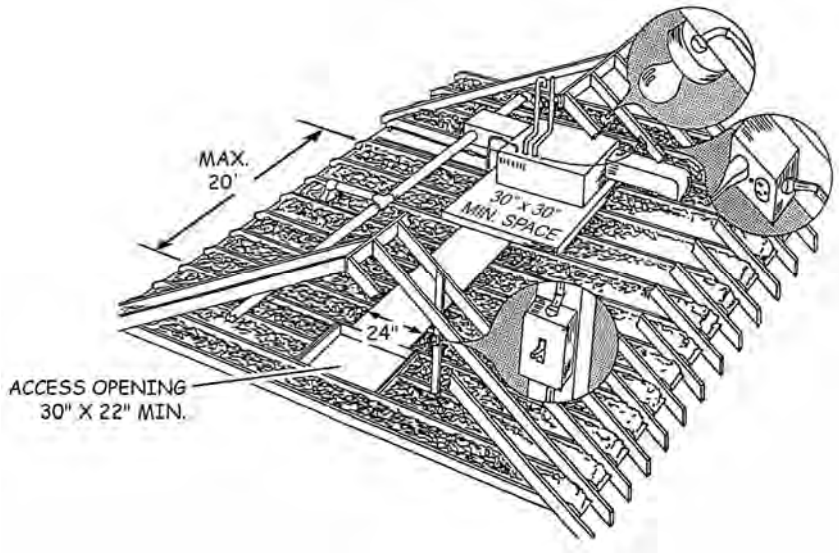
11. ACCESS AND SERVICE SPACE

- **Equipment in Enclosures**
  - Access door shall be:
    - At least 24" wide when installed by crew.
    - Wide enough to remove the appliance.
    - High enough to accommodate removal of the appliance.

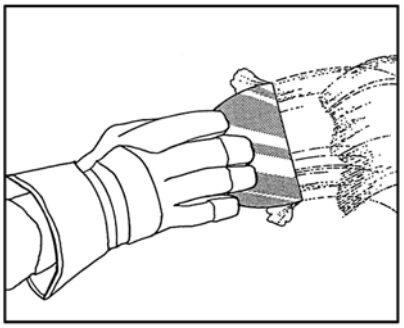


11. ACCESS AND SERVICE SPACE (cont.)

- **Equipment Under Floors and on Roofs**
  - Access shall be provided in accordance with local code.
- **Equipment in Attics**
  - Access opening shall be large enough to accommodate removal of the appliance, but no smaller than 30"x22".
  - An unobstructed passageway shall be provided which:
    - Is large enough to accommodate removal of the appliance, *but no smaller* than 30" wide and 30" high.
    - Is no longer than 20' in length (from access opening to the equipment).
    - Has continuous solid flooring not less than 24" wide.
  - A level service area shall be provided at the front or service side of the equipment that is at least 30" wide and 30" deep.
  - Walkways and platforms shall be above the level of the insulation (if practical).
- **Lighting and Convenience Outlet for Attic Installation**
  - If not already present, permanent switch-controlled lighting shall be installed.
    - Switch shall be located at the access/entrance and readily accessible.
    - Lighting shall provide sufficient illumination to safely approach the equipment and perform the task for which access is provided.
  - If not already present, a permanent 120-volt convenience receptacle (outlet) shall be installed near the appliance.

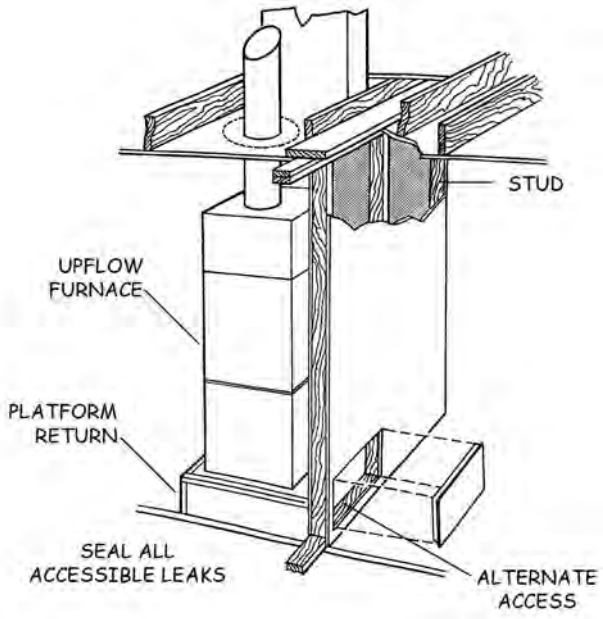


12. PREPARATION OF APPLIANCE ENCLOSURE, PLATFORM, AND PLENUM



SURFACE REPAIRS MUST MATCH SURROUNDING MATERIAL

- **Wall and Floor Repairs**
  - Holes and gaps in the walls and floor that create a draft and affect operation of the appliance shall be sealed before the appliance shall be installed.
- **Return Air Plenum shall be free of leaks which:**
  - Affect combustion air.
  - Draw in outside air, *except* economizer units.
- **Platform Returns**
  - Unlined platform cavity shall be sealed as a catastrophic leak to prevent unconditioned air from being drawn from building/wall cavities and the furnace enclosure (billed as duct sealing measure).
  - Platform bypasses (unlined cavities) shall be blocked/sealed with a liner of fiberglass duct board, plywood, or sheet metal.
  - Uninsulated platforms shall be insulated by:
    - Filling stud cavities inside the plenum with flexible insulation, when lining/sealing with sheet metal, or
    - Installing fiberglass duct board, this both lines/seals and insulates the plenum.
  - Platform return accessed by swinging appliance enclosure door (full-length door containing a return grille near the bottom):
    - Door-mounted grille shall not interfere with proper closure of door.
    - Return shall be isolated from furnace enclosure (e.g., with weatherstripping that seals the gap between the platform and inside surface of the door).



- **Housing and Plenum**
  - Components shall be mechanically attached and sealed around the perimeter (e.g., housing-to-platform, housing-to-plenum).
  - Wiring and plumbing penetrations into the return air chamber shall be sealed with cork tape.

13. REMOVAL OF EXISTING EQUIPMENT

- **Utility/Equipment Disconnects**
  - Electricity and natural gas will be turned off before removing old appliance.
  - Refrigerant lines, plumbing, ducts, electric, control wires, vents, and fuel supply will be disconnected.
- **Removal**
  - Equipment will be removed (e.g., furnace, air handler, evaporator, condensing unit) from space without damaging property and disturbing or compressing the insulation.
  - Equipment will be disposed of in accordance with local laws and regulations, recycling materials when feasible.

14. EVALUATIING SUBSYSTEMS

- **Electrical service shall be verified in the following categories:**
  - Polarity of equipment shall be correct.
  - Voltage/amperage for incoming power shall be in accordance with manufacturer specifications.
  - In accordance with manufacturer specifications, voltage drop shall be within acceptable range.
  - Grounding shall conform to CSD WIS Appendix D.
  - Bonding lug shall be selected to prevent corrosion due to dissimilar metals.
  - Blower amperage shall not exceed manufacturer full load amperage.
  - Compressor amperage shall not exceed manufacturer full load amperage.
  - Blower compartment safety switch operation will be verified.
  - Emergency heat circuit functions will be verified for heat pumps.
- **Refrigerant lines shall meet, or be corrected to meet, the following general requirements**
  - Insulation
    - All liquid refrigerant lines shall be insulated to a minimum of R-4.
    - Vapor or high side lines shall not be insulated unless specified by the equipment's manufacturer.
    - Suction lines shall be insulated to a minimum of R-4.
    - If exposed to sunlight, refrigerant line insulation shall be protected from UV degradation in accordance with manufacturer specifications or local code.
  - Sizing and Installation Requirements
    - Refrigerant lines shall be sized to meet manufacturer specifications for the installed equipment.
    - Refrigerant lines shall be installed without kinks, crimps, or excessive bends.
    - Refrigerant lines shall be routed, supported, and secured to house in a manner that protects the line from damage by workers or occupants.
- **Condensate Drain**
  - Connection
    - Connections in condensate drain system shall be watertight.
  - Insulation
    - Condensate drains shall be insulated with a minimum 1" of insulation with a vapor retarder when there is potential for condensation or freezing on the drains.
  - Overflow Protection—Upflow
    - Secondary drain pan and float switch shall be installed or a float switch installed in the primary condensate drain for upflow systems will be installed when overflow could damage finished surfaces.
  - Pumps
    - Condensate drain pumps shall be installed when condensate cannot be drained by gravity.
    - Power source for pump shall be installed if not present.
    - Operation and drainage of pump shall be verified.
  - Vents and Traps
    - Vents and traps shall be installed on condensate drain lines.
    - Trap supplied with the equipment shall be used and manufacturer specifications shall be followed.
  - Drain Pan
    - Condensate from all cooling coils or evaporators shall be conveyed from the drain pan outlet to an approved place of disposal
    - Piping shall maintain a minimum horizontal slope in the direction of discharge of not less than 1/8 unit vertical in 12 units horizontal (1% slope).
    - Condensate shall not discharge into a street, alley, or other areas where it would cause a nuisance.
  - Float Switch

- All secondary drain pans will have a float switch and be drained away through a drain line.

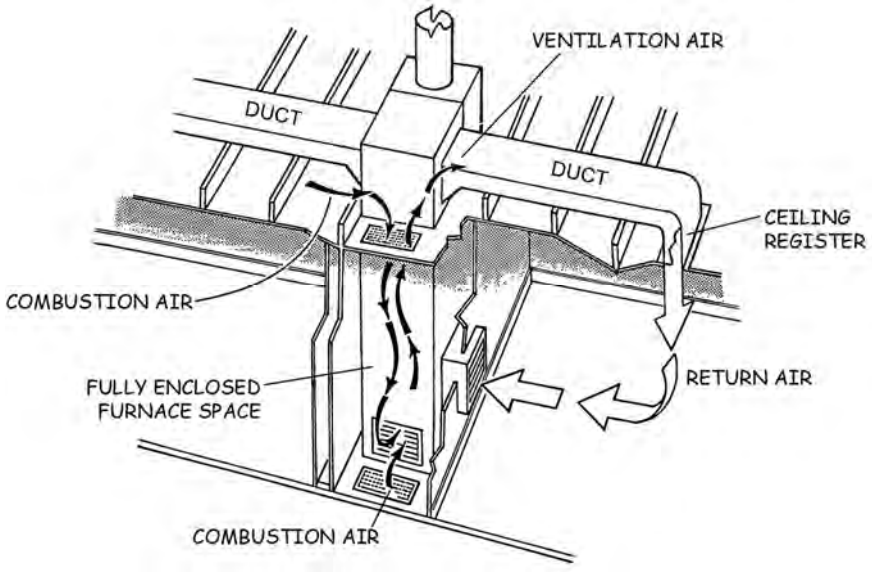
- Termination
  - Condensate drain will be terminated in accordance with local codes.

15. COMBUSTION VENTILATION AIR (CVA)

- **All Forced Air Units**
  - Combustion air shall be supplied per manufacturer's instructions, local code, and CSD Field Guide Appendix A (Material Specifications).[6]
  - Existing combustion air vents shall be free of obstructions (e.g., over-blown ceiling insulation, duct insulation, etc.).
  - Return air shall be isolated from combustion air.
- **Open Combustion Furnaces Inside the Home**
  - Combustion air shall be obtained entirely from either outdoors or inside the building (living space), but not both.
  - Best practice is that the source of combustion air be from the outdoors.
- **Open Combustion Furnaces Inside an Unconditioned Garage**
  - Combustion air may be obtained from indoors, outdoors, or a combination of indoors and outdoors.[7]

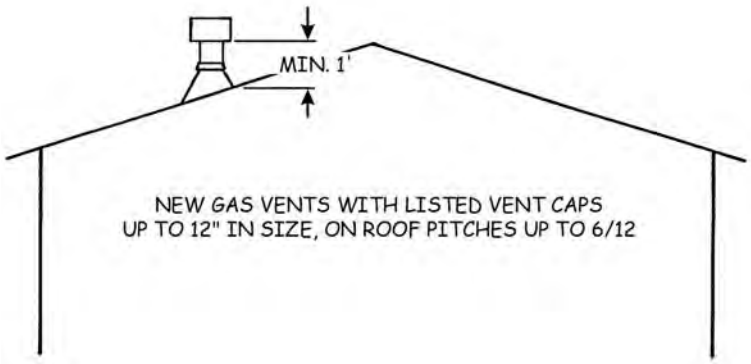
16. FURNACE INSTALLATION PROCEDURES

- **Installation of Unit**
  - A new furnace with damage or defects shall not be installed.
  - The furnace shall be installed in accordance with:
    - Manufacturer's instructions, and
    - Requirements of the local jurisdiction.



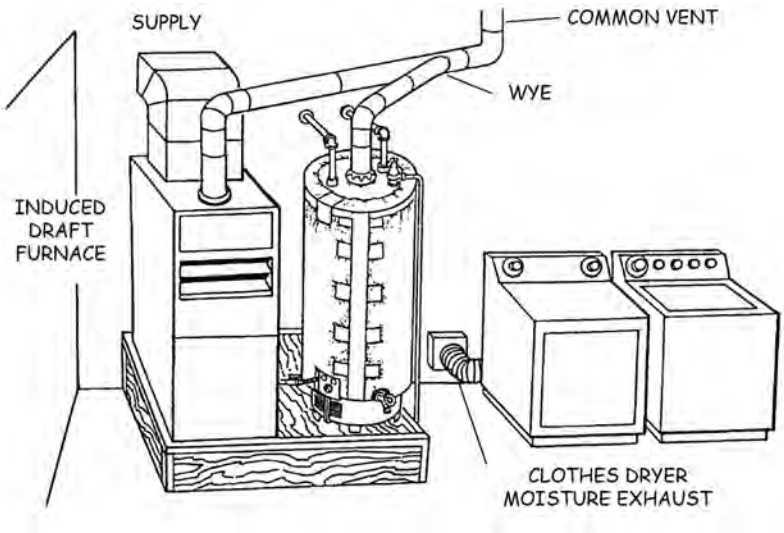
17. APPLIANCE VENT SYSTEM

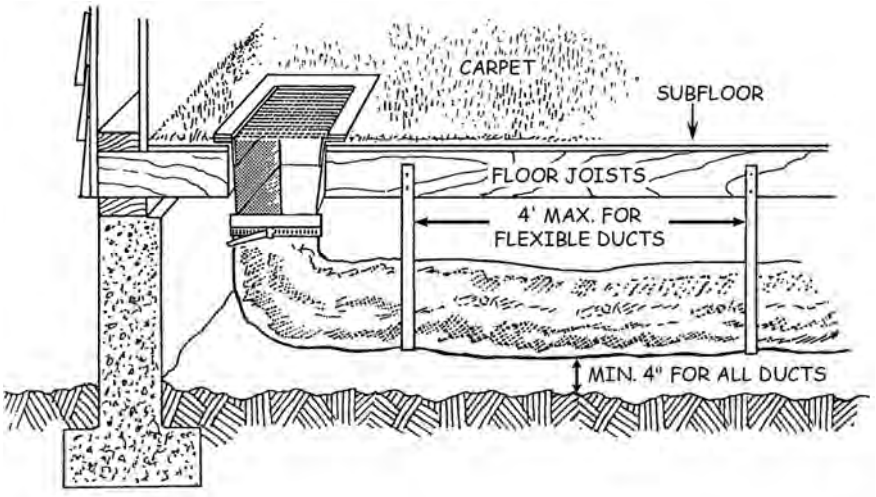
- **All Furnaces**
  - New vent system shall be installed and secured in conformance with manufacturer's instructions, local code[8], and CSD Field Guide Appendix A (CAS Protocol).
  - When an existing furnace that shares a common vent with another appliance is replaced with a new unit, the contractor shall ensure that both appliances are properly vented.



18. DUCT SYSTEM

- **New and Retrofit Duct Installation**
  - New FAU shall be compatible with existing duct system.
  - It is acceptable to install some new ducting as needed to comply with manufacturer's instructions and applicable codes; however, installation of an entire system shall only be allowed by program waiver.
  - Duct system shall be examined for leaks and disconnections, tested, and brought into conformance with Title 24 requirements, Item 8 in this section, and CSD Field Guide Appendix B (Duct Leakage Test Protocol).
  - The duct system shall be installed and sealed in conformance with manufacturer's instructions, Title 24 requirements, and CSD WIS Section 6 (Duct System Repair and Sealing).
  - New ductwork shall be installed in conformance with:
    - Manufacturer's instructions, and
    - Title 24 requirements, when *more* than 40' of new or replacement ducts are installed in unconditioned space.[9]





- **Retrofit Units Utilizing Existing Duct System**
  - Duct system shall be tested and, as needed, brought into conformance with Title 24 requirements.
  - The supply and return plenums shall be securely attached to the forced air unit (FAU).
  - The supply and return ductwork shall be securely attached to the respective plenums.

19. ELECTRICAL WIRING

- **All Units**
  - All wiring shall be in conformance with local code.
  - Sizing and installation of a replacement furnace shall not overload the dwelling's electrical system.
    - If electrical upgrade is required beyond the standard scope of HVAC installation, electrical work shall be performed by a licensed electrician.
  - In a "package unit", air conditioning equipment shall be installed and wired as prescribed in CSD WIS Section 31 (Air Conditioner and Heat Pump—Central System).
  - Plug-in units shall have a maximum 6' power cord (e.g., pigtail).

20. WALL THERMOSTAT

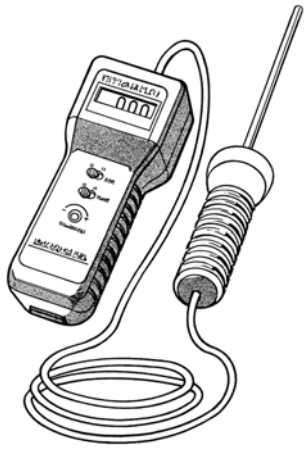
- **Programmable or Manual Thermostat**
  - Shall be installed in accordance with CSD Field Guide measure-specific policy and CSD WIS Section 27.

21. GAS LINES, FITTINGS AND VALVES

- **All Installations**
  - All gas piping (e.g., risers, flexible connectors, fittings and valves) shall be installed in conformance with manufacturer's instructions, local code[10], and CSD WIS Appendix A (Materials Specifications).
    - Flexible gas connectors, fittings, and the shut-off valve shall be replaced when a gas appliance is replaced (existing parts shall not be reused).
    - Any additional components (i.e., drip leg, condensate drain, etc.) shall be installed when required by manufacturer or local code.
  - Shutoff valve shall be within 3' of the appliance and in the same room or space where the appliance is located.

22. CAS CHECKS

- **Combustion Air**
  - The flow of combustion and ventilation air shall be verified to not be obstructed by any part of the installation.
  - The CVA shall be adequate to supply combustion air in accordance with requirements of the local jurisdiction and CSD Field Guide Appendix A.
- **Carbon Monoxide (CO) Levels**
  - Post-CAS Appliance Repair and Replacement testing for CO shall be made in accordance with CSD Field Guide Appendix A.
  - Corrections shall be made as needed to limit CO to acceptable levels.



23. AIR FILTER INSTALLATION

- **All Filters**
  - Shall be installed when the FAU is replaced in accordance with CSD WIS Section 28, local code, and manufacturer's instructions.
  - Filter shall be considered part of the replacement measure.
  - Unframed filters shall be properly supported to prevent being drawn into the air handler.
  - New central forced air HVAC systems will have minimum MERV 6 filtration with no air bypass around the filters.

24. FUEL SWITCHING

- **Furnace replacement requires that the same type of fuel is used.**
  - The furnace shall be verified to be equipped for the type of fuel used.
  - *Exception*: In-field fuel conversion is allowed only with written permission by CSD.
  - If the fuel source is changed to a more efficient fuel source, sizing of the furnace will be performed in compliance with the current CMC and Title 24 requirements.

PART 2: MOBILE HOME CRITERIA

25. GENERAL REQUIREMENTS

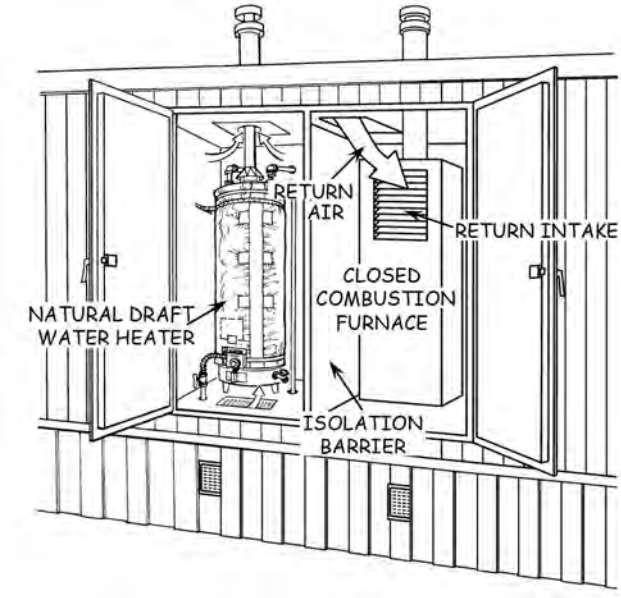
- **All Installations**
  - Where described in this section, the following Mobile Home criteria shall supersede the Part 1: Installation Requirements for Conventional Homes. If not listed or addressed in this section, the conventional home criteria shall apply.

Furnace Installation Standard	Standard Location
System Design and Performance	Conventional Home
Location	Conventional Home
Access and Service Space	Conventional Home
Preparation of Appliance Enclosure, Platform, and Plenum	Mobile Home
Combustion Ventilation Air (CVA)	Mobile Home
Furnace Installation Procedures	Mobile Home
Appliance Vent System	Mobile Home
Duct System	Mobile Home
Electrical Wiring	Mobile Home
Wall Thermostat	Conventional Home
Gas Lines, Fittings, and Valves	Mobile Home
Air Filter Installation	Conventional Home
Fuel Switching	Conventional Home

- Permits and installation shall be in compliance with manufacturer's instructions and specifications, with requirements of HCD, and/or the local building department.
  - HCD for installations inside the mobile home.
  - HCD, or the local building department, as applicable, for installations outside the mobile home.

26. PREPARATION OF APPLIANCE ENCLOSURE, PLATFORM, AND PLENUM

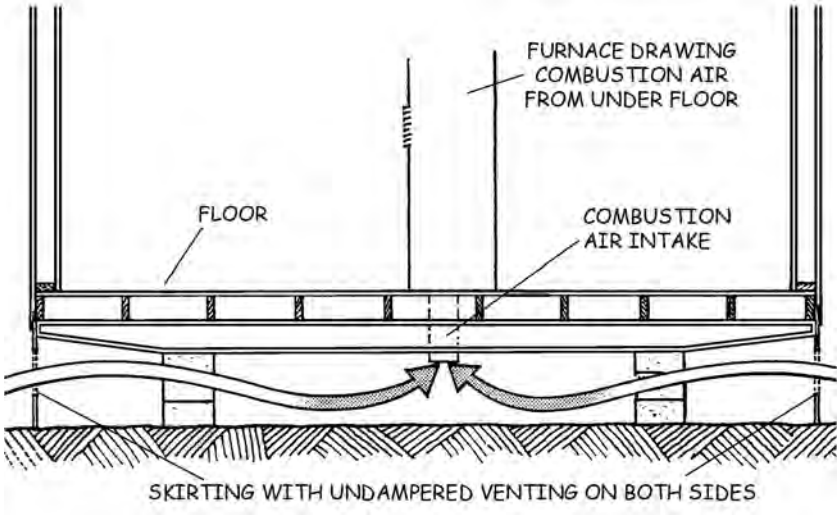
- **Isolation of Return Air**
  - The return air system shall not have leaks which:
    - Depressurize any open combustion appliance enclosure.
    - Draw in combustion air or combustion byproducts from any open combustion appliance (e.g., from furnace itself or nearby water heater).
    - Depressurize or draw air from a space where hazardous chemicals are stored or toxic fumes may be present.
  - The following conditions are not allowed and shall be corrected, when feasible:
    - An open combustion FAU drawing non-ducted return air through a grille in the furnace cabinet.
    - A closed combustion FAU located in an appliance enclosure adjacent to an open combustion water heater when:
      - The furnace enclosure is part of the return system, and
      - The two appliances are not separated by an airtight barrier.
  - Any condition which allows pollutants to be drawn into the FAU return shall be corrected. If not correctable, the home shall be NIM.



- **Sealing of Housing and Plenum**
  - Components shall be mechanically attached and sealed around the perimeter (cabinet-to-duct connector, cabinet-to-plenum) using materials and methods prescribed in CSD WIS Section 6 (Duct System Repair and Sealing).
  - Plumbing and wiring penetrations into the evaporator coil box and return air chamber shall be sealed with cork tape.

27. COMBUSTION VENTILATION AIR (CVA)

- **All Furnaces**
  - Combustion air shall be supplied from outdoors in conformance with furnace listing, manufacturer's instructions, HCD regulations, and CSD Field Guide Appendix A).
- **Furnaces Drawing Combustion Air from Undercarriage Space**
  - Undampered venting shall be present in the skirting.
  - Cross-ventilation shall be present, with venting located on at least two different sides of the mobile home skirting.
  - Skirting vents on each side shall provide at least 1.5 sq. ft. NFVA for each 25 linear feet of mobile home length.

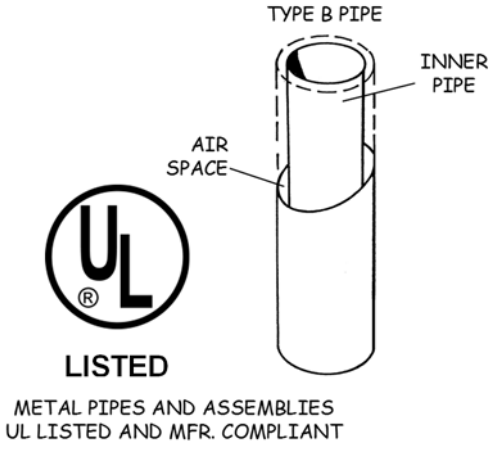


28. FURNACE INSTALLATION PROCEDURES

- **Installation of Unit**
  - A new furnace with damage or defects shall not be installed.
  - The furnace and component materials shall comply with the CSD WIS Appendix A (Materials Specifications).
    - Materials installed within a manufactured home:
      - Shall be in compliance with HCD regulations and HUD MHCSS11.
    - Materials installed outside a manufactured home:
      - Shall be in compliance with HCD regulations or, as applicable, requirements of the local building department.
  - The furnace shall be installed in accordance with:
    - Manufacturer's instructions, and
    - Requirements of the local jurisdiction.

29. APPLIANCE VENT SYSTEM

- **Metal Vent Pipes**
  - Vent systems shall be UL Listed and in compliance with CSD WIS Appendix A (Material Specifications).
  - Vent system shall be installed in compliance with furnace listing, manufacturer's specifications and instructions, HCD regulations, and CSD Field Guide Appendix A (CAS Protocol) for:
    - Installation of a new vent system.
    - Connection to an existing vent system.

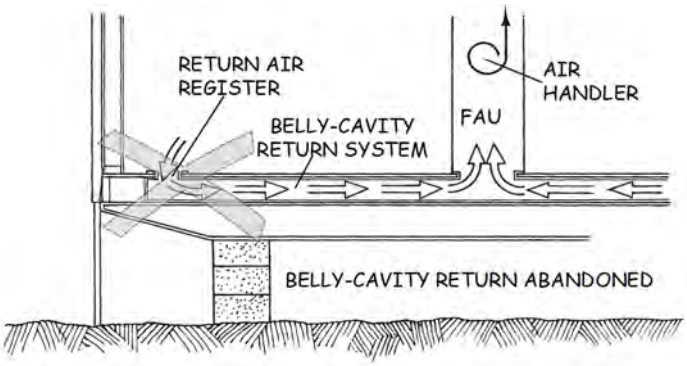


METAL PIPES AND ASSEMBLIES UL LISTED AND MFR. COMPLIANT

- **Existing vent system shall be replaced *unless* it:**
  - Is in good condition (free of leaks, deterioration, damage, etc.).
  - Meets listing requirements of the replacement furnace.
  - Is in conformance with furnace manufacturer's instructions.

30. DUCT SYSTEM

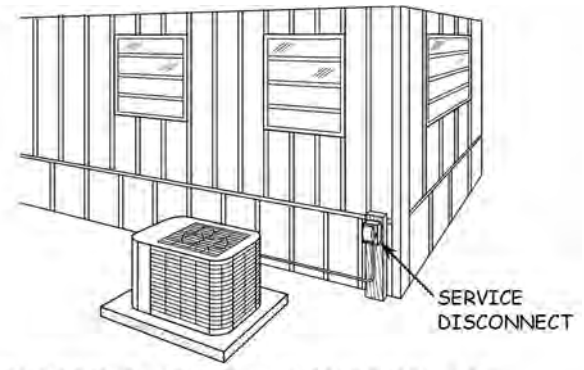
- **Existing Duct System**
  - Duct leakage testing shall be performed in accordance with Field Guide Appendix B.
  - System shall be examined for leaks and disconnections and repaired as needed, in accordance with CSD WIS Section 6.
- **Return System**
  - Belly-Cavity and Roof-Cavity Returns as Catastrophic Leaks
    - Existing belly-cavity return shall be abandoned, and a new ducted central return shall be installed.
    - Existing leaky roof-cavity return shall be repaired as applicable, and replaced with a new central return when repair is needed but not feasible.



- **New Ductwork**
  - Components shall be installed in conformance with HVAC manufacturer's instructions.

31. ELECTRICAL WIRING

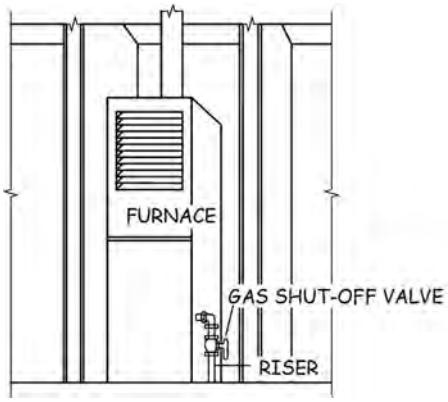
- **Electrical wiring, grounding, and unit accessibility shall be in conformance with:**
  - Manufacturer's instructions,
  - HCD[12], and/or as applicable, requirements of the local building department.
- **Service Disconnect**
  - An independent means of disconnect within view of the equipment shall be provided when required (e.g., for a new split system condenser).



SPLIT SYSTEM REPLACEMENT CONDENSER UNIT

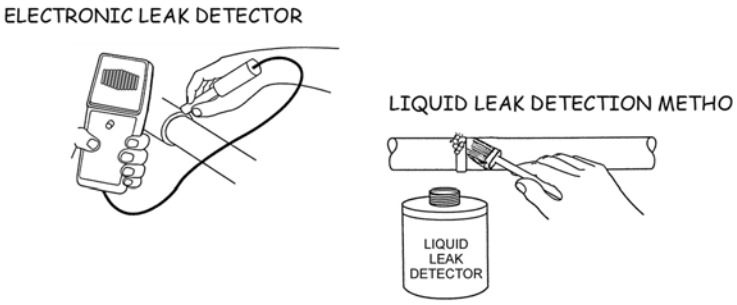
32. GAS LINES, FITTINGS, AND VALVES

- **Plumbing/Piping**
  - Risers, flexible connectors, fittings and valves shall be installed in conformance with manufacturer's instructions, HCD[13] and as applicable, requirements of the local building department.
  - Only <u>new</u> parts shall be installed. Used parts (risers, flexible connectors, fittings and valves) shall not be <u>not</u> allowed.
  - Shutoff valve shall be within 3' of the appliance and in the same room or space where the appliance is located.



33. CAS CHECKS

- **Gas Leaks**
  - All new and affected lines and components shall be checked for gas leaks by a method approved by the local jurisdiction, such as one or more of the following:
    - Commercial leak detection liquid (brush-on or spray-on).
    - Electronic leak detector.
    - Pressure test of the line.
- **Carbon Monoxide**
  - CO in flue gas shall be within limits specified by:
    - CSD Field Guide, Appendix A, or
    - Manufacturer's instructions, if more stringent.



GAS LINE FITTINGS, VALVES, AND CONNECTORS CHECKED FOR GAS LEAKS

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

34. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

35. OPERATIONAL CHECKS

- **FAU**
  - The installed unit shall be tested for proper operation.
  - Proper operation shall be explained and demonstrated to the customer, including:
    - Operation of all user-accessible controls.
    - Filter replacement.
    - Routine maintenance recommended by manufacturer.
  - Manufacturer's written instructions and warranty documents shall be supplied to the customer.

36. DISPOSAL REQUIREMENTS

- **All Units**
  - Refrigerant shall be recovered and all hazardous waste materials shall be disposed of in conformance with federal and state regulations and local code.

INFORMATION ABOUT HANDLING REFRIGERANT AND OTHER HAZARDOUS MATERIALS IS AVAILABLE FROM EPA'S STRATOSPHERIC OZONE INFORMATION HOT LINE

37. CLIENT EDUCATION

- **Basic Operation**
  - Operation of the equipment shall be explained to the client (e.g., design conditions, efficiency measures, differences from previous system or situation).
- **System Controls (e.g., Thermostat, Humidistat)**
  - Proper operation and programming of system controls to achieve temperature and humidity control shall be explained.
- **System Disconnects**
  - Indoor and outdoor electrical disconnects and fuel shut-offs shall be demonstrated.
- **Combustion Air Inlets**
  - Location of combustion air inlets shall be identified.
  - Importance of not blocking inlets shall be explained.
- **Blocking Air Flow**
  - Importance of cleaning dust and debris from return grilles shall be explained.
  - Proper placement of interior furnishings with respect to registers shall be explained.
  - Negative consequences of closing registers shall be explained.
  - Importance of leaving interior doors open as much as possible shall be explained.
- **Routine Maintenance**
  - Proper filter selection and how to change the filter shall be explained.
  - Importance of keeping outside unit clear of debris, vegetation, decks, and other blockage shall be explained.
  - Importance and timing of routine professional maintenance shall be explained.
- **Calling Heating, Ventilation, And Air Conditioning (HVAC) Contractor**
  - Situations when the client should contact an HVAC contractor shall be explained, including:
    - Fuel odors
    - Water draining from secondary drain line
    - Emergency heat indicator always on for a heat pump system
    - System blowing cold air during heating season and vice versa
    - Icing of the evaporator coil during cooling mode
    - Outside unit never defrosts
    - Unusual noises
    - Unusual odors

REFERENCED STANDARDS

[1] At the CEC website http://www.energy.ca.gov/title24/2013standards/, the Residential Compliance Manual may be downloaded.

[2] CEC Residential Compliance Manual Section 8.4.2

[3] For heating equipment sizing, reference CEC Building Efficiency Standards, Subchapter 7, §150(h).

[4] CRC §R303.8

[5] CMC, §304

[6] CMC Chapter 7

[7] CMC Chapter 7.

[8] CMC Chapter 8

[9] CEC 2013 Residential Compliance Manual, Sec. 8.4

[10] CMC and CRC

REFERENCED STANDARDS cont.

[11] Code of Federal Regulations, Chapter XX, Part 3280

[12] HUD MHCSS, Section 3280, Subpart I

[13] HUD MHCSS Section 3280.705

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NOTES

FURNACE—WALL, FLOOR, AND FREESTANDING

Lead Paint Risk Factor
VARIABLE

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FURNACE—WALL, FLOOR, AND FREESTANDING

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

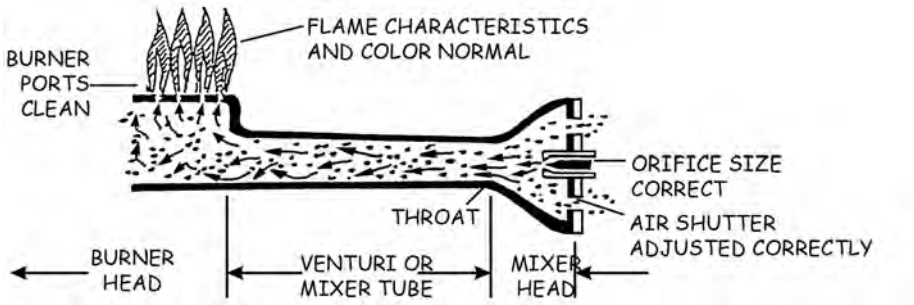
1. DOCUMENTATION REQUIREMENTS

- **All Appliance Repairs and Replacements**
  - Following the assessment by an agency assessor, combustion appliance operational or safety issues with an existing appliance shall be diagnosed by a qualified technician and fully described in writing for the agency before any repair or replacement work shall be allowed. The agency also shall accept or decline this scope of work in writing. These additional documents shall become part of the assessment record.

FURNACE REPAIRS

2. PRE-CAS TESTING

- **Pre-CAS Testing shall identify combustion appliance operational defects, as defined in the CSD Field Guide Appendix A (CAS Protocol).**
- **Checks for Combustion Problems**
  - The furnace (wall, floor, or freestanding unit) shall be checked for evidence of all CAS Hazards and CAS Fails, such as those listed in the CSD Field Guide Appendix A. All identified and necessary corrections shall be made when within the scope of the weatherization program.



3. OTHER REPAIRS

- **The scope of repairs must also take into consideration, but are not limited to, the following operational repairs:**
- **Heating Unit Integrity**
  - Loose items shall be tightened (e.g., screws, bolds, panels, etc.).
  - Missing/damaged components critical to proper operation shall be replaced/repaired (e.g., access doors, roll-out shield, etc.).
  - Improper alterations that adversely affect unit operation shall be corrected.
- **Wiring**
  - Unit shall be free of wiring defects (e.g., frayed or burned wires, loose or improper connections, etc.).

BURNERS AND HEAT EXCHANGER ARE CHECKED FOR DEFECTS

- **Thermostat and Controls**
  - Wall thermostat shall function properly:
    - Anticipator correctly set to 24-volt heating control circuit amperage, when applicable.
    - Wiring connections correct and tight.
    - Unit level and securely installed.
  - Furnace controls shall operate in accordance with manufacturer's specifications.

FURNACE INSTALLATION

4. GENERAL REQUIREMENTS

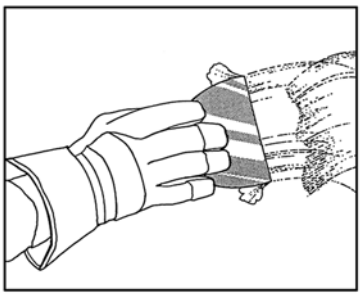
- **All Installations**
  - All items in this section shall apply to all furnace types *except* where otherwise noted.
  - Installation shall be in compliance with:
    - Manufacturer's instructions and local code.
    - Current California Electrical Code (CEC).
    - Current California Mechanical Code (CMC).

5. SYSTEM DESIGN

- **System Requirements**
  - Heating capacity and system design shall be in conformance with local code and the current CEC Title 24 manuals.[1].
- **Furnace Performance**
  - Furnace shall perform as designed and be properly sized for the living space.

6. PREPARATION OF WALLS AND FLOORS

- **Installation Quality**
  - Any holes or damage to wall/floor from installation or removal of a furnace shall be repaired and any patching area cleaned in a professional manner.
- **Wall Repairs**
  - Wall repairs shall match plane of adjacent material.
  - Repairs shall match texture of, and blend with, surrounding surfaces.
- **Floor Repairs**
  - Abandoned floor openings shall be closed in a professional manner:
    - Framed on all four sides.
    - Finished with 3/4" CCX plywood or better material.
  - Floor shall be surfaced in accordance with the following:
    - Flush with surrounding flooring material, or
    - Recessed to accommodate future installation of floor covering material.



FINISH WALL PATCH WITH SPACKLING OR DRYWALL COMPOUND

7. COMBUSTION AIR

- **All Installations**
  - Combustion air shall be provided in accordance with manufacturer's instructions, local code[2], and Field Guide Appendix A (CAS Protocol).
- **Open Combustion Wall Furnaces**
  - Volume of the room or space from which combustion air is obtained shall be:
    - At least 50 cu. ft. for each 1,000 Btu/hr input, when the "Standard Method" is used[3], or
    - A reduced volume calculated using the "Known Air Infiltration Rate Method".[4] (see CSD Field Guide Appendix A).
  - When volume of room or space is not adequate, venting shall be provided as prescribed by local code.[5]
- **Floor Furnaces**
  - Under-floor spaces shall have free flow of air, and meet CMC requirements.[6]

8. WALL FURNACE—INSTALLATION REQUIREMENTS

- **General Requirements**
  - Installation shall be in conformance with CMC requirements.[7]
  - A wall furnace shall not be installed in a sleeping room *unless* it is a direct vent unit approved for such installation by the local jurisdiction.
  - Modifications shall not be made to the furnace (e.g., cutting support legs) *unless* allowed by manufacturer.
  - Finished installation shall include blocking of all unnecessary holes in wall studs, floor, and bottom plate.
  - Unit shall be properly aligned and free of metal stress expansion that causes banging and metal ticking.
  - Existing parts (i.e. header plate) shall not be reused for new installations; all parts shall be new.
- **Wall Furnace Clearances**
  - Clearances shall be maintained in accordance with the requirements of the listing, manufacturer's installation instructions, and local code.
  - Clearance guidelines for installing a vented wall furnace designed for installation in a nominal 4" wall are provided in Table 25-1; however, manufacturer's specifications and requirements of the local jurisdiction take precedence.

TABLE 25-1: WALL FURNACE MINIMUM CLEARANCE GUIDELINES

CLEARANCE CRITERIA	MINIMUM DISTANCE
Inside corners: Lateral distance from side of furnace to an inside corner of the room	6"
Door swinging open toward furnace: Lateral distance from arc of door swing to air inlet/outlet openings (grilles) on furnace	12"
Overhead projections: Vertical distance from top of furnace to structural projections above (including a door or window which could project over the furnace)	18"

9. DIRECT VENT WALL FURNACE

- **General Requirements**
  - Shall be installed per manufacturer's instructions and local code.
  - Gas piping shall be code-compliant.
    - New piping shall be pressure-tested and free of leaks.
- **Vent Placement**
  - The hole in wall for vent system must be placed between studs.
  - Care must be taken, if electrical wiring is in the wall.
  - Vent terminal must be correct distance from an opening into the home (openable window or door) in conformance with the CSD Field Guide Appendix A (CAS Protocol).

10. FLOOR FURNACES—INSTALLATION REQUIREMENTS

- **General Requirements**
  - Installation shall be in conformance with CMC requirements. [8]
  - Furnace shall not be installed in a bedroom.
  - Floor opening shall be framed on all four sides, and furnace cabinet shall be secured to structural framing.
  - When required, a seepage pan shall be installed per CMC requirement. [9]
- **Placement**
  - Bottom of floor furnace shall be at least 6" above earth.
  - When excavation is required, it shall extend 30" beyond control side of furnace, and 12" beyond other sides and back.
- **Access**
  - Foundation wall opening at least 24" by 18", or trapdoor 24" by 24".
  - Passageway with minimum 24" by 18" cross-section.
- **Indoor Clearances**
  - Clearances shall be maintained in accordance with the requirements of the listing, manufacturer's installation instructions, and local code.
  - Clearance guidelines for installing a floor furnace are provided in Table 25-2; however, manufacturer's specifications and requirements of the local jurisdiction take precedence.
- **Controls**
  - Control valve operation must be accessible from inside the residence.
  - Pilot light must be accessible for lighting from inside the residence.

TABLE 25-2: FLOOR FURNACE MINIMUM CLEARANCE GUIDELINES

CLEARANCE CRITERIA	MINIMUM DISTANCE
Walls: Clearance from wall surfaces	6"
Inside corners: Minimum clear space on two adjoining sides of the installation	24"
Inside corners (wall-register-type furnaces): Clearance from inside corner of the room	6"
Swinging doors, draperies: Minimum distance from arc of door swing to furnace grille openings	12"
Overhead projections: Vertical distance from warm-air grille to structural projections above (including a door or window which could project over the furnace)	60"

11. FREESTANDING HEATER—INSTALLATION REQUIREMENTS

- **General Requirements**
  - Shall be installed per manufacturer's instructions and local code.
  - Proper clearances from combustibles (as described by the manufacturer) shall be maintained.
  - Install floor protection when required.
  - Room volume (CVA) must be adequate for installation.
  - Heater shall be vented outdoors, with correct Listed vent pipe and properly terminated above the roof, in accordance with CSD Field Guide Appendix A (CAS Protocol).

12. VENT SYSTEMS—ALL FURNACE TYPES

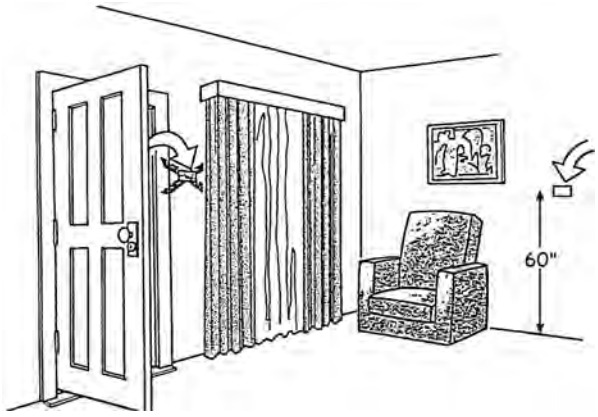
- **Venting**
  - Appliance venting shall be in conformance with manufacturer's installation instructions and venting tables.
  - Existing vent pipe may be used if it is in good condition and complies with unit listing, manufacturer's instructions and local code.
- **Installation and Termination**
  - New vent system shall be installed and secured in conformance with the manufacturer's instructions, local code[10], and CSD Field Guide Appendix A (CAS Protocol).

13. ELECTRICAL WIRING

- **All conductors and connections shall be installed per manufacturer's instructions and local code.**

14. THERMOSTATS

- **Location and Mounting**
  - Shall be installed in conformance with CSD WIS Section 27.
- **Calibration and Settings**
  - Thermostat shall be calibrated after installation is complete.
  - Anticipator shall be set to 24-volt heating control circuit amperage, when applicable.



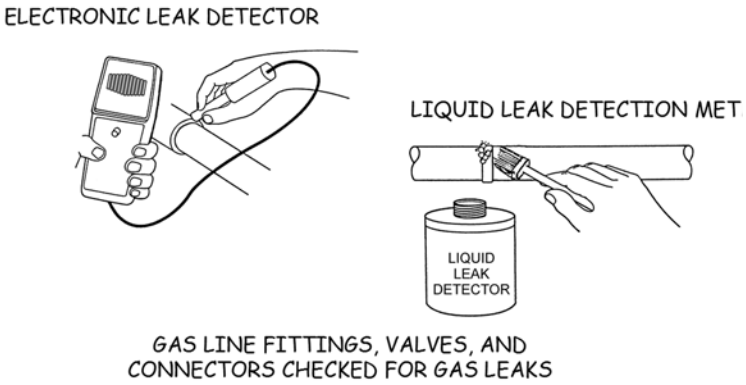
15. GAS CONTROL VALVE

- **All Units**
  - The valve shall turn properly and be free of leaks and electrical defects (e.g., short or open).
  - Gas pressure shall comply with manufacturer's specifications.

16. GAS PIPING AND VALVES

- **Plumbing/Piping**
  - All components (i.e., pipes, valves, fittings, flexible connectors, etc.) shall comply with local code, CMC and CBC.
  - Only new components listed above shall be used; used parts not allowed.
  - Shutoff valve shall be present in accordance with local code.

- **All Installations**
  - All new and affected lines and components shall be checked for gas leaks by a method approved by the local jurisdiction, such as one of the following:
    - Commercial leak detection liquid.
    - Electronic leak detector.
    - Pressure test of the line.
  - Non-conforming or unsafe connectors shall be replaced with code-compliant materials in conformance with CSD Field Guide Appendix A (CAS Protocol).



17. FUEL SWITCHING

- **Heat source replacement requires that the same type of fuel is used.**
  - The heat source shall be verified to be equipped for the type of fuel used.
  - *Exception*: In-field fuel conversion is allowed only with written permission by CSD.
  - If the fuel source is changed to a more efficient fuel source, sizing of the unit will be performed in compliance with the current CMC and Title 24 requirements.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

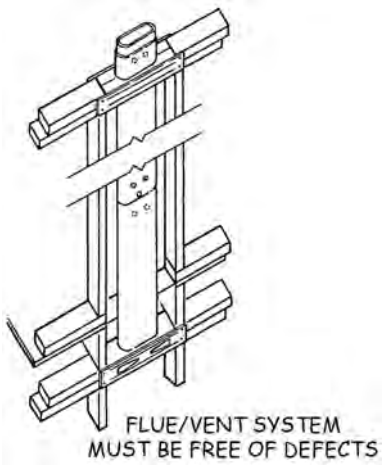
18. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

19. CAS TESTING OF FURNACE

- **Post-Repair/Replacement Test**
  - Appliance shall be CAS tested following installation to ensure proper operation in conformance with CSD Field Guide Appendix A (CAS Protocol) and manufacturer's instructions.



- When repaired/installed before weatherization work is complete, test shall be an Appliance Post-Repair/Replacement CAS test.

20. CARBON MONOXIDE

- **CO in flue gas shall be within limits specified by:**
  - Manufacturer's instructions, and
  - CSD Field Guide, Appendix A (CAS Protocol).

21. OPERATIONAL CHECKS

- **Programming and Operation**
  - Thermostat shall be cycled to insure proper operation of all functions.
  - Setbacks shall be programmed in accordance with client's wishes.

22. CLIENT EDUCATION

- **Basic Operation**
  - Operation of the equipment shall be explained to the client, with proper operation of system controls to achieve desired temperature.
- **Blocking Air Flow**
  - Client shall be advised of the importance of cleaning dust and debris from heat source grilles.
  - Safe placement of interior furnishings with respect to heat source shall be explained.
- **Routine Maintenance**
  - Client shall be advised of the importance of:
    - Maintaining the outside of unit/or interior of enclosure clear of debris, hazardous chemicals, and other blockage.
    - Routine professional maintenance.

REFERENCED STANDARDS

[1] Energy Efficiency Standards for Residential and Non-Residential Buildings & Residential Compliance Manual

[2] CMC Chapter 7

[3] CMC §701.2.1

[4] CMC §701.2.2

[5] CMC §701.3 and §701.4

[6] CMC Chapter 7

[7] CMC §928.0

[8] CMC §912.0

[9] CMC §912.9

[10] CMC Chapter 8, Chimney and Vents

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NOTES

WOODBURNING SPACE HEATERS

Lead Paint Risk Factor
NONE

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WOODBURNING SPACE HEATERS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

WOODBURNING SPACE HEATER REPAIR

1. DOCUMENTATION REQUIREMENTS

- **All Appliance Repairs and Replacements**
  - Following the assessment by an agency assessor, combustion appliance operational or safety issues with an existing appliance shall be diagnosed by a qualified technician and fully described in writing for the agency before any repair or replacement work shall be allowed. The agency also shall accept or decline this scope of work in writing. These additional documents shall become part of the assessment record.

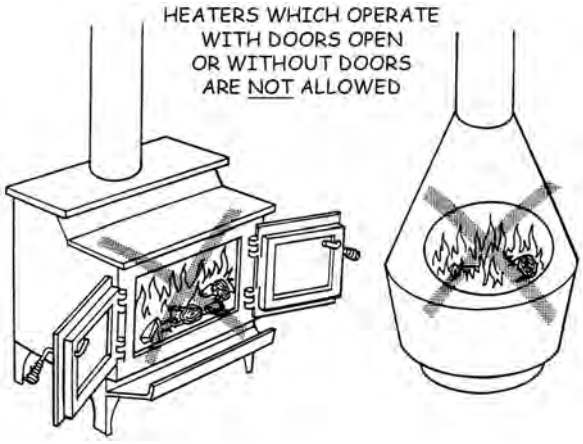
2. CORRECTION TO EXISTING CONDITIONS

- **Complete Unit Analysis**
  - Heat source repairs shall include an inspection of the complete woodburning space heater, including:
    - Heating unit, vents, connectors, chimneys, and terminations.
    - Floor/wall protection
    - Safety clearances.
    - Source of combustion air.
  - All repairs shall conform to the listed requirements for the appliance, the local jurisdiction or HCD (when required), the CSD Field Guide, and the Installation Requirements from this section.

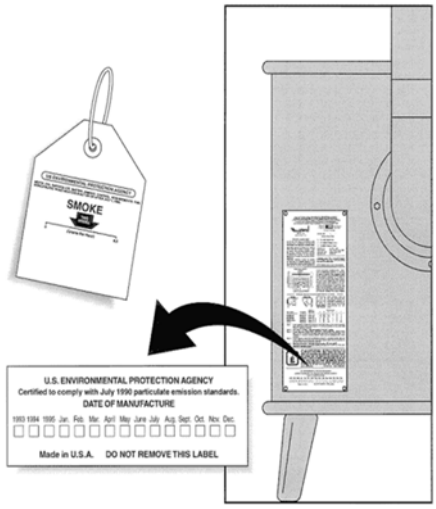
WOODBURNING SPACE HEATER INSTALLATION

3. GENERAL REQUIREMENTS

- **Laboratory Listing**
  - Only “listed” equipment and hardware shall be installed.
- **Labels**
  - All heaters shall bear permanently affixed label stating “For use with solid fuel only.”
- **Types Allowed**
  - Freestanding heaters designed to operate only with fire chamber door closed.
- **Types Not Allowed**
  - Units designed to operate with fire chamber door open.
  - Units without doors.



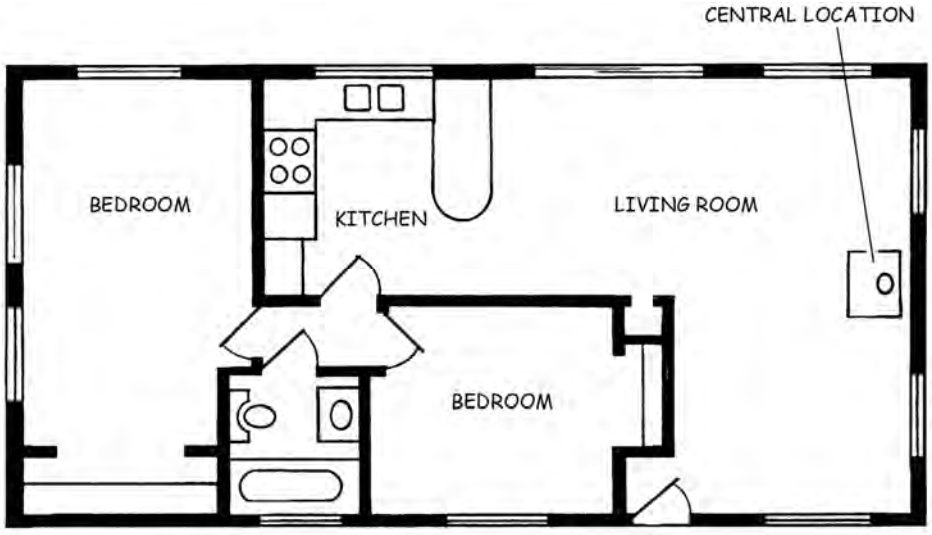
- **Permanent Label**
  - Heater shall have permanent factory label(s) in conformance with EPA regulations.
- **Temporary Label**
  - Unit shall bear temporary label(s) certifying conformance to EPA emission standards.



EPA HANG TAG AND PERMANENT LABEL

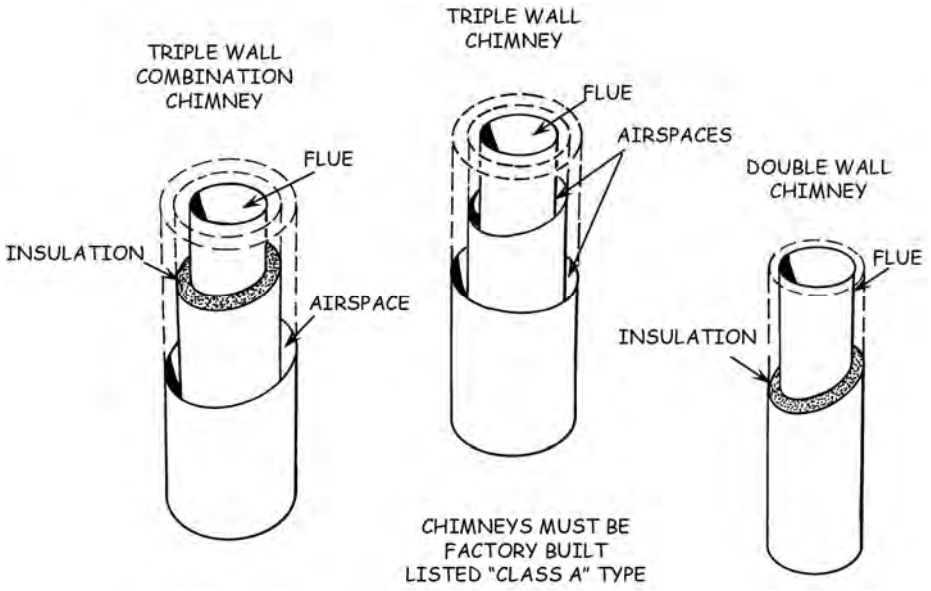
4. INSTALLATION

- **Instructions and Code**
  - The woodburning space heater, air intake assembly, hearth extension, clearance reduction system, chimney, vent connectors and other components shall be installed in accordance with the terms of their listings, manufacturer's instructions, applicable local codes, and the CSD Field Guide.
  - Where applicable, any installed woodstove shall comply with the EPA Phase II emission limits.
- **Appliance Location**
  - Checks shall be made to determine that an appropriate location is available for proper, safe installation of a new woodburning space heater and chimney before:
    - The existing unit is removed (when applicable).
    - Structural preparation (e.g., cutting holes) for the new unit occurs.
  - Heater shall be located in the living room or other central location.
  - Installation in bedrooms is not allowed.
- **Appliance Sizing**
  - Over-sizing *more* than 20% not allowed.
  - Sizing of unit shall be based on manufacturer specification for home area to be heated.
  - The space surrounding the installed heater shall be of sufficient size to assure proper clearances to combustibles and safe operation.



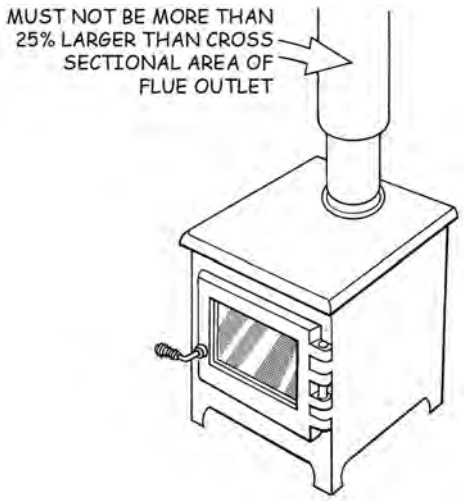
- **Chimney and Components**
  - Only new, factory-built, listed chimney components specified by the heater manufacturer shall be installed (existing components shall not be re-used), including:
    - Ceiling support package when vent connector is used.
    - Insulation shield when penetrating an attic.
    - Chimney cap and spark arrestor.

- **Connectors Types and Related Components**
  - Shall be:
    - Those specified by the heater manufacturer.
    - Factory-built.
    - Laboratory-listed.



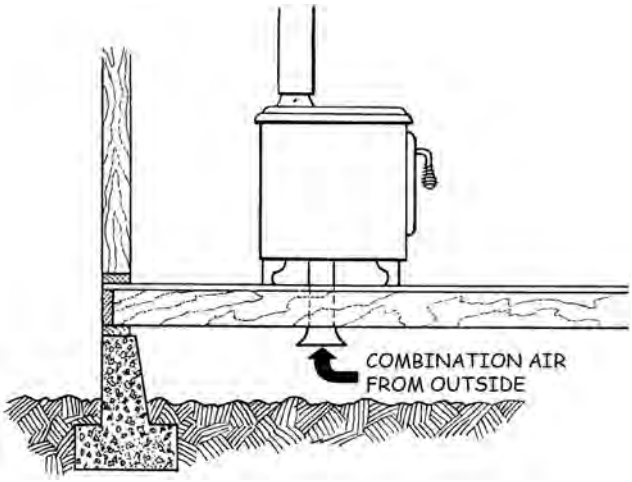
5. CONNECTOR/CHIMNEY SIZING

- **All Units**
  - Connector shall be no smaller in diameter than the flue outlet.
  - Connector may be a maximum of 25% larger than the cross sectional area of the flue outlet.



6. COMBUSTION AIR

- **Source**
  - Heater shall be designed to obtain combustion air ducted directly from outdoors to heater air inlet.
- **Crawlspace Ventilation**
  - The crawlspace shall be ventilated when combustion air is drawn from under the house.
    - Net-free venting area (NFVA) in the foundation shall be at least twice (double) the NFVA of the air intake opening for the stove.
    - Vents shall be installed located on at least two opposite sides of the crawlspace in accordance with CSD WIS Section 21 (Attic and Crawlspace Ventilation).
    - When additional ventilation is needed, undampered crawlspace ventilation shall be installed.

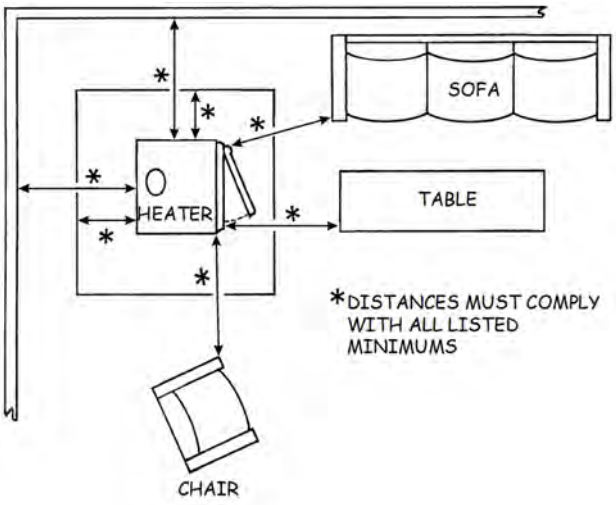


7. CLEARANCE FROM COMBUSTIBLES

- **All Heaters, Connectors, and Chimneys**
  - Manufacturer's listed clearance minimums shall be maintained.

8. CLEARANCE REDUCTION SYSTEMS

- **All Heaters, Connectors, and Chimneys**
  - Only listed clearance reduction devices shall be used.
  - Heater installation shall conform to the listed clearance requirements.

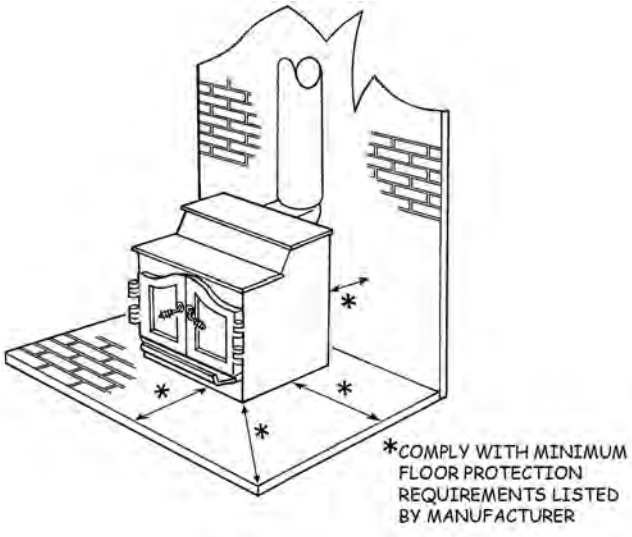


9. FLOOR PROTECTION

- **All Heaters**
  - When required by manufacturer or code, a listed floor protector shall be installed in conformance with manufacturer's instructions and applicable codes.

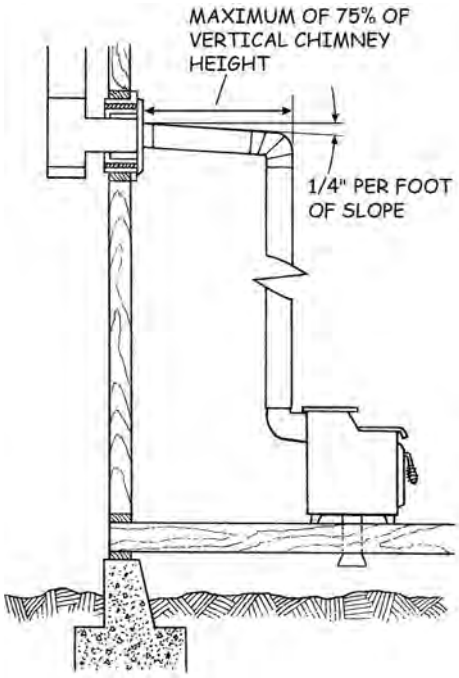
10. VENT CONNECTOR INSTALLATION REQUIREMENTS

- **All Connectors**
  - Installation shall be in conformance with this item *unless* otherwise specified by manufacturer.
  - Run shall be as short and straight as possible.
  - Installation shall allow for cleaning.

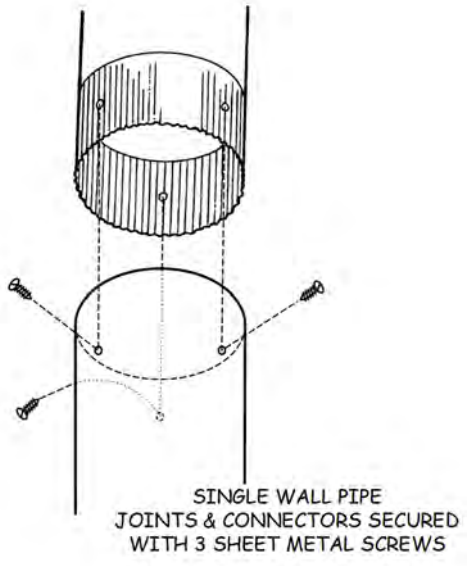


10. VENT CONNECTOR INSTALLATION REQUIREMENTS (cont.)

- **Bends**
  - Heaters with top vent outlet:
    - Maximum of one 90 degree bend.
  - Heaters with rear vent outlet:
    - Maximum of two 90 degree bends (including one at heater).
    - Tee recommended at flue outlet to facilitate cleaning.
- **Horizontal Runs**
  - Minimum 1/4" rise per foot of run.
  - Maximum horizontal run not to exceed 75 percent of vertical chimney height above connector.

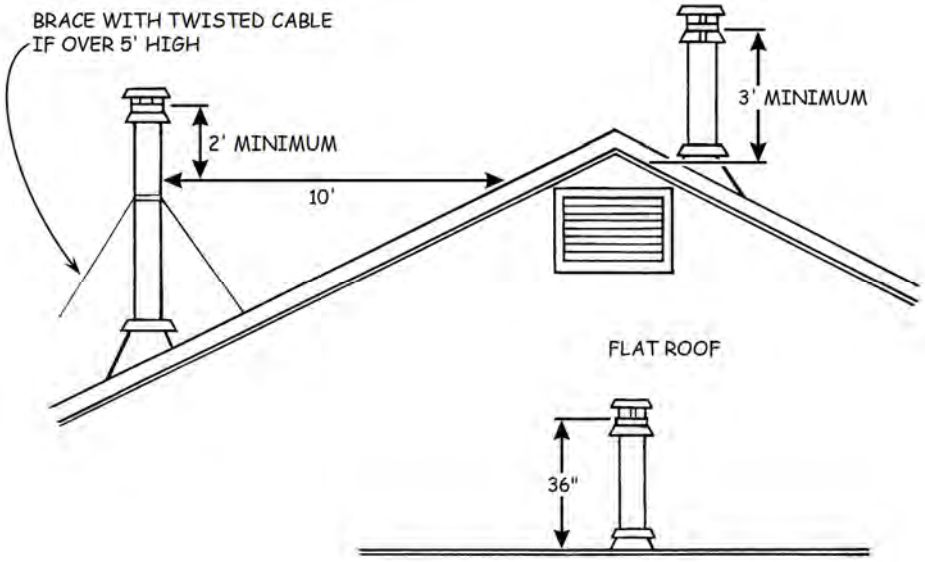


- **Attachment**
  - Single Wall Vent Connectors
    - Joints and connections shall be secured with a minimum of 3 sheet metal screws evenly spaced.
  - Multi-Wall Vent Connectors
    - Screws shall not be installed *unless* allowed in manufacturer's instructions.
- **Location Restrictions**
  - Vent connectors are limited to visible indoor locations and shall not be installed through a wall, ceiling or roof or into any concealed space.



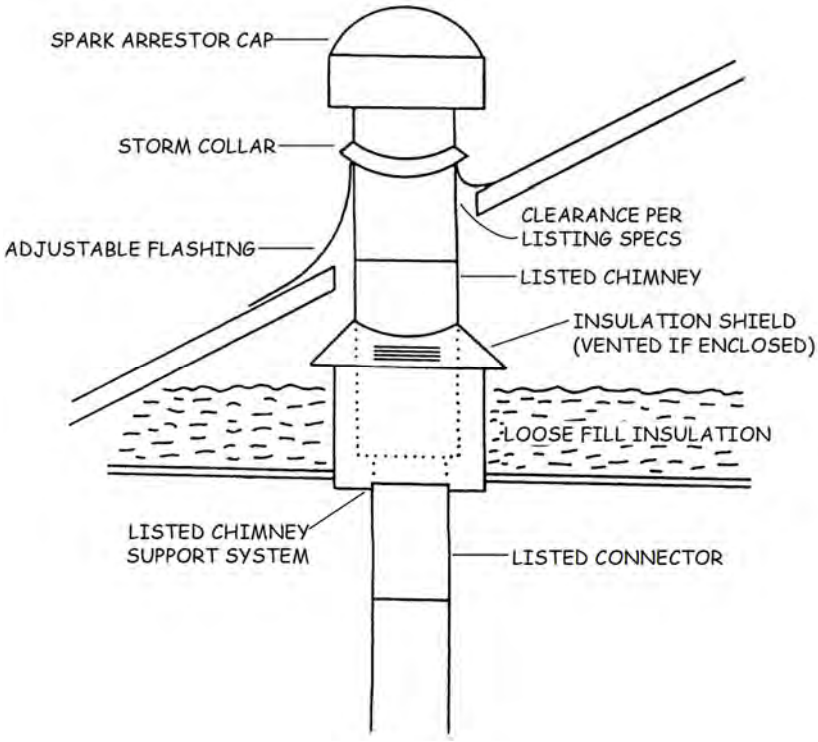
11. FACTORY-BUILT CHIMNEY INSTALLATION

- **Chimney Height**
  - 3' above the highest point of roof penetration.
  - 2' higher than any portion of a pitched roof, a wall, an evaporative cooler, or any other such object located within 10' of the chimney.
- **Bracing**
  - Chimneys extending *more* than 5' above roof at the highest point of penetration shall be braced in conformance with manufacturer's instructions and applicable codes.



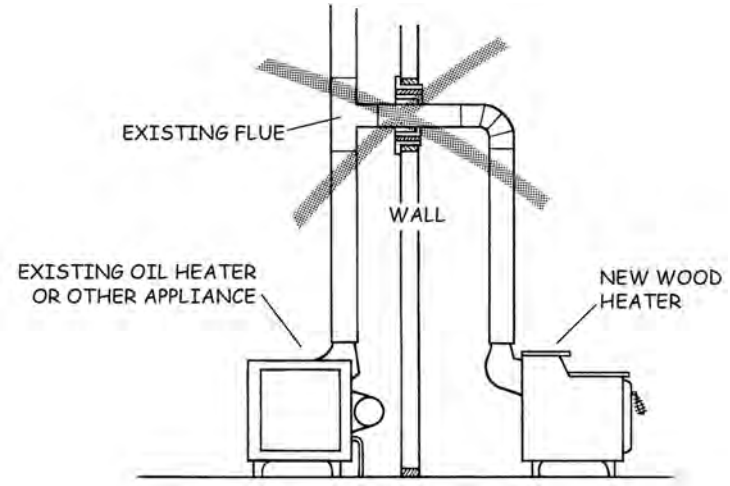
12. PENETRATIONS

- **Walls or Ceilings**
  - Only listed chimney hardware shall be used at penetration per manufacturer's specifications.
  - Wall/ceiling heat protection specified by manufacturer shall be installed.
- **Roofs**
  - Only listed chimney hardware shall be used at penetration in conformance with manufacturer's specifications.
  - Nail heads shall be sealed with non-hardening waterproof mastic.



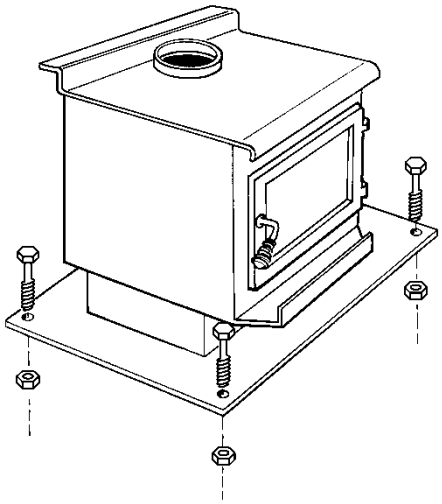
13. USE OF EXISTING CHIMNEYS

- **Stoves**
  - Sharing vent of existing appliance or chimney is not allowed.
  - Routing connector into a masonry chimney is not allowed.
- **Insert Installed in a Fireplace**
  - Insert or wood stove shall have its own continuous metal vent with cap and spark arrestor installed in conformance with local code.
  - Use of the existing masonry chimney alone is not allowed.



14. FLOOR ANCHORS

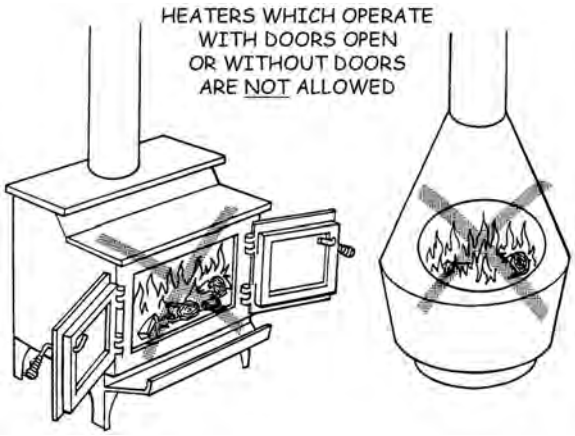
- **All Freestanding Heaters**
  - Unit shall be firmly attached to the floor of home as specified in manufacturer's instructions.



PART 2: MOBILE HOME CRITERIA

15. HEATER TYPES

- **Freestanding Heaters Allowed**
  - Radiant and convective woodburning stoves which:
    - Bear a permanent manufacturer's label stating stove is approved for use in mobile homes.
    - Obtain combustion air from outdoors.
    - Are designed to operate only with fire chamber door closed.
- **Units Not Allowed**
  - Units not bearing a permanent manufacturer's label stating stove is approved for use in mobile homes.
  - Units that:
    - Draw combustion air from the living space.
    - Are designed to operate without doors or with fire chamber door open.
    - Do not have doors.



16. INSTALLATION

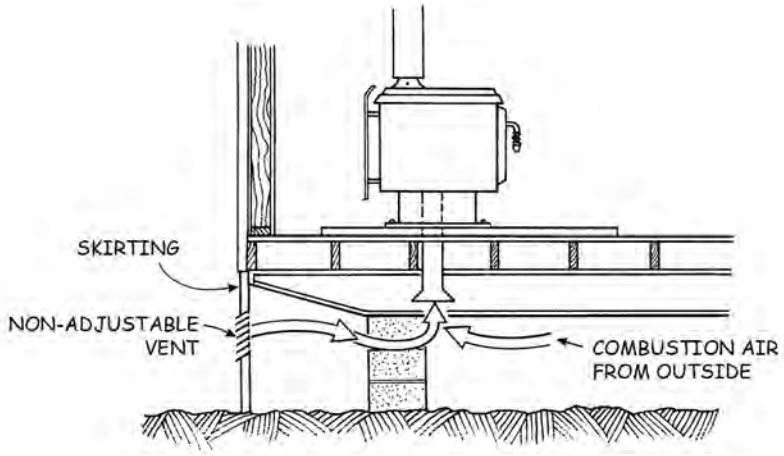
- **All Units**
  - The woodburning stove, air intake assembly, hearth extension, clearance reduction system, chimney, vent connectors and other components shall be installed in accordance with the terms of their listings, manufacturer's instructions, and regulations of the California Department of Housing and Community Development (HCD).
  - Unless otherwise stated in this Mobile Home section, the Conventional Home standards shall apply.

17. CHIMNEY AND COMPONENTS

- **Listed Units**
  - Only factory-built, listed chimney components specified by the heater manufacturer shall be installed, including:
    - Ceiling support package when vent connector is used.
    - Insulation shield when penetrating an attic.
    - Chimney cap and spark arrestor.

18. COMBUSTION AIR

- **Source**
  - Combustion ventilation air shall come from outside the living space in conformance with HUD and HCD regulations.
  - Combustion air intakes shall be ducted through the envelope as specified by the manufacturer.
- **Crawlspace Ventilation**
  - Skirting shall be ventilated when the undercarriage area is the source of combustion air.
    - Undampered venting shall be installed as needed.
    - Net-free venting (NFV) area in the skirting shall be at least twice (double) the NFV area of the air intake opening for the stove.
    - Vents shall be installed and located on at least two opposite sides of the mobile home in accordance with CSD WIS Section 21 (Attic and Crawlspace Ventilation).



PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

19. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

Not applicable to this measure.

THERMOSTATS—PROGRAMMABLE AND MANUAL

Lead Paint Risk Factor
NONE-LOW

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THERMOSTATS—PROGRAMMABLE AND MANUAL

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

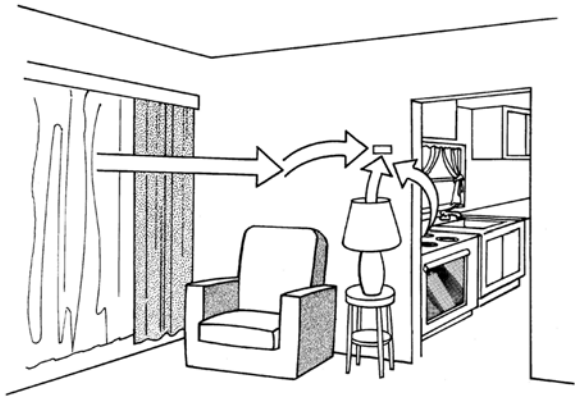
THERMOSTAT REPAIR

Not applicable to this measure.

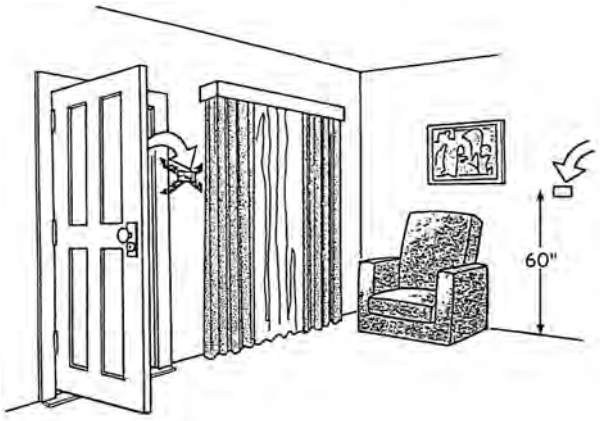
THERMOSTAT INSTALLATION

1. GENERAL REQUIREMENTS

- **Unit Selection**
  - Replacement thermostat shall be compatible with the unit **forced air** unit controls.
- **Existing Location**
  - New thermostat shall be installed at existing location, *unless* affected by drafts, heat from direct sun, or adjacent appliances.
- **New Location**
  - Thermostats shall be installed in the HVAC zone to control the temperature for that zone.
  - The new thermostat shall be mounted according to manufacturer specifications, or at a minimum it must be:
    - On a partitioning interior wall in a location of average temperature, away from:
    - Direct sunlight, entrance doors, windows, corners, area behind interior doors, and supply air registers.
    - Water pipes, heat-producing appliances, and sources of electrical interference.
  - When manufacturer specification is different than the minimum described above, a copy of the manufacturer specification shall be kept in the client file for inspection verification.
  - The surrounding area must be free of shelves, pictures, and other wall decor that may impede the airflow around the thermostat.
  - It shall be mounted with the top of the unit 60" above the floor, when occupants are not handicapped.
  - It shall be mounted as low as 48" above the floor, when an occupant uses a wheelchair.



THERMOSTAT MUST NOT BE AFFECTED BY DIRECT SUNLIGHT, DRAFTS, OR ADJACENT APPLIANCES



1. GENERAL REQUIREMENTS (cont.)

- **Mounting**
  - Thermostat installed in a new location:
    - If lowered from original location, wires shall be enclosed in a wall cavity or a raceway with cap at top.
  - All Installations:
    - Mounting bracket shall be securely attached to wall with screws for wood, or manufacturer-specified anchors for drywall and plaster.
    - The hole where wires come through the wall must be very small or sealed (e.g., with spackle) to prevent drafts form affecting accuracy of the thermostat.
    - Any holes or damage to wall from installation or removal of a thermostat shall be repaired and patched to match the existing finish (within the program scope).
    - When sheetrock repair is required, drywall patching compound shall be used, lightly sanded, and the patched area cleaned in a professional manner.

2. WIRING

- **All Installations**
  - All wiring shall be a minimum of 18-gauge and conform to manufacturer's specifications and local code.
  - Wiring Location
    - All wiring shall be installed inside wall cavities when possible.
    - Exposed wiring shall be enclosed in raceway.

3. TESTING AND PROGRAMMING

- **Testing**
  - Thermostat shall be cycled to ensure proper operation of all functions.
  - Terminals on the gas valve and at the system control shall not be shorted (jumped) to test the installation.
- **Programming**
  - Thermostat shall be programmed in accordance with client's wishes.
- **Blower Speed**
  - Blower speed shall be set for equipment in accordance with manufacturer specifications.
- **Thermostat: Installer Programming**
  - The installer options will be set to match the thermostat to the equipment and control board settings.
- **Time Delay Settings for the Programmable Thermostat**
  - Time delay for equipment will be set in accordance with manufacturer specifications and as appropriate for the climate zone (e.g., no time delay for hot, humid climates).
- **Humidistat: Location, If Present**
  - The humidistat shall be installed
    - To reflect humidity of the zone in which it is installed; and
    - In a dry location.

4. HEAT PUMP THERMOSTATS

- **Thermostat Selection**
  - A thermostat shall be selected with a supplementary heat lockout that will interface with an outside temperature sensor.
- **Supplementary Heat**
  - Supplementary heat shall be used on air-to-air heat pumps with conditions that allow for a balance point of less than 30°F.
  - The supplementary heat lockout shall be installed and set to manufacturer specifications.

- **Low Ambient Compressor Lockout**
  - For air-to-air heat pumps, low ambient compressor lockout shall be set to 0°F outdoor temperature or to manufacturer's specifications.
- **Outside Temperature Sensor**
  - An outdoor temperature sensor shall be installed in accordance with manufacturer specifications.
- **Supplementary Heat Wiring**
  - Supplementary heat will be wired onto second-stage heating terminal in accordance with manufacturer specifications.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

5. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

6. CLIENT EDUCATION

- **Clients shall be educated on proper use of thermostat including:**
  - Proper use of setbacks (programmable) thermostats for furnaces, air conditioners, or heat pumps (as applicable).
  - Installers shall allow for client comfort in programming the thermostat for combustion heating appliances.
  - Client shall be counseled to use portable or emergency heat appropriately, when present.

7. DISPOSAL REQUIREMENTS

- **Disposal of Replaced Thermostats**
  - Old thermostats containing mercury shall be disposed of in accordance with Universal Waste Regulations, as set forth by DTSC at: http://www.dtsc.ca.gov/HazardousWaste/Mercury_Therm_Act.cfm

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NOTES

AIR FILTERS

Lead Paint Risk Factor
NONE

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AIR FILTERS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

AIR FILTER REPAIR

Not applicable to this measure.

AIR FILTER INSTALLATION REQUIREMENTS

1. FILTER LIMITATIONS

- **New, Replacement Forced Air Systems**
  - All filter media shall be MERV 6 or better.
- **Existing Forced Air Systems with Replacement Filter**
  - A MERV 6 filter shall be used when specifically allowed by the manufacturer's specifications.
  - When not specifically allowed, a washable "hog hair," foam, or other specialty-type filter (listed below) shall be installed in existing forced air systems (to prevent excessive static pressure that may cause the appliance to fail).

2. GENERAL FILTER SIZING

- **All Filter Types**
  - Filters shall be sized, supported, and installed in conformance with manufacturer specifications.
  - All filters shall be installed in conformance with appliance and filter manufacturers' instructions.
- **Size**
  - Unframed filters shall be cut for a snug fit with maximum 1/4" tolerance.
  - Framed filters shall fit within the filter housing without crimping or buckling.

3. GENERAL FILTER SUPPORT

- **All Unframed Filters**
  - Unframed filters shall be supported, as needed, to prevent being drawn toward the air handler, in accordance with manufacturer's instructions.
- **1" Bonded Fiber Filters**
  - When not in conflict with appliance or filter manufacturer's instructions, steel rods (galvanized recommended) shall be internally installed, as needed, to stiffen filters that are 20" or longer in either direction.
  - Support rods shall be:
    - Adequate gauge to provide the necessary stiffness.
    - Spaced a maximum of 20" on center.
    - Sized to fully extend from one edge of the filter to the other.
    - Inserted in the center of the filter medium, or per manufacturer's instructions, for other types.
  - At least one rod shall be positioned so that both ends are supported by a solid surface.
- **Other Filter Support Requirements**
  - Materials thinner than 1" shall be secured externally.
  - Filters shall not be installed when adequate support cannot be provided.

4. "A" SHAPED 1" BONDED FIBER FILTERS

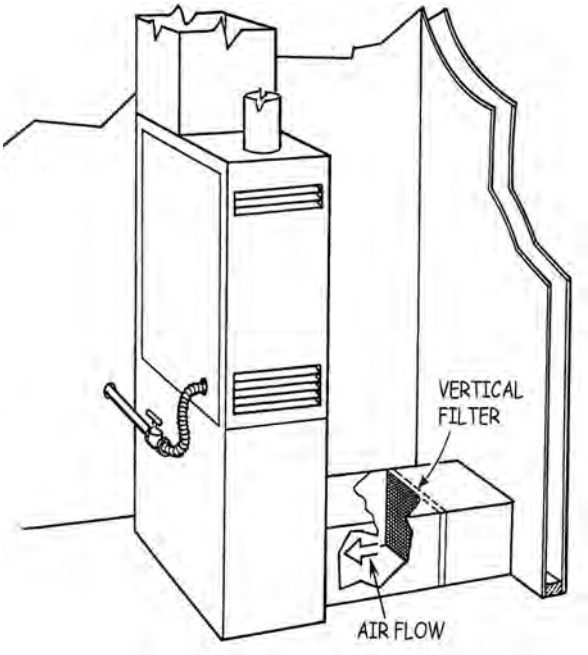
- **All Filters**
  - The HVAC unit shall have:
    - Both upper and lower support devices.
    - Filter access which does not require the removal of any duct or vent pipe.
- **One-Piece Unframed**
  - Bonded Fiber Filters
    - Shall be cut and installed per manufacturer's instructions.
- **Two-Piece Unframed**
  - Two pieces of material shall be used only when a single larger piece cannot be installed.
- **Framed**
  - Two framed filters of the correct size shall be installed.
  - Larger filters shall not be modified to fit by cutting or folding.

5. "V" SHAPED 1" BONDED FIBER FILTERS

- **All Filters**
  - The HVAC unit shall have:
    - A bottom support for the filter.
    - Filter access which does not require the removal of any vent, duct, or pipe.
  - A single piece of material shall be used when possible.
- **One-Piece Unframed**
  - Bonded Fiber Filters
    - Shall be cut and installed per manufacturer's instructions.
- **Two-Piece Unframed**
  - Two pieces of material shall be used only when a single larger piece cannot be installed.
- **Framed**
  - Two framed filters of the correct size shall be installed.
  - Larger filters shall not be modified to fit by cutting or folding.

6. HORIZONTAL AND HAMMOCK STYLES 1" BONDED FIBER FILTERS

- **All Filters**
- **Horizontal Unframed**
  - Internal support shall be installed as needed.
- **Horizontal Framed**
  - Internal support not required.
- **Hammock Style**
  - Unframed filters shall be used.
  - Filter shall be secured with the wire mesh hammock.



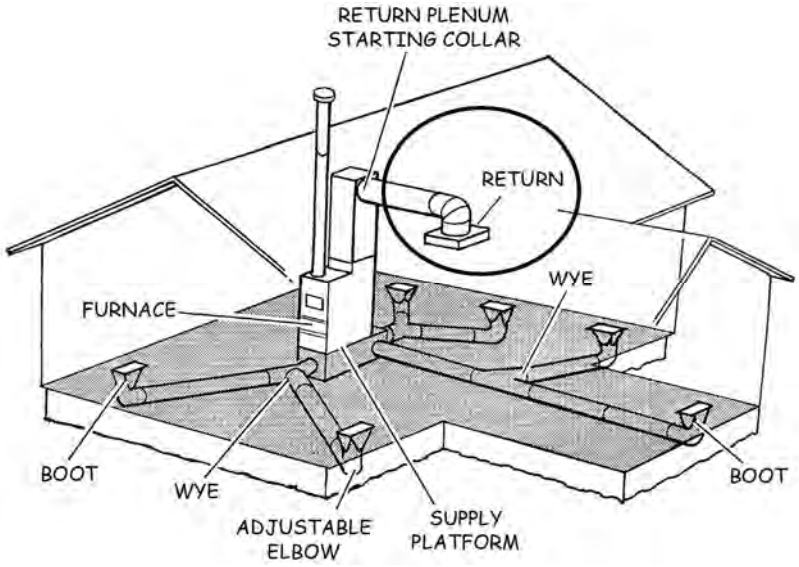
7. VERTICAL 1" BONDED FIBER FILTERS

- **All Filters**
- **Unframed**
  - Internal support shall be installed as needed.
- **Framed**
  - Internal support not required.
- **Vertical-Filter Cap/Cover**
  - When the filter access opening is not sealed by a cap/cover, one shall be provided which blocks leakage.
  - Fabricated caps/covers shall be:

- Made from minimum 26 gage non-corrosive metal (e.g., galvanized sheet metal).
- Mechanically secured with metal turn clips or other means allowing easy removal.

8. RETURN INTAKE GRILLE APPLICATIONS

- **All 1" Bonded Fiber Filters**
- **Unframed**
  - Internal support shall be installed as needed.
- **Framed**
  - Internal support not required.

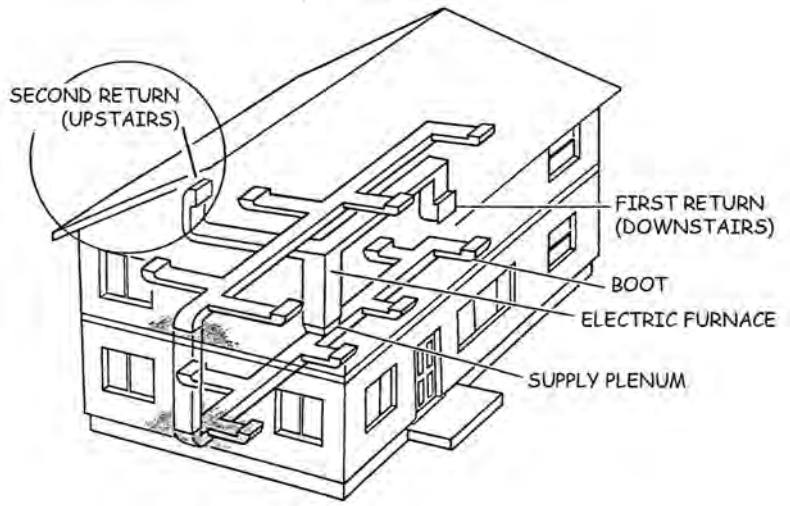


9. TWO FILTERS

- **One Return**
  - When two filters exist within the same return path, one shall be eliminated.
  - The most accessible filter shall be replaced.
- **Two Returns**
  - Each return shall be treated separately as specified above for one return.

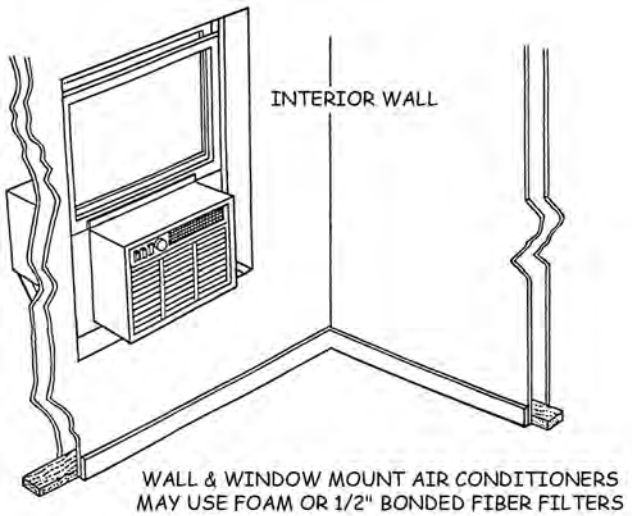
10. WALL FURNACES

- **Filters shall not be installed on wall furnaces, including models with circulating fans.**



11. WALL/WINDOW MOUNT AIR CONDITIONERS

- **All Filters**
  - Replacement filter shall be in accordance with manufacturer specifications.
- **1/2" Bonded Fiber Unframed**
  - Shall be used when not prohibited by appliance manufacturer.
- **Foam Unframed**
  - Shall be installed only when 1/2" bonded fiber:
    - Will not fit properly, or
    - Is prohibited by the appliance manufacturer.

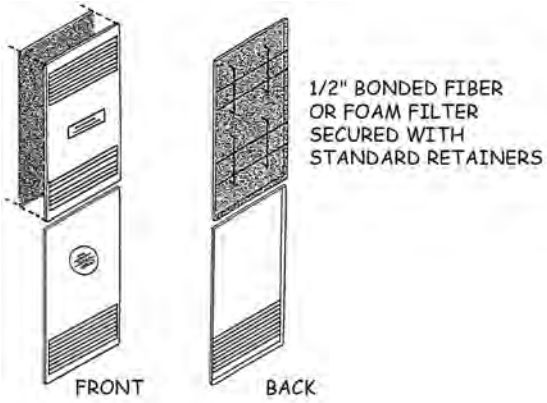


WALL & WINDOW MOUNT AIR CONDITIONERS MAY USE FOAM OR 1/2" BONDED FIBER FILTERS

PART 2: MOBILE HOME CRITERIA

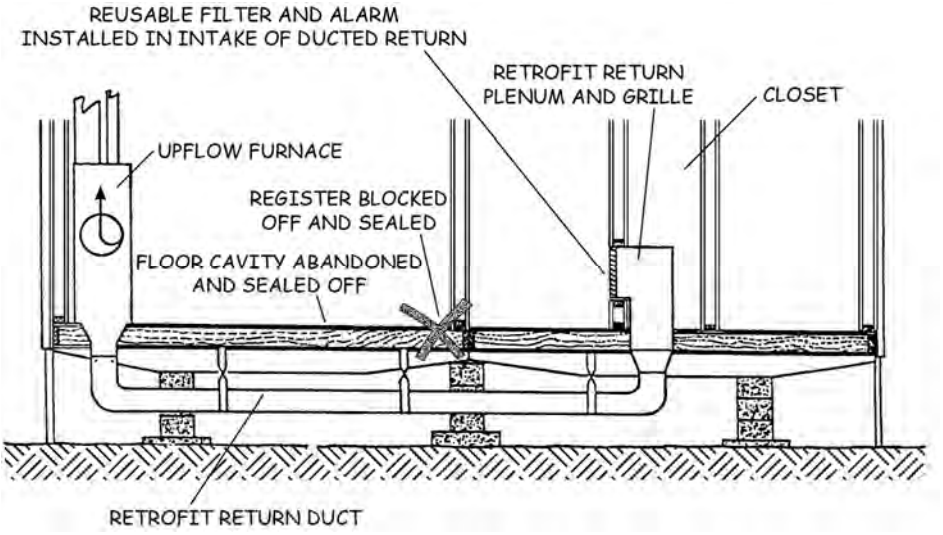
12. HVAC UNITS

- **All Units**
  - A reusable filter shall not be installed.
  - Exercise caution when installing air filters in Mobile Home furnaces to ensure that manufacturer's recommendations and restrictions are observed.
  - Filters shall be installed on Coleman series 7600, 7700, and 7900, and on other makes and models, in accordance with manufacturer's specifications.
  - Filters shall NOT be installed on units with manufacturer's specifications disallowing installation of a filter (e.g., Coleman 8600 "Solar Pack", International, Intertherm, etc.).
- **1" Bonded fiber**
  - Filter shall be installed only on:
    - Gas or oil upflow furnaces equipped with air conditioning.
    - Electric furnaces and heat pumps.
  - The air handler shall be rated by the manufacturer for a 1" filter.
  - The return shall accommodate a 1" filter, which can be properly secured with standard retainer.
- **1/2" Bonded Fiber and Foam**
  - Recommended for Downflow units when:
    - The return can accommodate the material.
    - It can be properly secured with standard retainer.
  - Foam shall be installed when:
    - The return will not accommodate 1/2" bonded fiber.
    - Bonded fiber is prohibited by the manufacturer.



13. DUCTED RETURN INTAKES

- **Unframed Filters**
  - Internal support shall be installed as needed.
- **Framed Filters**
  - Internal support not required.



PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

14. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

15. CLIENT EDUCATION

- **Required Education**
  - Crews shall show occupants how to remove and reinstall the filter, emphasizing the importance of timely replacement of the filters for occupant health and appliance operation.

Back to Main ToC

NOTES

EVAPORATIVE COOLERS

Lead Paint Risk Factor
NONE-HIGH

TABLE OF CONTENTS

EVAPORATIVE COOLERS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

EVAPORATIVE COOLER REPAIR & MAINTENANCE

1. REPAIR CHECKLIST

- **Items 2 through 16 shall be checked and repaired when defective.**
- **Other procedures recommended by manufacturer shall be followed.**

2. PLATFORM/ATTACHMENT REPAIR

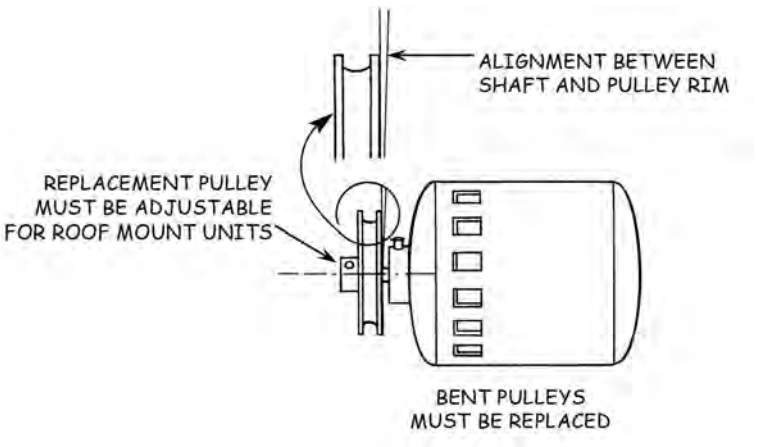
- **Existing installation shall be checked to ensure that the following requirements are met:**
  - Cooler is securely attached to the mounting assembly.
  - Unit is mounted level in all directions.
  - Mounting anchors are the correct size and properly installed.
  - Unit is installed in a manner which will safely support the operating weight (cooler plus water).
  - Existing platform is deteriorated or unsafe, and the condition is feasible to repair within the program scope.

3. ELECTRICAL WIRING

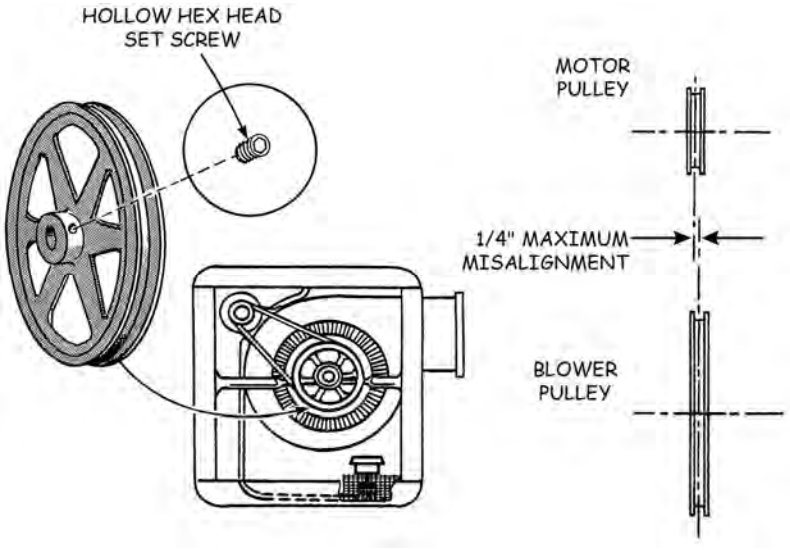
- **Electrical circuitry shall be checked for:**
  - Proper grounding of cabinet, electrical boxes, and conduit.
  - Safe and secure connections.
  - Adequate circuit capacity and overcurrent protection.
- **All Units**
  - All motors and pumps shall be grounded.
  - Newly installed (repaired) wiring or grounding shall be in compliance with the California Electrical Code requirements.

4. PULLEYS

- **Pulleys shall be checked for:**
  - Correct alignment.
  - Proper belt tension.
  - Tightly-installed set screws and nuts.
- **Bent Pulleys**
  - Bent motor and blower pulleys shall be replaced.
- **Pulley Pitch**
  - Replacement motor pulleys shall be adjustable for controlling motor amperage and speed of blower.
  - *Exception:* A fixed pitch pulley may be installed in a window- or wall-mount cooler, if the pulley and motor size/speed match the original equipment.
- **Shaft/Pulley Alignment**
  - Shaft and pulley rim must be in alignment.

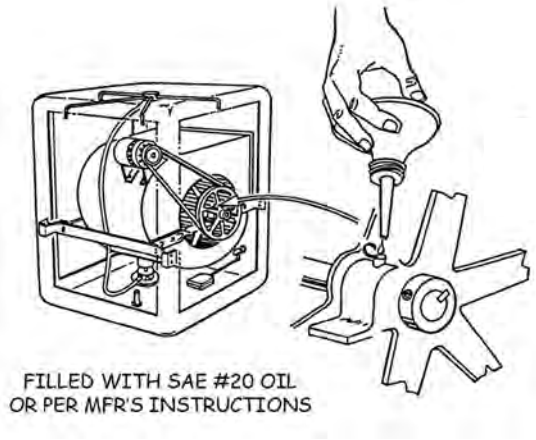


- **Set Screws**
  - Set screws shall be tightened properly to secure the pulley on the shaft.
- **Alignment**
  - Motor pulley and blower pulley shall be aligned to within 1/4".



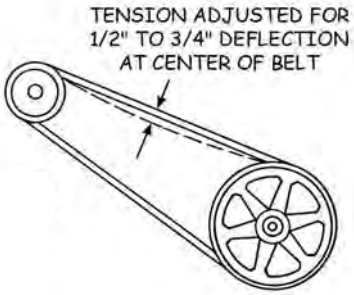
5. BLOWER MOTOR

- **Blower bearing shall be checked for:**
  - Proper lubrication, if applicable.
- **Blower fan shall be checked to ensure:**
  - Proper clearance from housing.
  - Free rotation.
  - Proper operation of both motor and fan.
- **Motor Shaft**
  - Motor shaft shall spin freely.
  - Motor shall be replaced if frozen or if shaft does not spin freely.
- **Unsealed Bearings**
  - Oil cups on unsealed bearings shall be filled with SAE #20 non-detergent oil or lubricated per motor manufacturer's instructions.
- **Blower Motor Replacement**
  - Defective motors shall be replaced.
  - Replacement motors shall be 2-speed.
    - *Exception:* If the existing motor is single speed, the replacement may be single speed.
- **Mounting**
  - Motor shall be safely and securely mounted.
  - All nuts and bolts shall be checked.

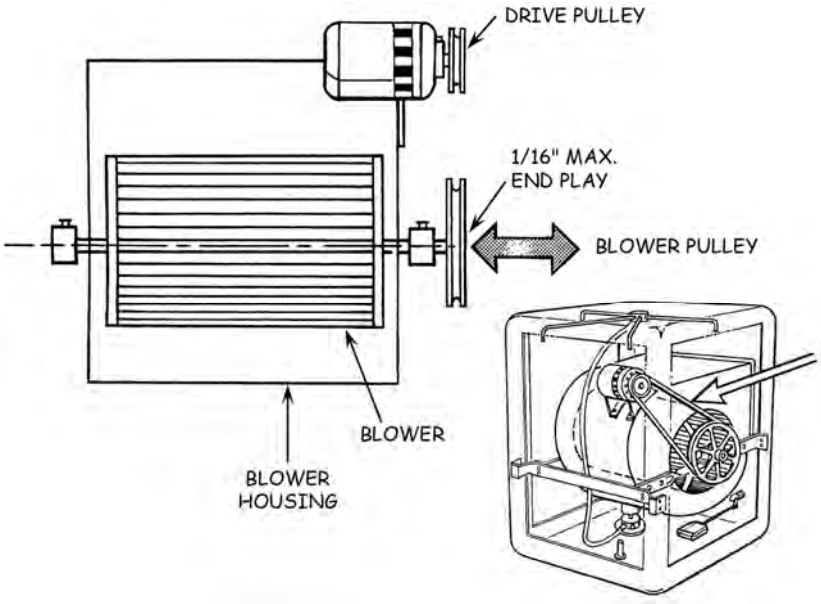


6. BLOWER ASSEMBLY

- **Belt Adjustment**
  - Belt tension shall be adjusted to:
    - A 1/2" to 3/4" deflection at the center of the span, or
    - Per manufacturer's specifications.
  - Motor sheave shall be adjusted to achieve specified motor amperage specified on the nameplate.
    - *Exception:* Does not apply to window/wall units with factory-specified motor speed and fixed pitch pulley.



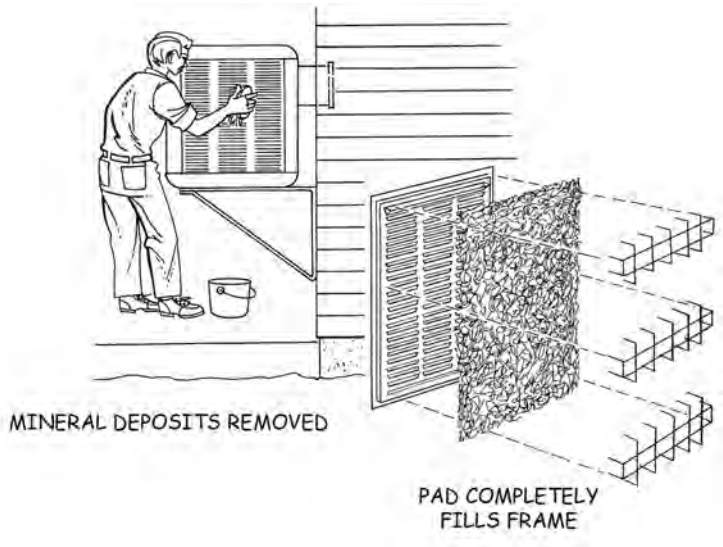
- **Belt Replacement**
  - Belt shall be replaced if cracked or worn unevenly.
- **Blower Maintenance**
  - Oil cups or unsealed bearings shall be filled with SAE #20 non-detergent oil or lubricated per manufacturer's instructions.



- **Alignment**
  - Shaft end play shall not exceed 1/16".
  - Blower wheel shall be centered end-to-end in blower housing.

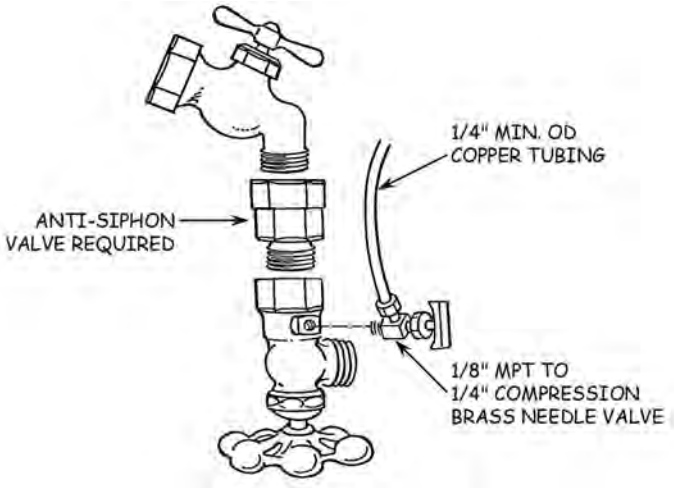
7. COOLER PADS AND FRAMES

- **Pad Frames**
  - Frames shall be cleaned and scraped to remove mineral deposits.
- **Pads**
  - Cooler pads shall be cut to ensure complete coverage of frame.
  - Pad thickness of at least 1" shall be achieved, with a single 1" pad, or with two thinner pads.



8. WATER SUPPLY

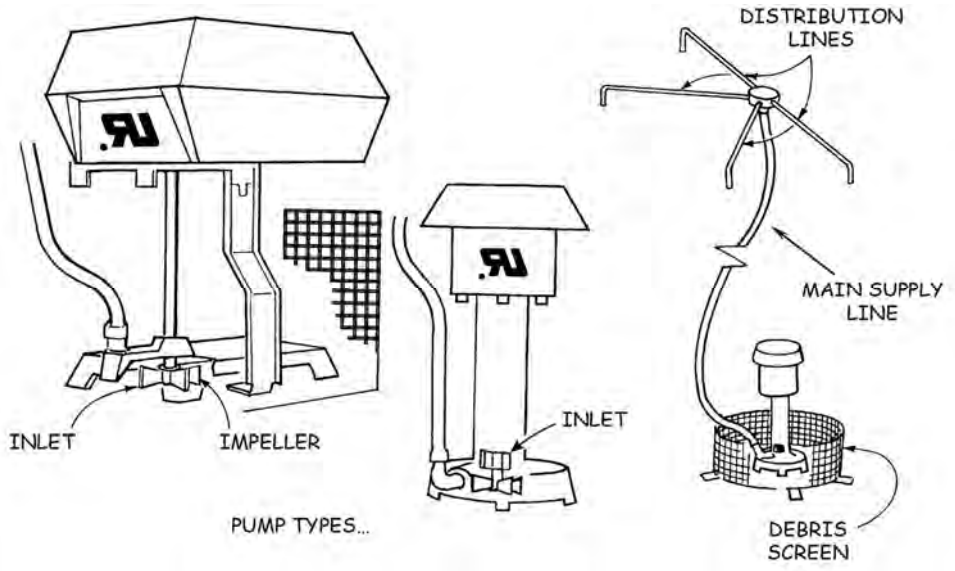
- **Water system shall be checked for:**
  - Proper flow and absence of leaks.
  - Proper adjustment of float, water level, and splash shield.
- **Leaks shall be repaired.**
- **Mineral/calcium deposits shall be removed.**
- **Copper Supply Lines**
  - Shall be minimum of 1/4" OD with brass fittings.
- **Shut-Off Valve and Fittings**
  - Brass shut-off valve shall be installed if no shut-off valve exists.
    - 1/4" x 1/8" needle valve, or as required by local code.
    - Self-tapping needle valve not allowed.
    - Outdoor shut-off shall be reachable from ground level.



- **Plastic Supply Lines**
  - Existing damaged or leaking plastic line shall be replaced with copper.
- **Fittings**
  - Brass fittings only.
- **Anti-Siphon Valve**
  - Anti-siphon valve shall be present.

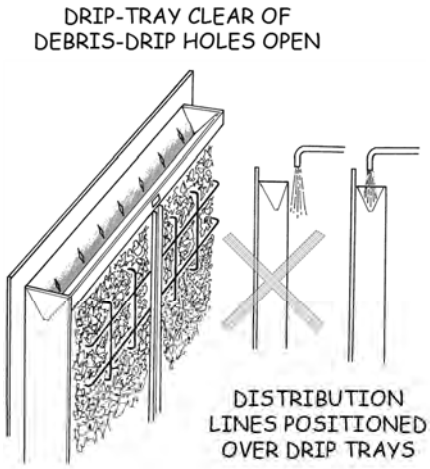
9. WATER PUMP

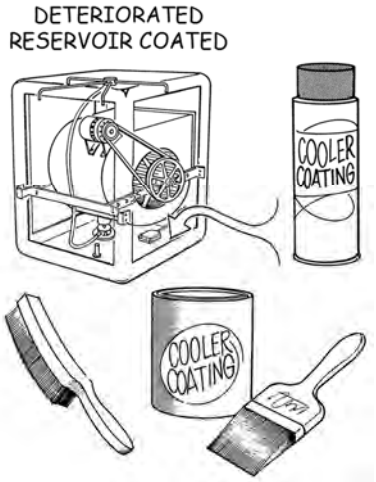
- **Pump and screen shall be checked for:**
  - Properly-installed screen.
  - Debris-free inlet with proper clearance from obstructions.
  - Proper pump impeller operation (turns freely).
- **Pump shaft shall turn freely.**
- **Pump Replacement**
  - Pump shall be replaced if defective.
- **Pump Inlet**
  - Inlet cover shall be free and clear of debris.
  - Debris screen shall be cleaned and replaced if corroded or damaged.
- **Water Lines**
  - Water shall flow freely from pump.
  - Distribution lines shall be:
    - Free of all obstructions, including kinks in main supply line.
    - Sealed at all connections.
    - Replaced if deteriorated.



10. WATER DISTRIBUTION AND DRIP TRAYS

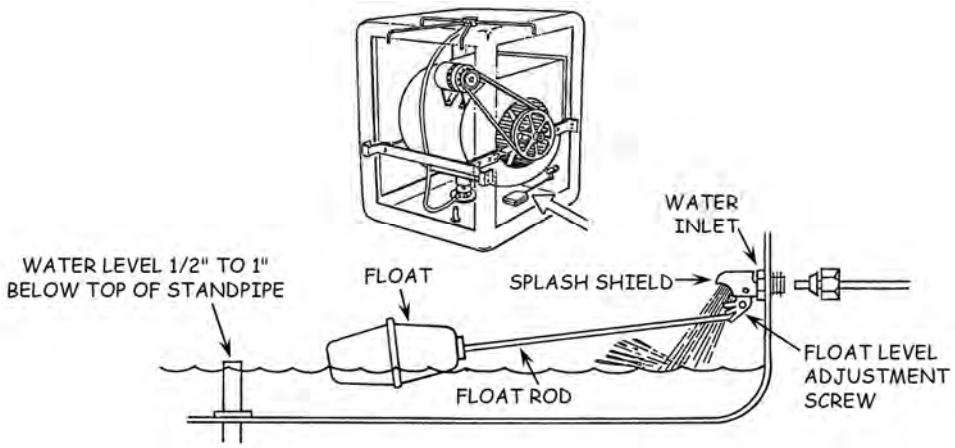
- **Water Troughs**
  - Water in the troughs and reservoir shall be evenly distributed.
- **Water Distribution**
  - Water shall be distributed evenly over cooler pads.
  - Distribution lines shall be positioned over trays.
  - Drip trays shall:
    - Be free of all debris.
    - Have clean, open holes.
    - Be level for proper operation.





11. FLOAT VALVE

- **Float Adjustment**
  - Water level shall be within 1/2" to 1" of the top of standpipe.
  - Water level may be adjusted with float level adjustment screw, or by bending the float rod.
- **Valve**
  - Float valve shall completely shut off incoming water when raised.
- **Splash shield**
  - Float splash shield shall prevent water from spraying away from reservoir.
- **Replacement**
  - All malfunctioning parts shall be replaced.

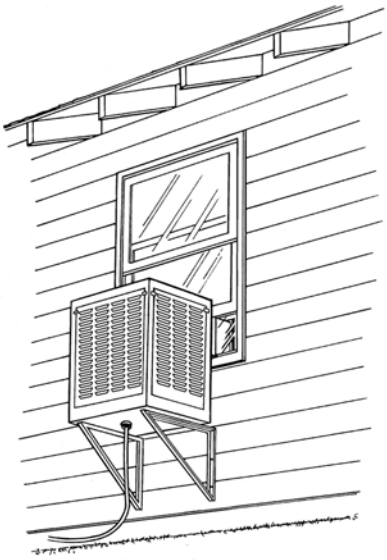


12. COOLER RESERVOIR

- **Reservoir and Standpipe shall be checked to determine that they:**
  - Are properly installed and free of leaks.
  - Defective standpipe and/or gasket shall be replaced if leaking.
- **Maintenance and Cleaning**
  - All debris shall be removed.
  - Rusted or deteriorated units shall be cleaned and coated with undercoating.
  - Other services, as identified by a qualified technician.

13. DRAIN SYSTEM

- **Drain line shall be checked to determine that it:**
  - Is properly installed and free of leaks.
  - Terminates correctly.
- **Drain Water:**
  - Shall flow away from the house.
  - Shall not flow or splatter against wall.
- **Drain Hose/Line**
  - Water shall be diverted away from the structure.
  - End of hose/line shall be visible.
  - If missing, a drain line shall be added.



DRAIN WATER MUST FLOW AWAY FROM THE HOUSE

14. COOLER DUCTING

- **Ducts Serving Only the Cooler**
  - Disconnections and damage/leaks shall be repaired per CSD WIS Section 6 (Duct System Repair and Sealing).
  - Routine duct testing of the evaporative cooler duct is not required.

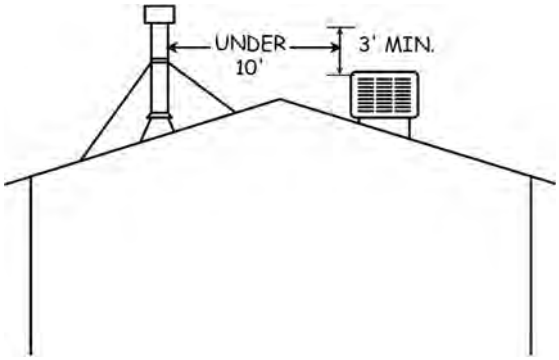
- When discharge is through supply registers, the registers shall be covered with magnetic sheet covers, per CSD WIS Section 10 (Vent Covers).

15. ADDITIONAL CHECKS FOR ROOF-MOUNT UNITS

- Roof jack must be securely installed and sealed at cooler and roof.
- Plumbing and electrical roof penetrations shall be properly sealed.

16. EXTERIOR CLEARANCES

- **All Conventional Home Units**
  - Cooler air intake shall be located at least 10' away from, or 3' below, combustion appliance vent terminations.
  - Cooler air intake shall be located at least 10' away from:
    - Plumbing vent terminations.
    - Kitchen and bathroom exhaust fan vent terminations.
  - Unit shall not be installed if clearance requirements cannot be met.



EVAPORATIVE COOLER INSTALLATION

17. GENERAL INSTALLATION REQUIREMENTS

- **Installation shall be in compliance with the CBC, the CEC, and with local codes and safety regulations regarding:**
  - Structural soundness.
  - Proper support system.
  - Secure attachment.
  - Plumbing of water supply system.
  - Electrical circuit and connections.
  - Location and exterior clearances.
  - Drain line.
- **Units shall be installed:**
  - Per manufacturer's instructions.
  - Plumb, level, and securely attached to the mounting surface.
  - With water in the troughs and reservoir evenly distributed.

18. EXHAUST VENTILATION

- **For an evaporative cooler to be installed, adequate exhaust ventilation must be present or provided, which may consist of one or more of the following means:**
  - Screened windows or doors, or security door.
    - Windows and doors with # 16 mesh insect screen must provide 2 sq. ft. of screened opening per 1,000 CFM cooler capacity (airflow), as shown in the following table, column 2.
  - Ceiling Vents (Pressure Relief Dampers or “Up-Ducts”)
    - These are ceiling vents (ceiling-mount exhaust vents or pressure relief dampers) with pressure-activated damper, which is exhaust cooled air through the attic.
    - May be used in lieu of, or in combination with, screened windows and doors if attic ventilation NFVA equals or exceeds the total NFVA of the ceiling vents (see table below).
    - Shall close completely to block backdraft/infiltration when the cooler is off.
    - Shall be equipped with a positive closure mechanism which is automatically activated by high heat.
    - Shall not be used when the attic contains open combustion appliances.

- **Ceiling Vents**
  - Attic venting NFVA (see table below, column 3) must equal or exceed the total NFVA of the ceiling vents being used.
  - Ceiling vents may be used as the sole exhaust path only if the total NFVA or CFM capacity of the vents equals or exceeds:
    - NFVA/capacity recommended by the vent manufacturer, or
    - Minimum NFVA shown in column 3 of the table below.

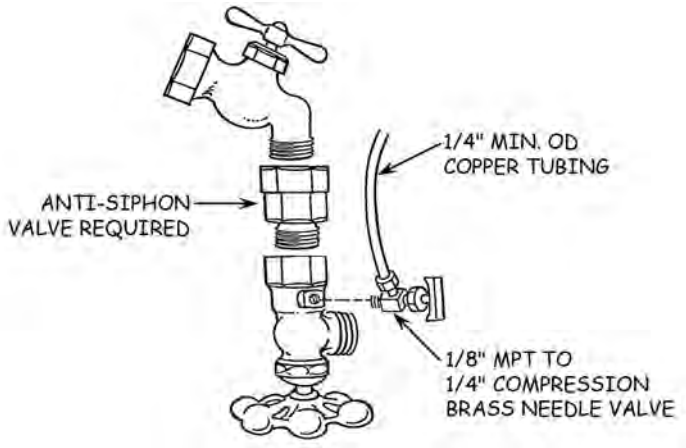
EVAPORATIVE COOLER EXHAUST OPENINGS		
COOLER CAPACITY (AIRFLOW IN CFM) [COLUMN 1]	**WINDOW & DOOR EXHAUST MINIMUM SCREENED OPENINGS [COLUMN 2]**	**ATTIC EXHAUST MINIMUM NFVA [COLUMN 3]**
3,000	6 sq. ft.	4.0 sq. ft.
3,500	7 sq. ft.	4.7 sq. ft.
4,000	8 sq. ft.	5.3 sq. ft.
4,500	9 sq. ft.	6.0 sq. ft.
5,000	10 sq. ft.	6.7 sq. ft.
5,500	11 sq. ft.	7.3 sq. ft.
6,000	12 sq. ft.	8.0 sq. ft.
6,500	13 sq. ft.	8.7 sq. ft.
Note 1: Column 2 values shown assume #16 mesh insect screening will be present. Note 2: Values in column 3 are calculated using the formula: Cooler Capacity CFM ÷ 750 = Min. Exhaust NFVA. See Section 21, "Net Free Venting Area (NFVA) Charts," for attic ventilation NFVA guidelines.		

19. LEVELING OF COOLER

- **All Units**
  - Cooler shall be level.
  - Water in the troughs and reservoir shall be evenly distributed.

20. WATER SUPPLY

- **Supply Lines**
  - Minimum 1/4" OD copper tubing shall be:
    - Routed along the exterior of the building, and
    - Secured with tube straps/brackets installed a minimum of 28" OC.
- **Brass Shut-Off Valve and Fittings**
  - Outdoor water shut-off shall be reachable from ground level.
- **Anti-siphon Valve**
  - Anti-siphon valve shall be present.

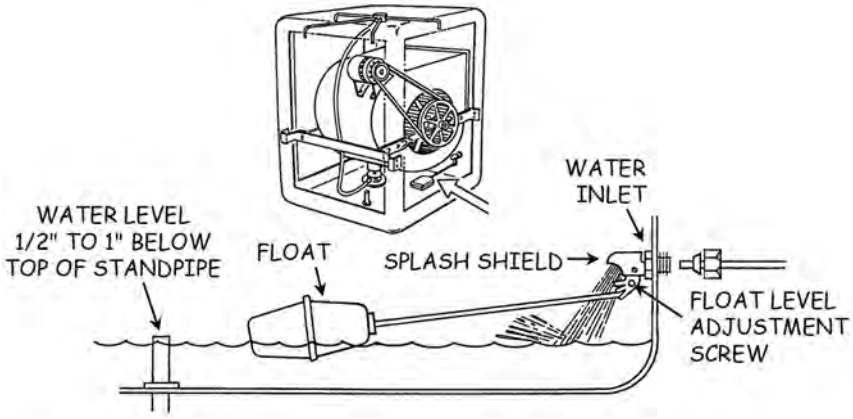


RESTRICTED MATERIALS

- **The following evaporative cooler materials shall <u>not</u> be installed:**
  - Plastic tubing, fittings, and valves.
  - Self-tapping needle valve.
  - Water Additives
    - Cooler cleaning and water treatment additives shall not be used, unless recommended by the cooler manufacturer

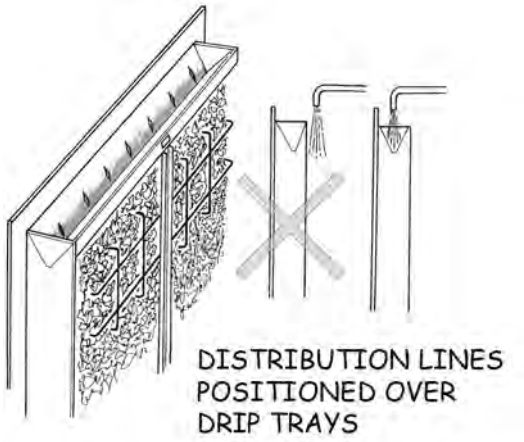
21. VALVE AND FLOAT

- **Valve shall:**
  - Completely shut off incoming water.
  - Incorporate a downward directional water outlet and/or splash shield that prevents water from spraying away from the reservoir.
- **Water Level**
  - Standard units: within 1/2" to 1" of the top of standpipe.
  - High-efficiency units: as specified by the manufacturer.



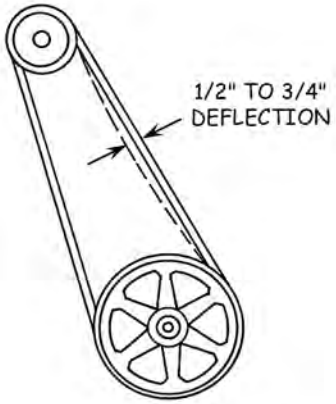
22. WATER DISTRIBUTION

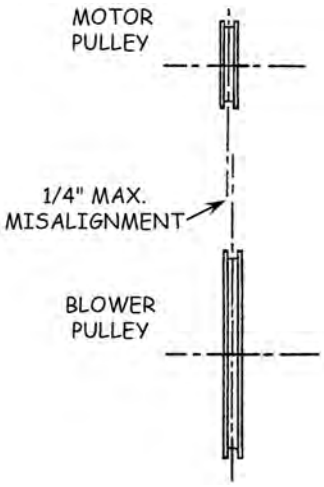
- **All Units**
  - Distribution lines shall be positioned directly over drip trays.
  - Drip trays shall:
    - Be positioned to provide even distribution of water over pads.
    - Be free of all debris.
    - Have clean, open holes.
    - Be level for proper water distribution.



23. CLEANING DEVICE/SYSTEM

- **All Units**
  - Shall be equipped with automatic cleaning device, such as:
    - An automatic flushing system (e.g., timed purging), or
    - A bleed-off system, when allowed.
  - Compliance
    - System shall be in compliance with local code.
    - Manufacturer's instructions shall be followed.





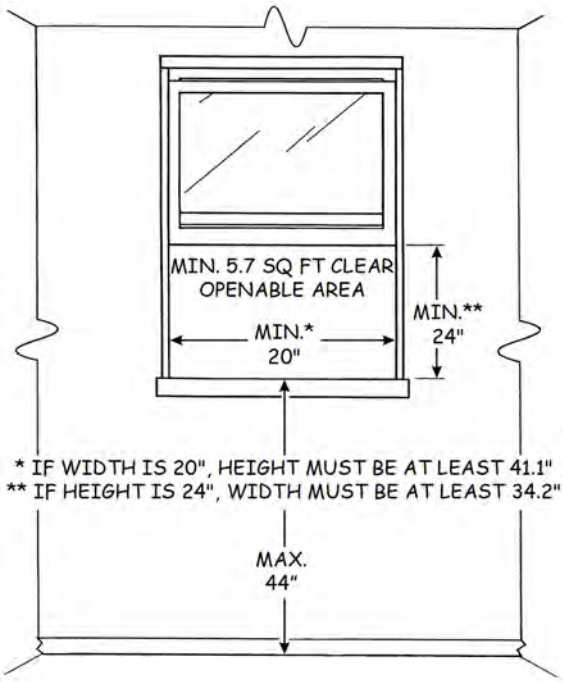
24. BLOWER ASSEMBLY

- **Motor**
  - Motor shall spin smoothly and freely.
  - Motor shall be mounted per manufacturer's instructions, with all fasteners tightened securely.
- **Lubrication**
  - Unsealed motor and fan bearings shall be lubricated:
    - With SAE #20 non-detergent oil placed in the cups, or
    - Per manufacturer's instructions.
- **Adjustments**
  - Belt tension shall be adjusted to a deflection in the middle of 1/2" to 3/4", or per manufacturer's specifications.
  - Amp draw shall be adjusted when applicable (e.g., roof-mount units with adjustable sheave).
    - The motor sheave shall be adjusted to achieve specified motor amperage, if not factory-set.
    - Amp draw shall be checked with a meter, and shall not exceed maximum shown on the motor specification plate.
- **Pulleys**
  - If not factory adjusted:
    - Pulley rim shall be perpendicular to the shaft.
    - Motor pulley and blower pulley shall be aligned within 1/4" of each other.

WINDOW & WALL UNITS—INSTALLATION REQUIREMENTS

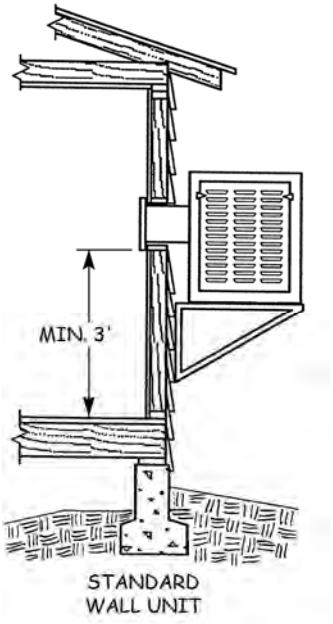
25. EGRESS WINDOWS

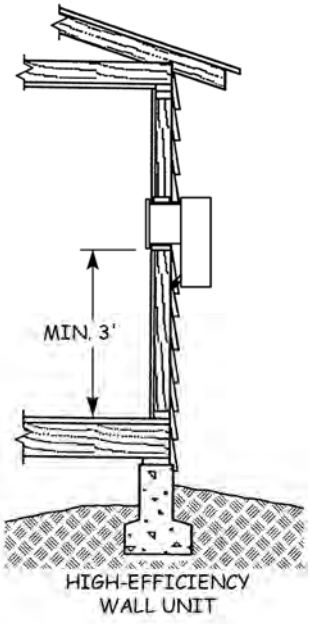
- **Coolers Installed in Egress Windows**
  - Unit shall not violate egress requirements, which apply to all rooms used for sleeping.
  - When a sleeping room has no operable exterior door, at least one window shall meet the egress requirements of local or state code[1], which places the following requirements on egress windows:
    - Minimum net clear openable area and dimensions:
    - Area of 5.7 sq. ft. (*Exception:* 5.0 sq. ft. minimum on a “grade-floor” opening/window (a window with sill height



not *more* than 44" above the finished ground level adjacent to the opening).
  - Minimum Width of 20" and Height of 24".
  - Maximum finished sill height of 44" above the floor.

- **Cooler shall <u>not</u> be installed in egress windows ***<u>unless</u>:***
  - Allowed by local jurisdiction, <u>and</u>
  - Allowed by client, <u>and</u>
  - One of the following is present in the same room:
    - Another operable window which meets egress requirements, <u>or</u>
    - An operable exterior door that meets egress requirements.





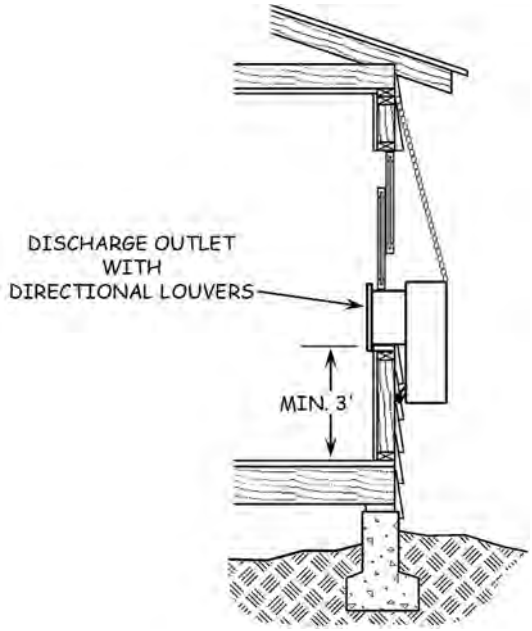
26. WINDOW/WALL UNIT LOCATION

- **All Units**
  - Clearances and mounting height shall be in compliance with local code and manufacturer's instructions.
  - Unit shall be installed only in a window or wall opening.
  - Exterior portion of unit shall be located a minimum of 1' above grade.
  - Discharge shall <u>not</u> be located where it can disturb combustion appliance burners/pilots (e.g., in kitchen near gas range).

Section 29

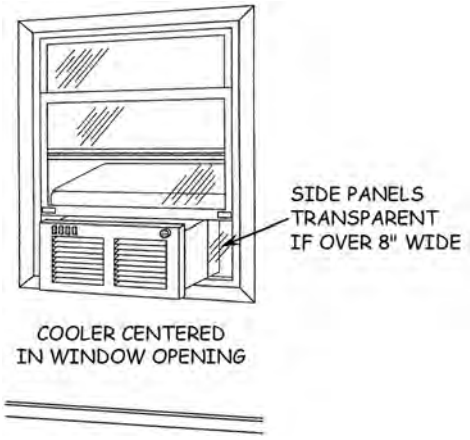
27. WINDOW/WALL INSTALLATION OPENING

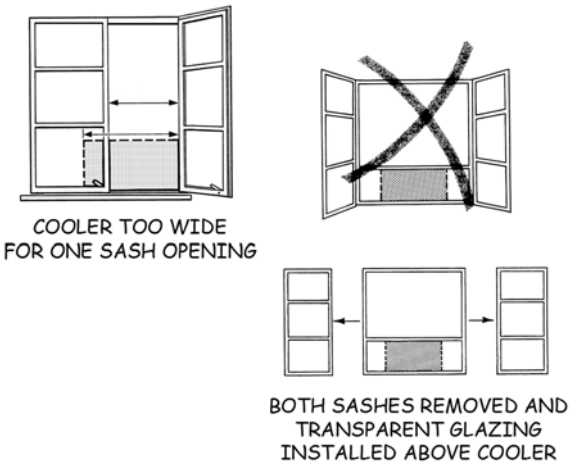
- **All Units**
  - Wall shall be structurally sound and able to support unit's weight and vibration.
  - The opening shall be framed with structural members.
  - Opening in brick veneer and block walls shall have:
    - Lintel and flashing installed above opening when required.
    - Flashing (drip rail) installed below unit.
  - Unit shall be sealed in place.
- **Wall-Mount Height**
  - Air discharge outlet shall be located in accordance with manufacturer's specifications. If no specifications are existing, location shall be a minimum of:
  - 3' above the floor unless mounted under window.
  - 18" above floor if:
    - Discharge grille is equipped with directional louvers, and
    - Location is allowed by manufacturer.
    - *Exception*: Height of an existing location is acceptable, if not in conflict with manufacturer's instructions or local code.
- **Wall Opening Modification**
  - The hole shall be enlarged or reduced to meet manufacturer's hole size and clearance specifications.
  - Opening shall be structurally sound and framed.
  - Interior and exterior sheathing shall be neatly patched and trimmed, with all exposed wood sealed (using primer or paint) to prevent moisture damage.
- **Window-Mount– Height**
  - Cooler shall be placed in center of window opening.
  - Unit location must be allowed by manufacturer.
  - Air discharge outlet shall be located a minimum of:
    - 3' above the floor unless mounted under a window.
    - 18" above floor if discharge grille is equipped with directional louvers and allowed by manufacturer.
  - All Windows
    - Permanent window panels shall be installed to completely fill empty spaces.
    - Side window panels over 8" wide shall be transparent: glass or polycarbonate.
    - Window panels shall be sealed in place.
  - Vertical Sliding Windows
    - Cooler shall be installed in lower sash opening.
    - Lower sash shall seal against unit and side panels.
  - Double-Hung Windows
    - Cooler shall be placed in center of window opening.
    - Cooler shall be installed in lower sash opening.
    - Lower sash shall seal against unit and side panels.
  - Horizontal Sliding Windows
    - Sliding sash shall seal against unit.
  - Awning or Jalousie Windows



- Displaced panels/panes shall be carefully removed and given to client for storage.
- Pivots, operators, or other hardware damaged during removal shall be repaired or replaced.

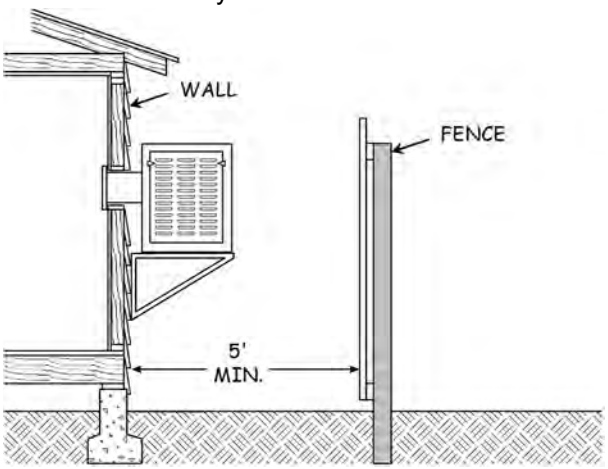
- **Single-Vent Casement Windows**
  - Sash shall be removed.
  - Cooler shall be permanently installed and sealed.
  - Transparent glazing shall be installed above cooler: glass or polycarbonate.
  - Owner shall be informed about sash removal and final appearance, and shall give written consent before installation.
- **Double-Vent Casement Windows**
  - When unit is too large for one sash opening, cooler may be installed only if:
    - Both sashes are removed.
    - Cooler is permanently installed and sealed.
    - Transparent glazing is installed above cooler: glass or polycarbonate.
  - Owner shall be informed about sash removal and final appearance, and shall give written consent before installation.





28. WINDOW/WALL EXTERIOR CLEARANCES

- **Setbacks**
  - Property setback requirements shall not be violated.
  - There shall be at least 3' between the cooler and the adjacent fence or wall, *unless* a shorter distance is allowed by local ordinance/code or recommended by the manufacturer.
- **Sidewalk Clearance**
  - Unit shall not extend into sidewalk clearance zone (i.e., over sidewalk).
  - Minimum clearance from sidewalk shall be 21" if allowed by local code.



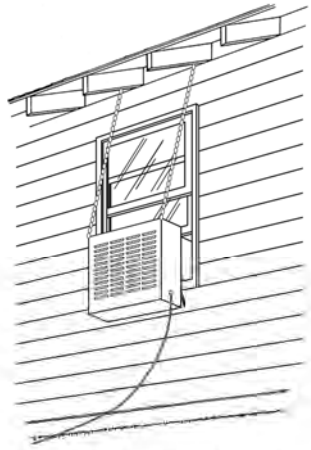
- **Exterior Clearance**
  - Clearance shall comply with local code.
  - Cooler air intake shall be located:

Evaporative Cooler Inlet shall be at least:	
10' from or 3' below	Gas vent pipe, solid-fuel chimney
10' from	Bathroom or kitchen exhaust, clothes dryer exhaust, plumbing vent, vehicle exhaust source, or other source of toxic contamination
3' from	Attic vent, gas meter assembly.

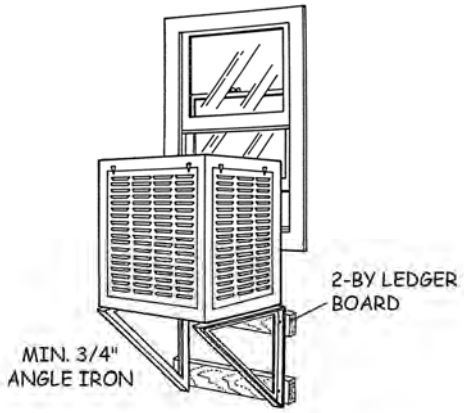
  - Minimum 24" clearance is required on all sides for maintenance.
  - Unit shall not be installed if clearance requirements cannot be met.

29. WINDOW/WALL COOLER SUPPORTS

- **All Installations**
  - Cooler shall be supported by platform, metal brace, or chain kit.
  - All metal shall be primed, anodized, painted, galvanized, or corrosion-resistant (e.g., aluminum).
- **Brace Support Material**
  - All material shall be metal.
  - Minimum 3/4" x 3/4" angle iron or equivalent.
- **Brace Supports**
  - Brace shall be anchored with non-corrosive screws to solid wood, such as:
    - Minimum 3/4" siding.
    - Structural framing.
    - 2-by ledger board.



HIGH EFFICIENCY WINDOW-MOUNT UNIT WITH CHAIN SUPPORT

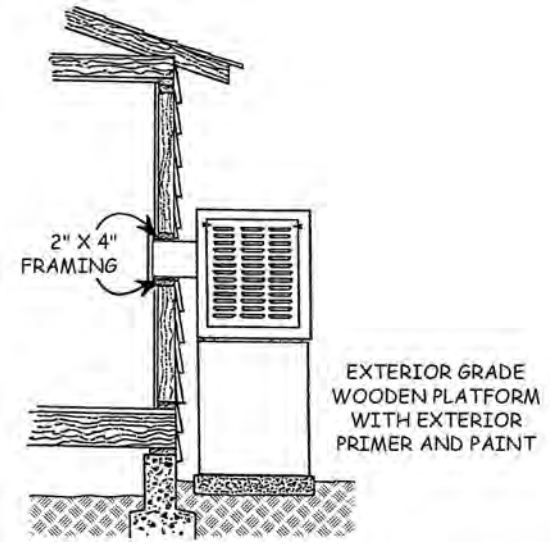


STANDARD WINDOW-MOUNT UNIT WITH BRACE SUPPORTS

Chain Brackets

- Brackets shall be attached with screws that penetrate solid wood at least 3/4" (1" if self-drilling).
- Brackets shall not be anchored to window sash or trim.

- **Platform Supports**
  - Platform shall:
    - Be braced and stable.
    - Rest on concrete pad or masonry supports.
  - Materials for wooden platforms shall be:
    - Exterior grade.
    - Sealed with exterior primer and paint.
    - Separated from the earth (e.g., by concrete).



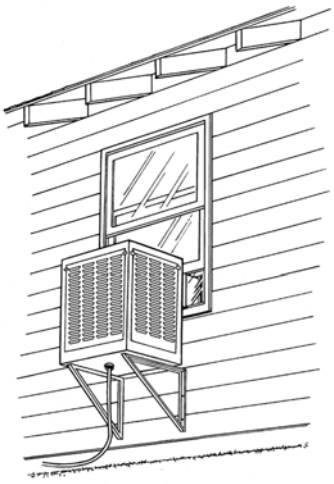
- **Opening for Wall-Mount Unit**
  - Wall opening shall be framed internally with 2-by lumber.
  - Studs cut to create the opening shall be properly secured to adjacent solid studs with header and sill.
  - Opening shall be flashed/sealed in accordance with local code.
  - Opening shall be trimmed on interior and exterior.
    - New wood shall be primed and painted to protect wood from moisture damage (non-cosmetic painting only).
    - Exterior grade materials shall be used outdoors.

30. WINDOW/WALL COOLER ATTACHMENTS

- **Attachment shall comply with manufacturer's minimum specifications, however:**
  - Non-corrosive screws or lag bolts shall be used.
  - Nails and molly bolts are not allowed.
- **Anchors shall penetrate framing members a minimum of 3/4" (1" if self-drilling screws).**

31. WINDOW/WALL DRAIN OVERFLOW

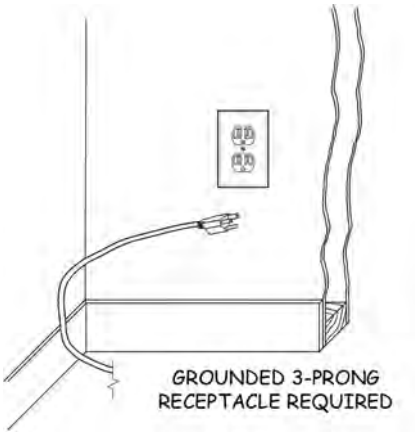
- **Drain water shall:**
  - Flow away from the house.
  - Not flow or splatter against wall.
  - Not puddle.
- **Drain Hose/Line**
  - Required on all coolers.
  - Shall be installed to divert water away from the house.
  - Shall not cross a walkway.
  - End of hose/line shall be visible.
- **Cleaning Device**
  - Standard units must be equipped with an automatic cleaning device, such as:
    - An automatic flushing system, or
    - A bleed-off kit.
  - Manufacturer's instructions shall be followed.



DRAIN WATER MUST
FLOW AWAY FROM THE HOUSE

32. WINDOW/WALL ELECTRICAL REQUIREMENTS

- **All Units**
  - Circuit type and capacity shall be in conformance with manufacturer's instructions.
  - Wiring shall be installed in compliance with the CEC.
  - Splices shall be:
    - Protected with pressure splicing connectors (e.g., “wire nuts”).
    - Placed inside junction boxes.
  - Junction boxes shall be properly covered.
  - Exposed wiring shall be housed in conduit.
  - Cooler and metal conduit shall be properly grounded.
  - Circuit Loading
    - Amp draw shall be checked with a meter.
    - Circuit shall not be overloaded.
  - Plug-in units shall be connected to a grounded 3-wire receptacle.
  - Appliance cord shall be factory-installed.
  - Extension Cord
    - Acceptable only if allowed by manufacturer.
    - Shall be rated for cooler load, but no lighter than 14 AWG.



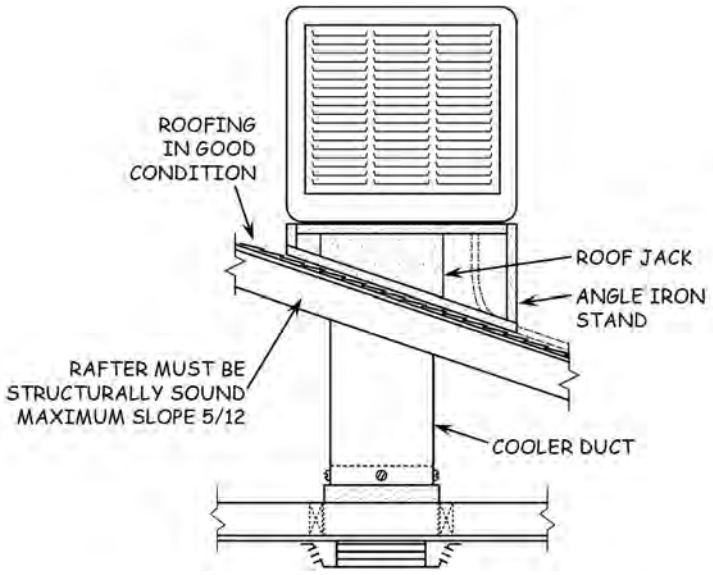
33. WINDOW/WALL WINTER PROTECTION

- **Interior means shall be present to close off the cooling system during winter to protect against infiltration of unconditioned air.**
  - Interior closure shall be created by:
    - Grilles which have positive closed positions, or
    - A damper in the face grille, or
    - Cover/closure for the discharge openings of the cooler unit.
  - Exterior closure may be created by an exterior cover/closure which seals the intake openings of the cooler unit.
  - Vent covers shall be installed in accordance with CSD WIS Section 10 (Vent Covers).

ROOF-MOUNT UNITS—INSTALLATION REQUIREMENTS

34. ROOF-MOUNT LOCATIONS

- **The unit shall be installed in a location:**
  - That is structurally sound and capable of properly supporting the operating weight of the cooler.
  - Where the base support can be securely attached and the cooler can be properly leveled.
  - Where roofing materials are in good condition and capable of withstanding foot traffic required for installation.
  - Providing clearances prescribed in Item 35.
- **Installation shall <u>not</u> be attempted on a roof:**
  - Having a slope greater than 5/12.
  - Finished with tile, metal, or wooden shingles or shakes.
  - On which foot traffic required for installation is likely to cause damage and/or roof leaks.

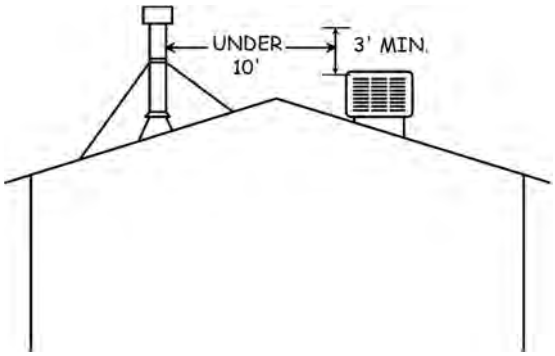


35. ROOF-MOUNT EXTERIOR CLEARANCES

- **All Units**
  - Clearance shall comply with local code.
  - Cooler air intake shall be located:

Evaporative Cooler Inlet shall be at least:	
10' from or 3' below	Gas vent pipe, solid-fuel chimney
10' from	Bathroom or kitchen exhaust, clothes dryer exhaust, plumbing vent, vehicle exhaust source, or other source of toxic contamination
3' from	Attic vent, gas meter assembly.

  - Cooler air intake shall be located at least 10' away from, or 3' below, combustion appliance vent terminations.
  - Cooler air intake shall be located at least 10' away from:
    - Plumbing vent terminations.
    - Kitchen and bathroom exhaust fan vent terminations.
  - Unit shall not be installed if clearance requirements cannot be met.

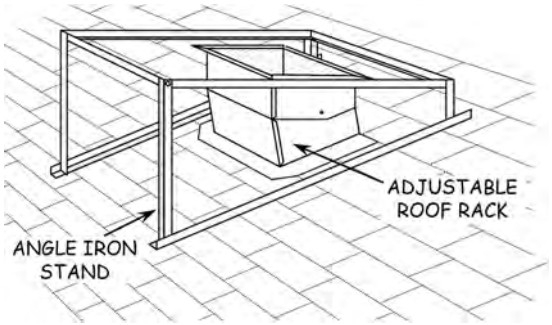


36. ROOF-MOUNT COOLER SUPPORTS

- **All Units**
  - The support system and cooler shall be installed in accordance with manufacturer's instructions and local code.
  - The support system shall be securely anchored to the roof and structural framing (truss chords and/or blocking).

- The cooler shall be:
  - Securely mounted and stable.
  - Level in all directions.
- All anchor points and roof penetrations shall be sealed.

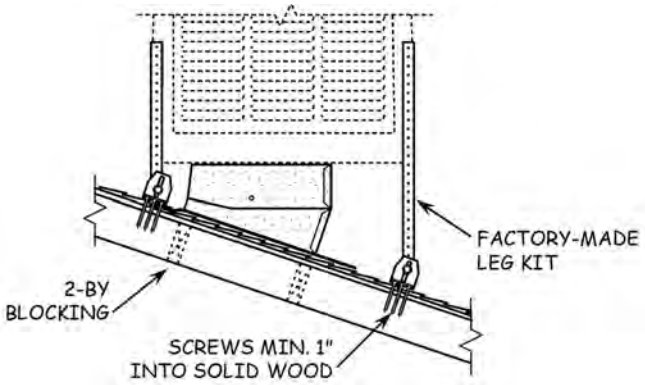
- **Bottom Support System**
  - Cooler shall be supported by wooden or angle iron stand, sheet metal curb, or support kit (e.g., roof jack and leg kit).
  - Cooler shall not be supported solely by the roof jack or duct.
  - The support system shall be:
    - Installed per manufacturer's instructions, when applicable.
    - Stable and secure.
    - Constructed in a manner which does not trap rain water.



- **Replacement units may be installed on an existing support system which:**
  - Is the correct size, and is in good condition.
  - Meets all requirements of this section.
- **Metal Frame Components**
  - Minimum 3/4" x 3/4" 16 gage angle iron or equivalent for support stand.
  - All metal shall be primed, anodized, painted, galvanized, or corrosion-resistant (e.g., aluminum).
- **Wooden Components**
  - Platforms constructed of wood:
    - Shall be framed.
    - Shall <u>not</u> trap water/debris nor enclose the roof jack/duct so tightly that moisture cannot readily escape.
  - Framing
    - Minimum 2x4 pressure-treated lumber or redwood.
    - Cut ends and holes made in pressure-treated lumber shall be treated with preservative.
  - Plywood for bracing and sheathing shall be:
    - Exterior grade.
    - Sealed with exterior primer and paint.

37. ROOF-MOUNT SUPPORT SYSTEM ATTACHMENTS

- **Support system attachments/anchors shall be:**
  - In conformance with manufacturer's instructions and local code.
  - Corrosion-resistant and chemically-compatible screws, bolts, or lag bolts (nails and molly bolts <u>not</u> allowed).
- **Anchors must penetrate minimum 1" into solid wood, such as:**
  - Structural framing or blocking.
  - 2-by ledger board attached to structural framing.
  - *<u>Exception</u>:* Factory-fabricated leg kits and support systems may be anchored to roof sheathing in accordance with manufacturer's instructions and local code.



38. ROOF OPENING

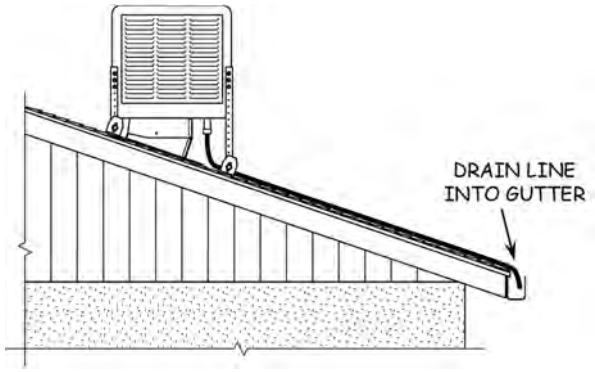
- **The roof opening shall be:**
  - Located between two roof rafters/chords.
    - Cutting roof rafters and truss chords is not allowed.
  - Framed with 2-by lumber to create a boxed opening.

39. ROOF-MOUNT PLUMBING

- **Water Supply**
  - Shall be in conformance with Item 8.
  - When the supply line penetrates the roof or roof jack, the penetration shall be sealed.

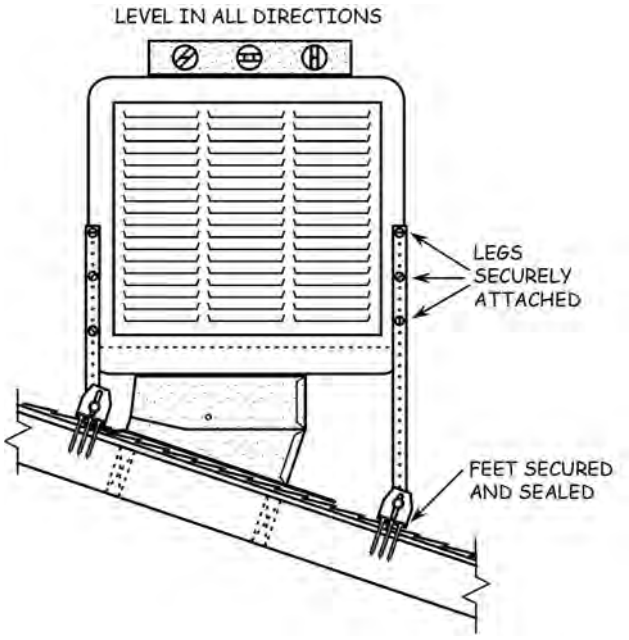
40. ROOF-MOUNT DRAIN SYSTEM

- **Permanent Drain Line**
  - Shall be installed to prevent drain and overflow water from running onto the roof.
  - Acceptable drain line materials include copper, PVC, and galvanized pipe.
  - Drain line shall terminate in a rain gutter, in an approved drainage system, on the ground, or as required by the local jurisdiction.
  - Exposed PVC piping shall be painted to resist UV degradation.
- **When the drain line is routed to the ground:**
  - It shall divert water away from the house.
  - The end of the drain line shall be visible.



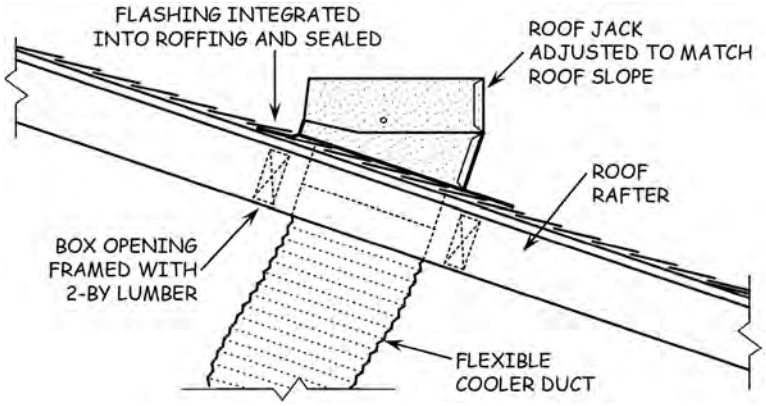
41. ROOF-MOUNT COOLER INSTALLATION

- **The support system and cooler shall be installed in accordance with:**
  - Manufacturer's instructions and specifications.
  - Local codes and safety regulations.
- **The support system:**
  - Shall be securely anchored to the roof, and
  - All anchor points shall be sealed.
- **The cooler shall be:**
  - Securely mounted and stable, and
  - Level in all directions.
- **Clearances**
  - Minimum 24" clearance is required on all sides for maintenance.
  - Drain fitting shall have minimum 4" clearance above the roof.



42. ROOF JACK AND DUCT START COLLAR

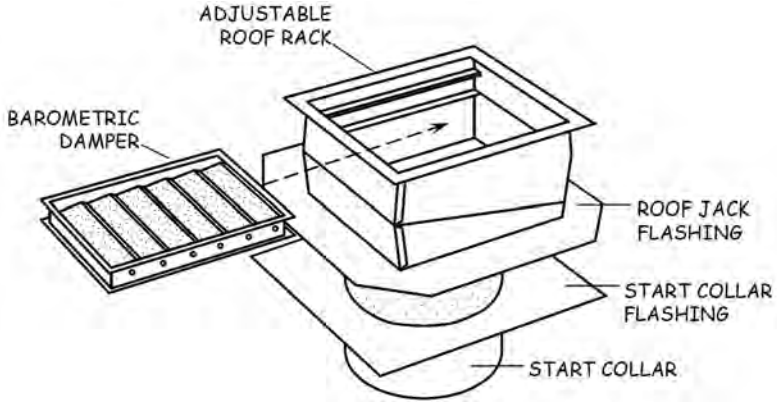
- **New Installations**
  - Minimum roof slope shall be 2/12.
  - The roof jack shall be:
    - Adjustable, or shall match the roof slope.
    - Sealed to the cooler.
- **Flashing**
  - Flashing for the roof jack (and duct start collar, if applicable) shall be integrated into the roofing in accordance with standard roofing practices.



    - The upper flange shall be placed underneath the roofing material.
    - Sealant shall be applied to prevent water leaks.
    - The flashing shall be mechanically attached to the roof.
- **Existing Roof Jack and Collar**
  - Replacement units may utilize the existing roof jack and duct start collar, *provided* they are the correct type and size, are in good condition, and meet all requirements of this section.

43. ROOF-MOUNT BAROMETRIC DAMPER

- **All Units**
  - Evaporative Cooler Duct Connected to the HVAC Duct System
    - An automatic barometric damper is required only when the HVAC system and cooler share the same ducts, and blocks loss of heated/cooled air when the HVAC system is used.



    - *Exception:* Not required when a manual winter closure damper is present that is operable from inside the dwelling.
    - A mechanical damper requiring manual operation from the roof is not an acceptable substitute for a required barometric damper.
  - Cooler Duct Connected to Ceiling Diffuser
    - A barometric damper is not required.
    - A barometric damper is not an acceptable means of winter closure.

44. ROOF-MOUNT COOLER DUCT

- **Duct Materials**
  - The cooler duct—which connects the cooler to a diffuser box with diffuser/grille, to a diffuser assembly, or to an HVAC duct system—shall be:
    - Rigid metal (rectangular or round), or
    - Factory-made flexible duct (metallic or non-metallic).

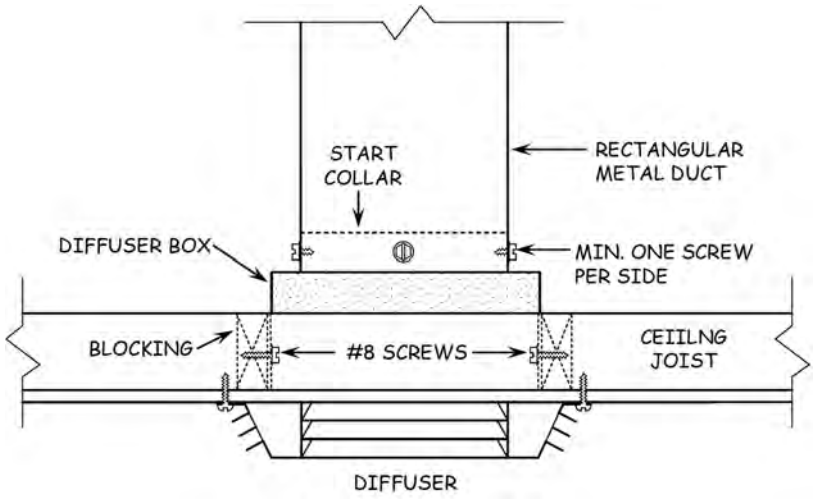
44. ROOF-MOUNT COOLER DUCT (cont.)

- **Duct Materials (cont.)**
  - Chases lined with plywood, drywall, and other moisture-absorbent materials shall be ducted, or shall be lined with metal and sealed at seams.
- **Existing Cooler Ducting**
  - Replacement coolers shall utilize existing rigid metal cooler ducting if it is the correct size, is in good condition, and meets all requirements of this section.
  - Existing flexible ducting shall not be reused.
- **New Cooler Ducting**
  - Shall have a slope (flat runs not allowed) to prevent condensation collection and related moisture damage.
  - Conform to local codes.
- **Size/capacity of the duct system and diffuser shall be adequate to:**
  - Meet cooler manufacturer's specification.
  - Effectively distribute cooled air.
  - Not produce excessive back pressure on the blower/motor.
- **Rigid Metal Duct Materials**
  - UL 181 ducts, or field-fabricated sheet metal ducts, shall be used.
  - Sheet metal shall be galvanized steel or aluminum.
  - Sheet gage shall be the greater of:
    - Rigid metal duct requirements shown in Table 29-1, or
    - Cooler manufacturer's specification.

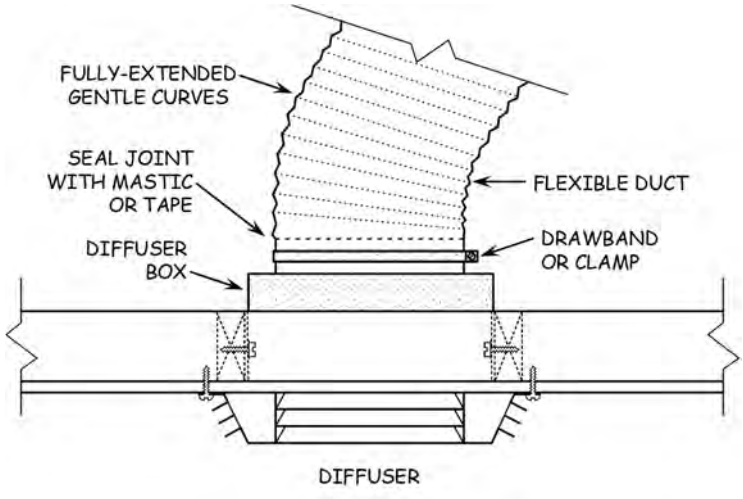
TABLE 29-1: GAGES OF METAL DUCTS

SHAPE AND SIZE OF DUCT	MIN. GAGE (GALVANIZED STEEL)	MIN. B. & S. GAGE (ALUMINUM)
Round Ducts		
Up to 14"	30	26
Over 14"	28	24
Rectangular Ducts		
Up to 14"	28	24
Over 14"	26	22

- **Rigid Metal Duct Installation**
  - The cooler duct shall be mechanically attached at both ends:
    - At the top, to the roof, start collar, roof jack, or cooler.
    - At the bottom, to:
      - A metal diffuser box attached to structural framing, or
      - Directly to structural framing (rectangular ducts only), or
      - An HVAC duct start collar.
  - Minimum #8 sheet metal screws shall be used.
    - At least 3 equally-spaced screws for round ducts
    - At least one screw per side for rectangular ducts.
  - The duct shall be additionally attached/supported as needed to:
    - Conform to manufacturer's instructions or local code.
    - Ensure a stable installation with minimal vibration and noise.
  - Screws and metal brackets attached to sheet metal ducting shall be corrosion-resistant and chemically-compatible.
  - Duct seams, joints, and connections shall be sealed (e.g., with duct mastic or butyl tape) as prescribed for rigid metal ducts in WIS Section 6 (Duct System Repair and Sealing).



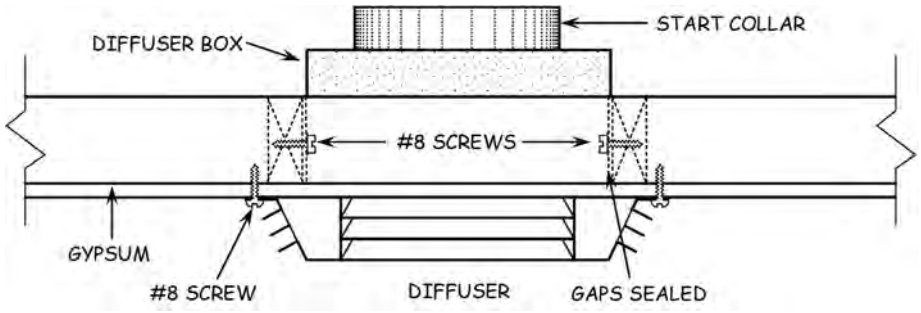
- **Flexible Duct Materials**
  - UL 181 Listed flexible metallic or non-metallic duct with R-4.2 insulation shall be installed.
    - *Exception*: Flexible duct not having R-4.2 insulation may be used when it is part of a factory-fabricated cooler installation kit.
- **Flexible Duct Installation**
  - Ducts with integral collars (supplied in an installation kit) shall be installed and supported in accordance with manufacturer's instructions.
  - Ducts without integral collars shall be installed fully extended and without excess material.
  - The following additional criteria apply to all flexible ducts:
    - Gentle curving; no sharp bends.
    - Supports (e.g., minimum 1-1/2" wide straps) shall be installed as needed, but shall not constrict the duct's internal diameter.
    - The duct shall be connected to a start collar at both ends.
  - Duct connections shall be mechanically fastened (e.g., with drawbands) and sealed (e.g., with duct mastic or pressure sensitive tape) as prescribed for flexible ducts in CSD WIS Section 6 (Duct System Repair and Sealing).



45. ROOF-MOUNT DIFFUSER/CEILING GRILLE

- **The diffuser/ceiling grille shall:**
  - Direct air in at least two directions.
  - Be equipped with adjustable/closable louvers, or with a positive damper.
  - Be located where it will not disturb combustion appliance burners/pilots (e.g., in kitchen near gas range).

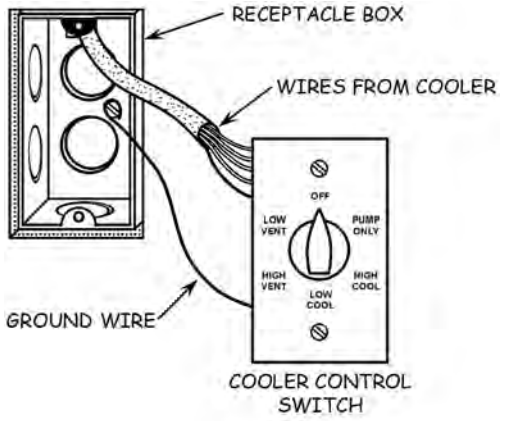
- **A galvanized sheet metal or aluminum diffuser box with start collar:**
  - Is required when round cooler duct is used.
  - Is optional when rectangular duct is used, if duct dimensions are compatible with the diffuser.
- **Sealing Gaps**
  - Gaps between the ceiling and the diffuser box or rectangular duct shall be sealed with elastomeric sealant.



- **The diffuser/grille shall be secured to the ceiling with:**
  - #8 screws which penetrate wood framing at least 3/4" (1" if self-drilling), or which penetrate sheet metal; or
  - Manufacturer's installation system or recommended method.

46. ROOF-MOUNT COOLER CONTROLS

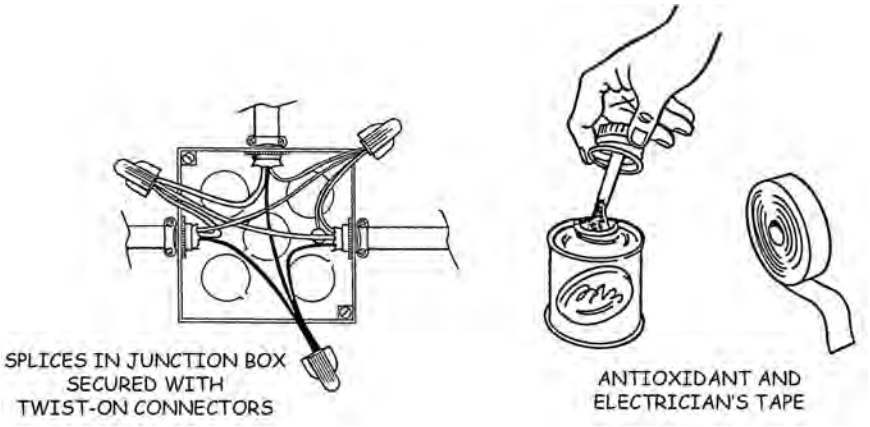
- **The control switch, and thermostat if installed, shall be:**
  - UL Listed, and
  - Installed per manufacturer's instructions.
- **Wall-Mounted Controls**
  - Controls shall be installed in a switch/receptacle box.
  - Box and wiring shall be installed inside the wall when feasible.
- **When controls and/or wiring are surface-mounted:**
  - The electrical box shall be designed for surface mounting (e.g., one made for use with raceway).
  - Wiring shall be enclosed in a UL Listed raceway.



47. ROOF-MOUNT ELECTRICAL REQUIREMENTS

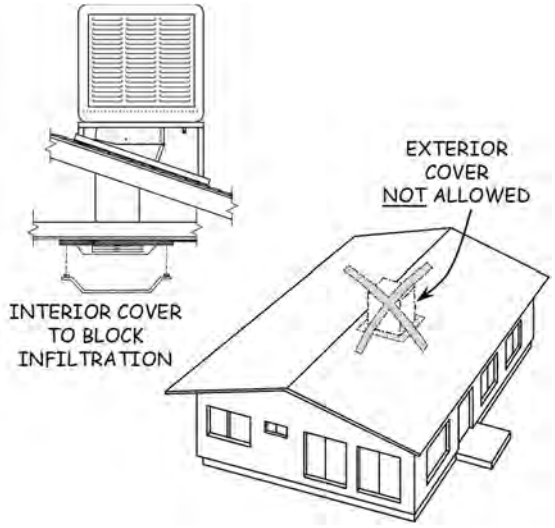
- **Wiring**
  - A service disconnect shall be installed when required by local code.
  - The cooler shall be hard-wired to an electrical circuit which has:
    - Proper overcurrent protection.
    - Adequate current capacity to add the cooler.
  - Replacement units may use existing wiring if it is in good condition, safe, adequate for the new cooler's controls, and meets the requirements of this section.
  - Factory-provided junction boxes and connections inside the cabinet shall be installed per manufacturer's instructions.
  - Exterior wiring shall be protected by liquid-tight conduit or cable, connectors, and junction boxes.
- **Electrical Connections and Grounding**
  - The cooler cabinet and all metal junction boxes and conduits shall be properly grounded.

- Splices shall be located in a junction box, and shall be:
  - Individually soldered and wrapped with electrician's tape, or
  - Secured with new, properly-sized twist-on splicing connectors (e.g., “wire nuts”).
- Wires shall be properly stripped, and connectors firmly twisted.
- For splices exposed to moisture (and when/where specified by cooler manufacturer or local code):
  - Antioxidant shall be applied to the joined wires (or “jell-filled” connectors shall be used), and
  - Splicing connectors shall be wrapped with electrician's tape.



48. ROOF-MOUNT WINTER PROTECTION

- **Requirement**
  - A means shall be present to close off the cooling system during winter to protect against infiltration of unconditioned air.
- **Diffuser/Grille Covers**
  - Interior closure may be provided by covers installed at the discharge termination (diffuser/grille or supply registers).
    - *Exception*: Shared vents/registers, used by both the cooler and HVAC unit, shall not be covered.
  - Interior covers shall be installed in accordance with Section 10 (Vent Covers).
  - Exterior cooler covers are not allowed.
- **Dampers**
  - The following types of dampers are acceptable means of winter closure, if infiltration of outdoor air is prevented:
    - Closeable or slide-in damper in the ceiling diffuser/grille.
    - A positively-closing damper in the cooler duct or roof jack that:
      - Completely closes off the cooler when not in operation (barometric damper does not qualify).
      - Does not require access from the roof to open/close it.



PART 2: MOBILE HOME CRITERIA

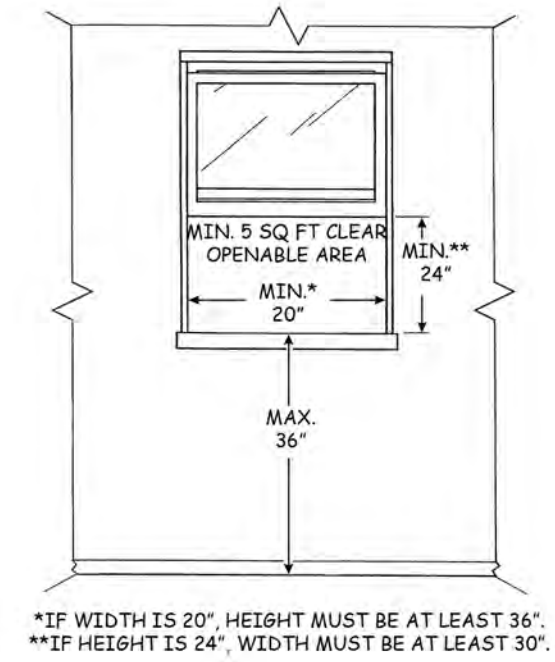
MH EVAPORTIVE COOLER REPAIR

See Part 1: Installation Requirements for Conventional Homes (Repairs).

MH EVAPORATIVE COOLER INSTALLATION—WINDOW/WALL-MOUNT UNITS

49. MH WINDOW/WALL EGRESS WINDOWS

- **Coolers Installed in Egress Windows**
  - Unit shall not violate egress requirements, which apply to all rooms used for sleeping.
  - When a sleeping room has no operable exterior door, at least one window shall meet the egress requirements of the following:
    - Authority having jurisdiction, or
    - By HUD code[2], , which places the following requirements on egress windows:
    - Minimum net clear openable: a) area of 5 sq. ft., b) width of 20", and c) height of 24".
    - Bottom of window maximum 36" above the floor.



50. MH WINDOW/WALL LOCATION

- **All Units**
  - Clearances and mounting height shall be in compliance with local code and manufacturer's instructions.
  - Exterior portion of unit shall be located a minimum of 1' above grade.
  - Discharge shall not be located where it can disturb combustion appliance burners/pilots (e.g., in kitchen near gas range).
- **Wall-Mount Units**
  - Mobile homes with wooden siding
    - Location and installation shall be in compliance with criteria for conventional homes.
  - Mobile homes with metal siding
    - Cooler shall be installed only in a window opening or an existing wall opening.
    - Cutting new wall openings is not allowed.
- **Window-Mount Units: See Conventional Home**

51. MH WINDOW/WALL EXTERIOR CLEARANCES

- **All Units**
  - Clearance shall comply with local code.
  - Cooler air intake shall be located:

Evaporative Cooler Inlet shall be at least:	
3' from	Gas vent pipe, solid-fuel chimney, bathroom or kitchen exhaust, clothes dryer exhaust, plumbing vent, vehicle exhaust source, attic vent, gas meter assembly, or other source of toxic contamination

- Minimum 24" clearance is required on all sides for maintenance.
- Unit shall not be installed if clearance requirements cannot be met.

MH EVAPORATIVE COOLER INSTALLATION—ROOF-MOUNT UNITS

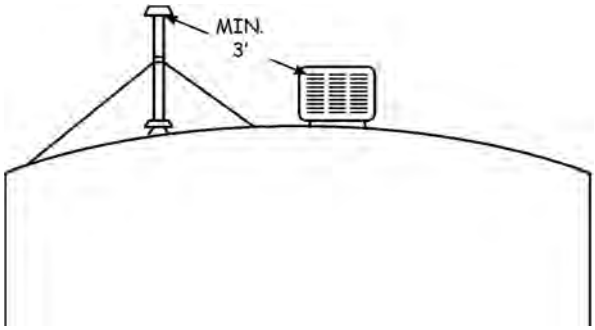
52. LOCATION

- **All Units**
  - The unit shall be installed in a location that is structurally sound and capable of properly supporting the operating weight of the cooler.
  - Installation shall not be attempted on a roof that is:
    - Finished with wooden shingles or shakes.
    - Likely to be damaged or to develop roof leaks from foot traffic required for installation.

53. MH ROOF-MOUNT CLEARANCES

- Clearance shall comply with local code.
- Cooler air intake shall be located:

Evaporative Cooler Inlet shall be at least:	
3' from	Gas vent pipe, solid-fuel chimney, bathroom or kitchen exhaust, clothes dryer exhaust, plumbing vent, vehicle exhaust source, attic vent, gas meter assembly, or other source of toxic contamination



54. PLUMBING

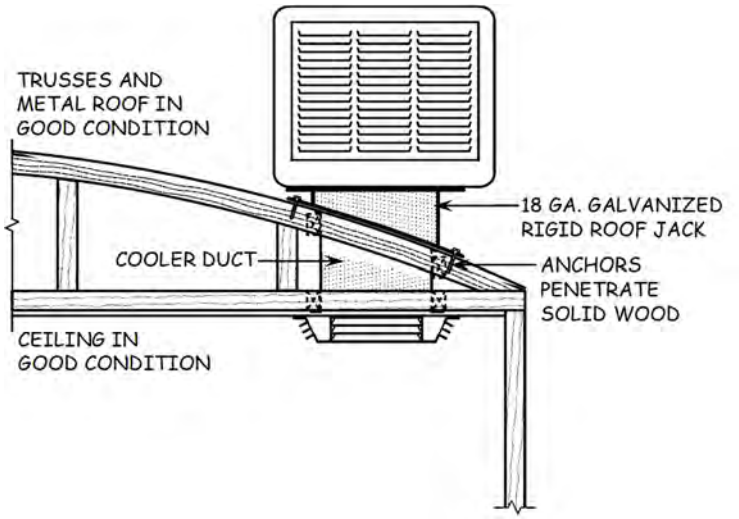
- **All Units**
  - Water supply shall be in conformance with Item 8.
  - When the supply line penetrates the roof or roof jack, the penetration shall be sealed.

55. DRAIN SYSTEM: See Part 1: Installation Requirements for Conventional Homes.

56. COOLER SUPPORTS

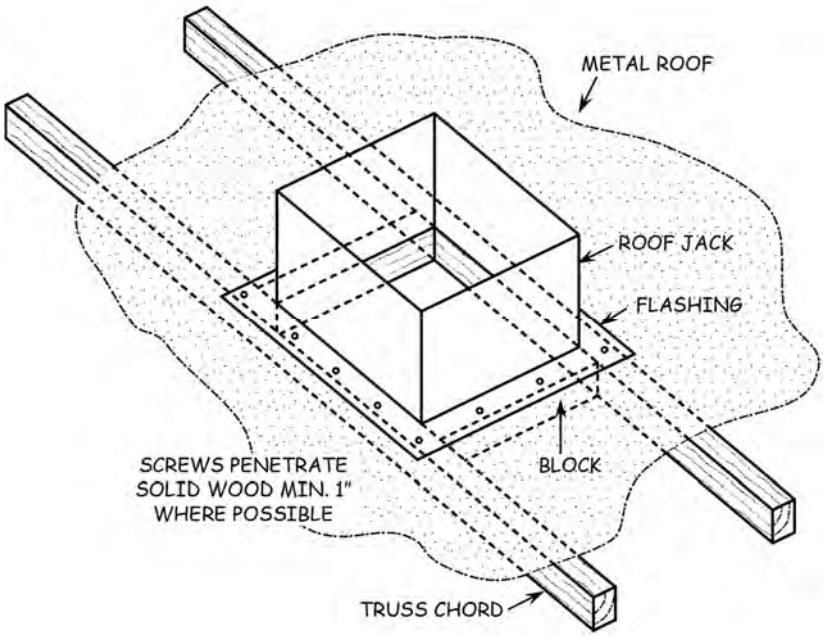
- **Secure Support**
  - The cooler shall be securely supported by such means as a rigid roof jack (minimum 18 gage galvanized), angle iron or wooden stand, sheet metal curb, or factory-made support kit.
    - Unit shall not be supported solely by the cooler duct.
    - The support system shall be:
    - Installed per manufacturer's instructions, when applicable.
    - Securely fastened to the roof structure with screws or bolts.
  - Replacement units may utilize an existing support system which:
    - Is the correct size, and is in good condition.
    - Meets all requirements of this section.

- **Metal Frame Components**
  - Minimum 3/4" x 3/4" angle iron or 16 gage angle stock.
  - All metal shall be primed, anodized, painted, galvanized, or corrosion-resistant.
- **Wooden Stands**
  - Shall be framed with 2-by pressure-treated lumber or redwood.
  - Plywood shall be exterior grade and primed/painted.
  - Cut ends and holes made in pressure-treated lumber shall be treated with preservative.
  - Stand shall not trap/hold moisture around the roof jack.



57. SUPPORT SYSTEM ATTACHMENTS

- **All Units**
  - Support system attachments/anchors shall be in conformance with manufacturer's instructions and local code.
  - Anchors shall be corrosion-resistant and chemically-compatible screws, bolts, or lag bolts (nails and molly bolts not allowed).
  - Anchors must penetrate minimum 1" into solid wood, such as:
    - Structural framing.
    - Support brace attached to structural framing.
    - *Exception*: Factory-made leg kits and support systems may be anchored to wooden roof sheathing on pitched roofs in accordance with manufacturer's instructions and local code.



58. PLUMBING: See Part 1: Installation Requirements for Conventional Homes.

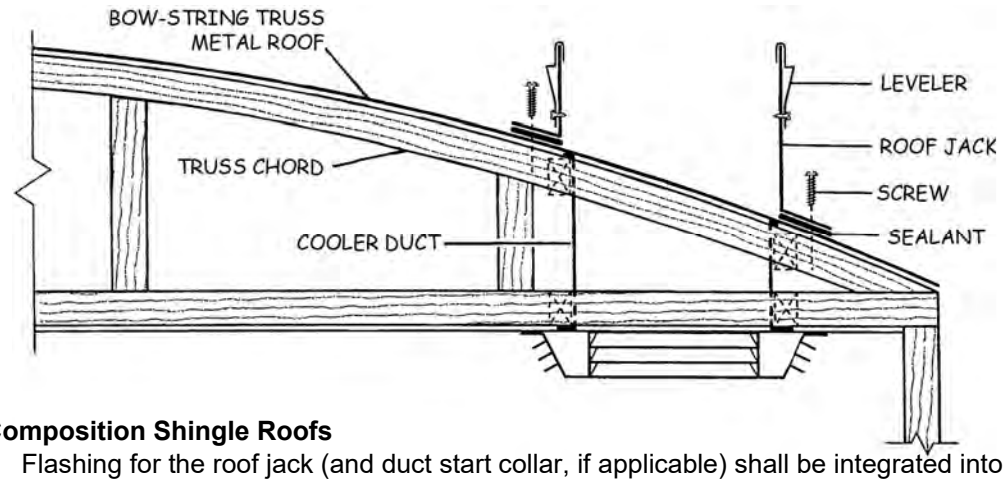
59. DRAIN SYSTEM: See Part 1: Installation Requirements for Conventional Homes.

60. ROOF OPENING

- **The roof opening shall be:**
  - Located between two roof truss chords.
    - Cutting truss chords is not allowed.
  - Framed with 2-by lumber to create a boxed opening.

61. ROOF JACK AND DUCT START COLLAR

- **Replacement Units**
  - Shall utilize the existing roof jack and duct start collar, if they are the correct type and size, are in good condition, and meet all requirements of this section.
- **Roof Jack**
  - The roof jack shall match the roof slope, or shall be adjustable.
    - Leveling assembly (e.g., "levelers" at the top) may be used to compensate for slight slope of a bow-string truss roof.
  - The roof jack/cooler connection shall be sealed.
- **Metal Roofs**
  - The roof jack flashing shall be:
    - Under-coated with elastomeric sealant (e.g., polyurethane).
    - Installed over the metal roof (spanning two truss chords).
    - Secured with screws (at least 4 screws shall penetrate chords and/or blocking).
    - Additionally sealed as needed to prevent water leakage at joints, seams, and anchor points
  - In sloped locations, the metal skin may be slit on the high side, with the roof jack/flashing upper flange slid underneath.
  - In locations adjacent to a ridge cap, the upper flange shall be placed under the ridge cap, when possible.



- **Composition Shingle Roofs**
  - Flashing for the roof jack (and duct start collar, if applicable) shall be integrated into the roofing per standard roofing practices.
    - Upper flange shall be placed underneath the roofing material.
    - Sealant shall be applied to prevent water leaks.
    - The flashing shall be mechanically attached to the roof.

62. COOLER DUCT: See Part 1: Installation Requirements for Conventional Homes and CSD WIS Section 6 (Duct System Repair and Sealing).

63. DIFFUSER/CEILING GRILLE

- **Diffuser Grille**
  - The diffuser/ceiling grille shall:
    - Direct air in at least two directions.
    - Be equipped with adjustable/closable louvers, or with a positive damper.
    - Be located where it will not disturb combustion appliance burners/pilots (e.g., in kitchen near gas range).
  - The diffuser/grille shall be secured to the ceiling with:
    - #8 screws which penetrate wood framing at least 3/4" (1" if self-drilling), or which penetrate sheet metal; or
    - Manufacturer's installation system or recommended method.
- **Diffuser Box**
  - A galvanized sheet metal or aluminum diffuser box with start collar:
    - Is required when round cooler duct is used.
    - Is optional when rectangular duct is used, if duct dimensions are compatible with diffuser.
  - Gaps between the ceiling and the diffuser box or rectangular duct shall be sealed with elastomeric sealant.

64. COOLER CONTROLS: See Part 1: Installation Requirements for Conventional Homes.

65. ELECTRICAL REQUIREMENTS: See Part 1: Installation Requirements for Conventional Homes.

66. WINTER PROTECTION: See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

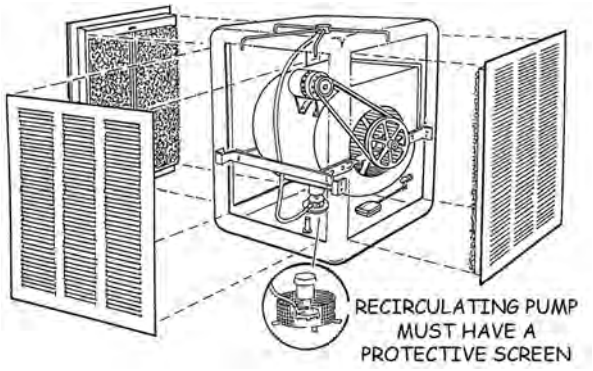
67. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

68. OPERATIONAL CHECK

- **The following shall be checked for proper operation:**
  - Blower motor and fan.
  - Control/switch, in all positions.
  - Even water distribution over pads (and pads correctly installed).
  - Automatic cleaning system (automatic flush or bleed-off).



- **Installed optional items shall be checked, such as:**
  - Ceiling exhaust vents (pressure relief dampers).
  - Barometric damper, or mechanical damper, to switch duct system between HVAC heating/AC and evaporative cooling.

69. CLIENT EDUCATION

- **Basic Operation**
  - Operation of the equipment shall be explained to the client (e.g., design conditions, efficiency measures, differences from previous system or situation).
  - Issues regarding multiple systems operating at the same time (A/C and Evaporative Cooler) will be discussed with occupants.
- **System Controls (e.g., Thermostat, Humidistat)**
  - Proper operation and programming of system controls to achieve temperature shall be explained.
- **System Disconnects**
  - Indoor and outdoor electrical disconnects shall be demonstrated.
- **Air Inlets**
  - Location of air inlets shall be identified.
  - Importance of not blocking inlets shall be explained.
- **Blocking Air Flow**
  - Importance of cleaning dust and debris from return grilles shall be explained.
  - Importance of leaving interior doors open as much as possible, and one exhaust source to the outdoors shall be explained.
- **Routine Maintenance**
  - Proper filter selection and how to change the filter shall be explained.
  - Importance of keeping outside unit clear of debris, vegetation, decks, and other blockage shall be explained.
  - Importance and timing of routine professional maintenance shall be explained.
- **Calling Heating, Ventilation, And Air Conditioning (HVAC) Contractor**
  - A regular service schedule for ongoing maintenance shall be recommended to occupants.
  - Situations when the client should contact an HVAC contractor shall be explained, including:
    - Water draining from secondary drain line
    - Unusual noises
    - Unusual odors

REFERENCED STANDARDS

[1] 2013 CRC, §R310.1

[2] CFR Part 3280 (HUD MHCSS)

LIMITED HOME REPAIR (LHR)

Lead Paint Risk Factor
LOW-HIGH

TABLE OF CONTENTS

Section 30

LIMITED HOME REPAIR (LHR)

UNIVERSAL LHR REQUIREMENTS

1. GENERAL REQUIREMENTS

a. Limited Home Repairs shall have a direct association with weatherization measures being installed, and are necessary for the effective performance or preservation of weatherization materials.

b. A permit shall be obtained prior to commencement of work, when required by the local jurisdiction.

c. All work performed shall be compliant with all applicable local building codes and regulations.

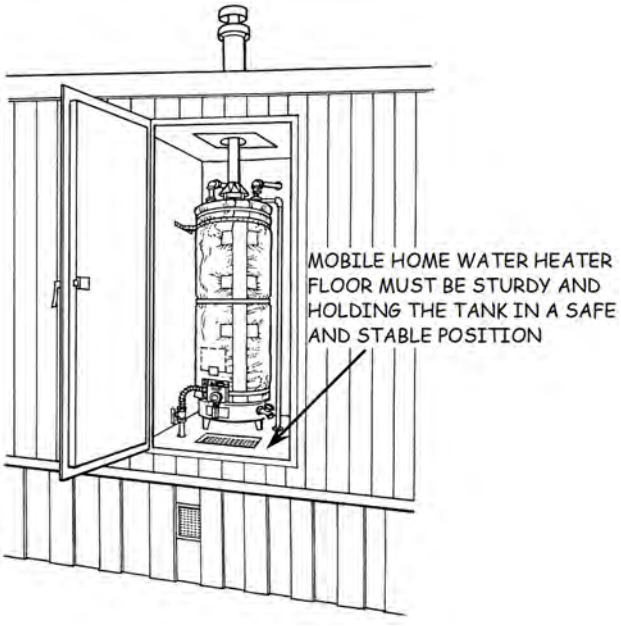
d. All work shall be performed in accordance with applicable manufacturer's installation instructions.

e. These guidelines shall apply, unless superseded by manufacturer or local code.

TASK 1: FLOOR/PLATFORM REPAIR FOR HEATING/COOLING SOURCES OR WATER HEATERS

1. INSPECTION

- **Floor/platform shall be inspected for structural integrity and strength adequate to safely support appliance(s) in an upright vertical position.**
- **Wood Floor/Platform**
  - A water damaged/deteriorated drywall or plywood platform surround shall be removed to allow inspection of hidden structural wood members.
  - Floor/Platform Surface Wood and Structural Members
    - When platform is intact, solid, and safely supporting the appliance, it shall not be replaced.
    - When platform is rotted, visually deteriorated, or unable to safely support the appliance in an upright vertical position without leaning, it shall be removed and replaced.
- **Existing Metal Water Heater Stands**
  - A stand that is no longer safely supporting the storage water heater shall be replaced.
  - If stand is bent or damaged, it shall be replaced (not straightened and put back into service).
  - A rusted but otherwise viable stand shall not be replaced.

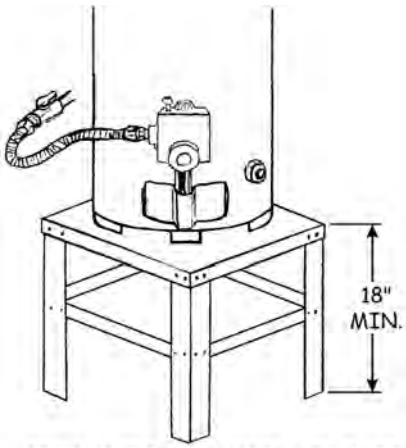


Section 30

INSTALLATION REQUIREMENTS FOR CONVENTIONAL AND MOBILE HOMES

2. FLOOR/PLATFORM REQUIREMENT

- **Existing Wood Floor/Platform—Stand-Alone or Shared with Another Appliance**
  - Horizontal surface shall be plywood.
    - Minimum 1" thickness.
    - C-grade or better face, bonded with exterior glue.
  - Structural members shall be:
    - 2" x 4" or larger, as required by local code.
    - Pressure-treated or redwood.
  - Horizontal surface support joists shall be maximum 16" on center.
  - Platform legs shall be cross-braced.
  - Fasteners shall be:
    - Sufficient length to have minimum 5/8" penetration into adjoining wood
    - Spaced to properly secure the platform components, such as:
      - 2" intervals on framing; and
      - 4"-6" intervals on plywood.
  - A platform surround, of drywall or plywood, which had been removed to allow inspection of hidden structural wood members shall be replaced with new material.
  - Existing lower CVA venting in an appliance enclosure floor shall be retained, or be relocated to the wall or door.
  - Plumbing penetrations in the platform shall be retained or relocated, as required.
- **Metal Water Heater Stand**
  - A damaged metal water heater stand shall:
    - Not be repaired.
      - A bent or damaged stand shall not be straightened and put back into service.
    - Be replaced with a listed, galvanized steel or aluminum water heater stand sized to support the entire footprint of the water heater.
  - Replacement Stand
    - Shall be assembled and installed per manufacturer's instructions.
- **Replacing Wood Water Heater Platform with Metal Stand**
  - When making major repairs to or totally replacing a deteriorated stand-alone wood platform, whenever possible replace with a metal water heater stand.



COMBUSTION CHAMBER AT LEAST 18" ABOVE GARAGE FLOOR

MOBILE HOME CRITERIA

See Installation Requirements for Conventional and Mobile Homes (Task 1).

MULTI-FAMILY WHOLE BUILDING CRITERIA

See Installation Requirements for Conventional and Mobile Homes (Task 1).

TASK-SPECIFIC POST-INSTALLATION REQUIREMENTS

Not applicable to this measure.

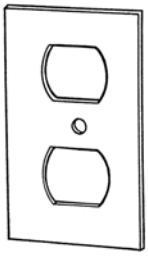
TASK 2: COVER PLATE INSTALLATION

INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

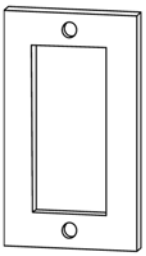
CRACKED OR BROKEN COVER PLATE

1. **COVER PLATE**
   - **Shall be sized to properly fit the application.**
   - **Shall be installed when:**
     - Plate is missing.
     - Existing plate is cracked or broken.
   - **Painted-Over Cover Plate**
     - Carefully cut around painted-over plate to allow removal and replacement without damaging wall.
     - Cover plate shall not be painted to match wall color.

2. **COVER PLATE SIZE, COLOR, AND FIT**
   - **Shall be sized and configured to the application.**
     - Use oversize plate when required to cover gap or wall damage.
   - **Plate Color**
     - Shall match existing cover plates, or
     - Look best with existing wall color.
     - Screw(s) shall match plate color.
   - **Plate Fit**
     - Shall fit with no gap.
     - Shall fit close against wall when feasible.
     - Shall be secured with a screw that is snug, but not so tight that it cracks the cover plate.
     - Where two (or more) screw holes are present, a screw shall be installed in each location.
     - Shall seal cover plate gasket (where present or installed).



STANDARD RECEPTACLE



ROCKER SWITCH AND RECTANGULAR RECEPTACLE

MOBILE HOME CRITERIA

See Installation Requirements for Conventional Homes (Task 2).

MULTI-FAMILY WHOLE BUILDING CRITERIA

See Installation Requirements for Conventional Homes (Task 2).

TASK-SPECIFIC POST-INSTALLATION REQUIREMENTS

Not applicable to this measure.

TASK 3: MINOR ROOF REPAIR

INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

1. **GENERAL REQUIREMENTS**
   - **Roof repair shall be completed only to protect installed measures from the weather.**
   - **A minor roof repair shall be performed only on an existing roof in otherwise good condition.**
   - **Materials used shall match existing roofing components whenever possible.**

3. SAFETY

- **Roof structure shall be strong enough to safely support weatherization personnel.**
- **All roof related work shall be conducted in adherence to all applicable CAL/OSHA regulations.**

4. LEAK DETECTION AND DAMAGE INSPECTION

- **Locate roof leak by inspection on and/or under roof.**
- **When a leak is identified, remove surface roofing material to inspect underlayment membrane and wood sheathing for weather deterioration and/or other damage.**

5. ROOF REPAIR

- **Underlayment and sheathing that is intact, solid and safe shall not be replaced.**
- **All deteriorated or damaged wood sheathing, underlayment, and surface roofing material shall be replaced.**
  - Wood sheathing is damaged, sagging, or unsafe.
  - Underlayment membrane (i.e., felt paper, etc.) is damaged, deteriorated, or leaking.
  - Surface roofing material is damaged or leaking.

MOBILE HOME CRITERIA

6. REPAIR OF MOBILE HOME ROOF

- **Shall be performed only by a technician experienced in mobile home roof repair.**

MULTI-FAMILY WHOLE BUILDING CRITERIA

See Installation Requirements for Conventional Homes (Task 3).

TASK-SPECIFIC POST-INSTALLATION REQUIREMENTS

7. LEAK TESTING

- **Completed roof repair shall be tested and verified to be suitably weather- and water-tight.**

TASK 4: MOBILE HOME SKIRTING REPAIR

INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

Not applicable to this measure.

MOBILE HOME CRITERIA

1. GENERAL REQUIREMENTS

- **Skirting repair shall be conducted in accordance with skirting material manufacturer's installation instructions.**

2. SKIRTING REPAIR

- **Shall be completed only to prevent animal infiltration/intrusion under home.**
  - Shall not be completed for visual or aesthetic reasons.

3. EXISTING SKIRTING

- **Shall be visually inspected for:**
  - Structural integrity.

- Skirting deterioration or damage where animals have intruded, or intrusion is imminent, shall be repaired.

- **Repair shall be performed only on existing skirting in reasonably good condition. Material in poor condition shall be replaced.**

4. ACCESS DOOR/PANEL AND VENTING

- **Access Door/Panels and Venting**
  - Shall be:
    - Repaired or replaced when damage allows animal intrusion.
    - In compliance with access door requirements as described in CSD WIS Section 21 (Attic and Crawlspace Ventilation) and the CSD Field Guide.
    - At least 22" x 30" or feasible to enlarge to those dimensions
    - Clear of obstruction by pipes, ducts, or other equipment.
    - Accessible. Special tool or device to open or remove is not required.
    - Skirting ventilation screens shall be repaired or replaced as needed with 1/4" metal mesh to prevent animal intrusion. Venting will be in accordance with local climate conditions or code as required.

5. WORKMANSHIP

- **Materials**
  - Materials used shall match existing skirting components when feasible.
- **Work performed shall be compliant with all HCD requirements.**
  - Moisture retarder shall be installed (see WIS Section 22B, Floor/Undercarriage Insulation for MH).
  - Skirting will be installed to allow for movement (e.g., no screws or nails directly through panels)
  - Skirting installation shall allow for expansion, contraction, and frost effects.
- **Wood skirting material within 6" of earth or concrete shall be:**
  - Treated wood or wood of natural resistance to decay.
    - Redwood, cedar, or pressure treated fir.
- **Fasteners**
  - Shall be corrosion-resistant metal screws appropriate for use with the applicable skirting materials.
- **Exposed Wood**
  - New bare wood skirting and/or access door shall be treated with at least one coat of exterior grade, UV- and stain-resistant primer to prevent moisture intrusion.

MULTI-FAMILY WHOLE BUILDING CRITERIA

Not applicable to this measure.

TASK-SPECIFIC POST-INSTALLATION REQUIREMENTS

6. CLIENT EDUCATION

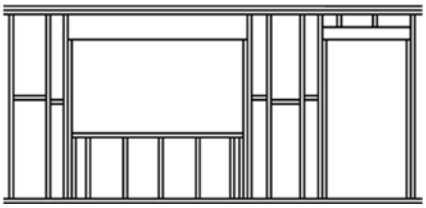
- **Crew Responsibilities**
  - Client shall be educated on maintenance of skirting (e.g., floating panels are not tightly screwed to framing, string-type lawn trimmers may damage skirting, etc.).

TASK 5: ROUGH FRAMING REPAIR TO SUPPORT WINDOW OR DOOR INSTALLATION

INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

1. EXISTING ROUGH FRAMING INSPECTION

- **All rough framing lumber shall be visually inspected.**
- **After removal of old door or window to expose rough framing:**
  - Only rough framing that is decayed or deteriorated and unable to safely and effectively support the installation of a new door or window shall be replaced with new wood.
    - Wood that is soft, decayed, or deteriorated shall be removed and replaced.
    - Care shall be taken to minimize the disturbance to the surrounding materials (drywall, siding, stucco, flooring, etc.).



WINDOW AND DOOR ROUGH FRAMING

2. SAFETY

- **When required, header shall be temporarily supported with falsework.**

3. NEW ROUGH FRAMING INSTALLATION REQUIREMENTS

- **Work shall be performed only by qualified and experienced personnel.**
- **Finished Rough Frame**
  - Installation shall be square and plumb.
  - Frame material shall be securely installed, with adequate bracing and fasteners to make the frame solid and able to properly support the weight of the door or window.
  - Fasteners shall be consistent with local code requirements.
  - New replacement framing wood shall be installed in preparation for the installation of a new door or window.
    - Framing members and any furring shall be of the same dimensions as the original wood.
  - Rough opening shall not be *enlarged* from the original size and dimensions.

4. SURROUNDING MATERIALS

- Care shall be taken to minimize the disturbance to the surrounding materials (drywall, siding, stucco, flooring, etc.).
- Any damage shall be repaired.

MOBILE HOME CRITERIA

See Installation Requirements for Conventional Homes (Task 5).

MULTI-FAMILY WHOLE BUILDING CRITERIA

See Installation Requirements for Conventional Homes (Task 5).

TASK-SPECIFIC POST-INSTALLATION REQUIREMENTS

Lead-safe work practices shall be observed in accordance with CSD WIS Section 2 (Lead-safe Weatherization Practices) for pre-1978 dwellings.

TASK 6: EXHAUST FAN VENT EXTENSION (EXCEPT KITCHEN EXHAUST)

INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

1. GENERAL REQUIREMENTS

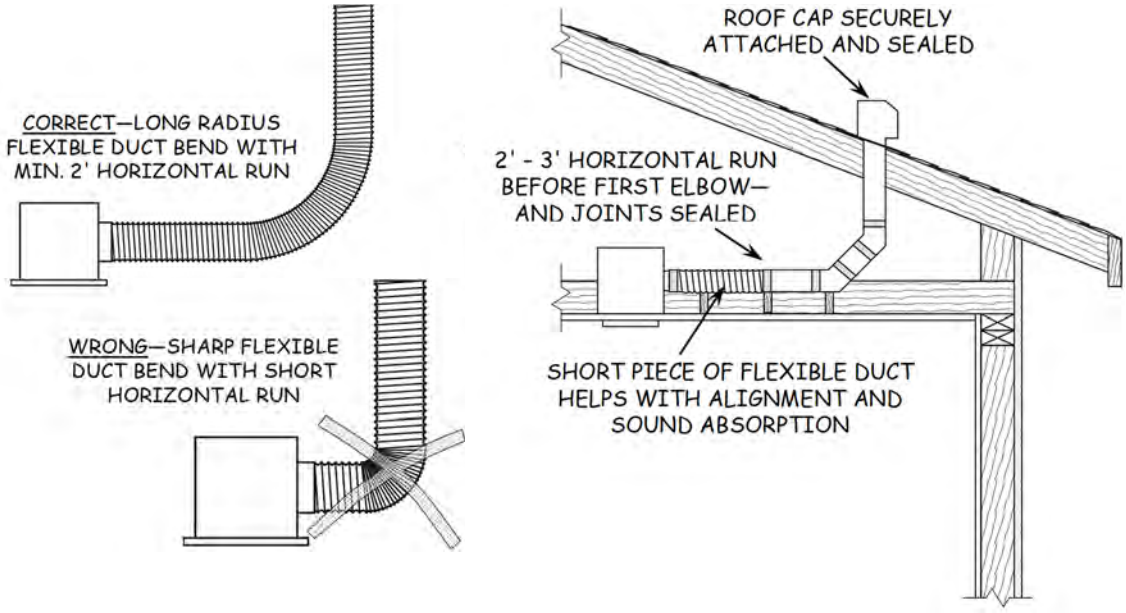
- **Existing Exhaust Fan**
  - Local exhaust fan vents shall not terminate in the attic or crawlspace, and shall be extended to outdoors.
  - A fan with a missing duct shall have one installed and vented to the outdoors.
- **Duct Termination and Dampers**
  - A gravity type backdraft damper shall be present in the system.

2. ALL DUCTS

- **Joints and Seams**
  - Shall be joined and sealed per manufacturer's instructions or when none are available,
- **Duct Runs**
  - Guidelines from CSD WIS Section 6 (Duct System Repair and Sealing) shall apply.
  - To maximize airflow, shall follow shortest possible path to the outdoor termination.
- **Duct Insulation**
  - Duct insulation is not necessary, unless specified by fan manufacturer or local code.

3. NEW AND EXISTING DUCTS

- **Shall be:**
  - Replaced or repaired if damaged.
  - Installed and supported in accordance with manufacturer's instructions and local code.
  - Maximize airflow duct diameter and match fan exhaust port diameter without any reduction(s).
  - Intact (not be deformed or crushed, which restricts free airflow).
  - Free of sharp bends, loose connections, and shall be properly supported.
- **Shall terminate outside the building in an approved wall or roof termination.**
- **New Duct Materials**
  - Rigid metal or PVC ducts have the best airflow characteristics.
  - Flexible metal ducts have the next-best airflow.
- **Bends and 90º Elbows**
  - Duct shall:
    - Be installed with the fewest possible bends and elbows.
    - Have a 90º maximum bend, but be avoided where possible.
    - Be limited to 3 elbows for duct diameters 4" or larger.
    - Not be used in 3" diameter duct.
- **Long-Radius Bends**
  - Short, sharp bends are not allowed.
  - Whenever possible, bends and 45º offsets shall be used instead of 90º elbows to create long-radius bends.
    - Bends of 45º or less constitute the equivalent of half a 90º elbow (two of them count as one elbow).



- **Horizontal Ducts**
  - Duct shall exhaust outside the building in a wall termination assembly, or to an eave or soffit vent when allowed by local jurisdiction.
  - It is acceptable for duct to slope downward toward the exterior.
- **Vertical Ducts**
  - Duct shall exhaust outside the building in a roof cap assembly, or attached to a roof-mount attic vent when allowed by local jurisdiction.
  - When exhausting into a roof-mount vent, duct shall be securely attached to a metal portion of the vent.

4. CLEARANCES FOR ROOF AND WALL CAP TERMINATIONS

- **All Terminations**
  - Termination shall be located in accordance with manufacturer's instructions.
  - The following guidelines apply, unless superseded by manufacturer requirements or local code.
- **Roof Termination for Vertical Ducts**
  - Outlet shall be located at least 3' from an:
    - Evaporative cooler or mechanical air inlet.
    - Openable window or door into the home.
- **Wall Termination for Horizontal Ducts**
  - Outlet shall be located at least 3' from an:
    - Evaporative cooler or mechanical air inlet.
    - Openable window or door into the home.

MOBILE HOME CRITERIA

See Installation Requirements for Conventional Homes (Task 6).

MULTI-FAMILY WHOLE BUILDING CRITERIA

See Installation Requirements for Conventional Homes (Task 6).

TASK-SPECIFIC POST-INSTALLATION REQUIREMENTS

5. EXHAUST FAN TESTING

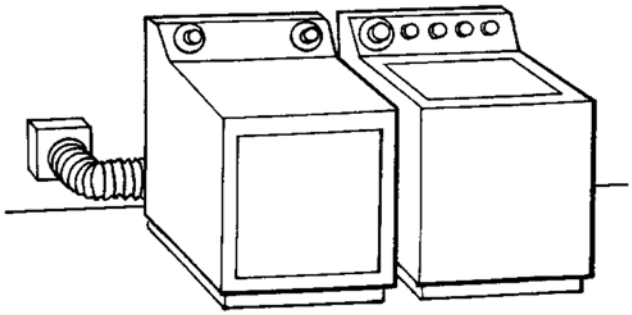
- **Fan shall be tested with vent extension and outdoor termination in place to ensure proper operation.**

TASK 7: DOMESTIC CLOTHES DRYER MOISTURE EXHAUST

INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

1. GENERAL REQUIREMENTS

- **Clothes Dryer Located Within a Living Space**
  - Clothes dryer shall belong to the unit being served.
  - A gas or electric clothes dryer located within a living space shall have the moisture exhaust system ducted to the outdoors before infiltration-reduction measures are installed.
  - When not feasible, see CSD Field Guide Section 7.25 for consequences.



DRYER VENTED TO OUTDOORS

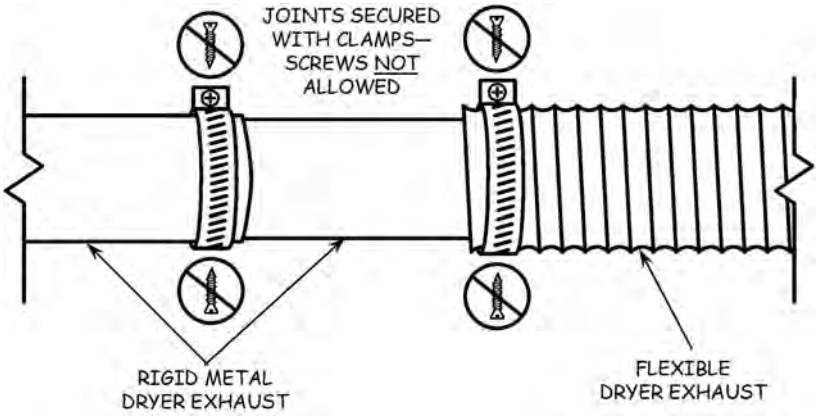
- **Clothes Dryer Located Outside the Living Space**
  - Dryer located in an unconditioned dwelling area (i.e., an enclosed porch, attached garage, etc.), not used as a living space shall have the moisture exhaust ducted to the outdoors*.
  - When not feasible or a lint condition exists that cannot be corrected, see CSD Field Guide Section 7.25 for consequences.
- **Moisture exhaust shall terminate a minimum of**
  - 3' from openings to the building.
  - 3' from the property line.
  - 3' from a gas meter.
  - 10' from forced air (fan-driven) inlets.
- **Moisture exhaust shall not pass through an FAU plenum.**
- **Insulation of Dryer Duct**
  - Clothes dryer duct that passes through unconditioned spaces such as attics and crawlspaces shall be insulated when a dryer duct is installed.
- **Condensing Dryers**
  - Condensing dryers shall be plumbed to a drain.

2. EXISTING MOISTURE EXHAUST DUCT AND TERMINATION

- **Shall be repaired or replaced when:**
  - Crushed or deformed, and
    - Restricts air flow to outdoors, or
    - Creates lint buildup, or
    - Impedes gravity damper function.
  - Hole(s) or disconnect(s)
    - Create a moisture exhaust leak.

3. NEW DUCT/DRYER VENT

- **Shall be minimum 4" diameter.**
- **Domestic Dryer Duct**
  - A gas or electric clothes dryer moisture exhaust shall be of rigid metal and have a smooth interior surface.
    - Galvanized Steel: minimum 26 gauge.
    - Aluminum: minimum 24 gauge.
    - *Exception*: UL listed, flexible metal clothes dryer transition duct not more than 6' in length may be used in connection with domestic dryer exhausts.
    - Flexible transition duct shall not be concealed within construction.
    - Plastic venting material shall not be used.
- **Maximum Length**
  - Duct runs will be as short as practical with rigid or semi-rigid sheet metal ducting material used in accordance with manufacturer specification.
  - Moisture exhaust ducts shall not exceed a total combined horizontal and vertical length of 14', including two 90° elbows.
    - Two feet shall be deducted for each 90° elbow in excess of two.
    - *Exception*: Additional length shall only be allowed when otherwise permitted or required by the dryer manufacturer installation instructions and local code.
- **Connections**
  - All duct connectors shall be listed hose clamp style bands installed around the duct exterior.
  - Other specialized duct fittings will be fastened in accordance with manufacturer specifications.
  - Screws shall not be used to connect duct sections.
  - In addition to mechanical fasteners, duct connections will be sealed with UL 181B or 181B-M listed material.



- **Terminations Shall**
  - Comply with CSD WIS Appendix A (Material Specifications).
  - Have a gravity type backdraft damper.
  - Not have a mesh screen.

MOBILE HOME CRITERIA

See Installation Requirements for Conventional Homes (Task 7).

MULTI-FAMILY WHOLE BUILDING CRITERIA

See Installation Requirements for Conventional Homes (Task 7).

TASK-SPECIFIC POST-INSTALLATION REQUIREMENTS

4. CLOTHES DRYER DUCT TESTING

- **Moisture exhaust system shall be tested with duct and outdoor termination in place to ensure proper operation and performance.**

5. CLIENT EDUCATION

- **Crew Responsibilities**
  - Client shall be instructed to keep lint filter and termination fitting clean.
  - Client shall be instructed on clothes dryer operation safety including information on items that shall not be placed in the clothes dryer (items with any oil or other flammable liquid on it, foam, rubber, plastic or other heat-sensitive fabric, glass fiber materials).

TASK 8: MAKE-UP AIR FOR A DOMESTIC CLOTHES DRYER

INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

1. GENERAL REQUIREMENTS

- **Clothes Dryer Located Within an Enclosure Inside the Living Space**
  - Clothes dryer shall belong to the unit being served.
  - A gas or electric clothes dryer located within a living space shall have adequate make-up air.
- **Make-Up Air**
  - Clothes dryers that are installed in an enclosure in the living space require adequate makeup air (between the enclosure and the living space).
  - Make-up air shall be provided via a transfer grille equaling at least 100 sq. in. NFVA:
    - In the closet door, or
    - By other approved means.
  - If installation of a make-up air transfer grille is not feasible, the home shall NOT be NIM.

MOBILE HOME CRITERIA

See Installation Requirements for Conventional Homes (Task 8).

MULTI-FAMILY WHOLE BUILDING CRITERIA

See Installation Requirements for Conventional Homes (Task 8).

TASK-SPECIFIC POST-INSTALLATION REQUIREMENTS

2. OPERATIONAL CHECKS

- **Quality of Workmanship**
  - Good quality workmanship is required at all times.
  - Make-up air grille shall be properly secured at all corners, in square alignment, and fit snugly against the door.

3. CLIENT EDUCATION

- **Crew Responsibilities**
  - Client shall be instructed to keep transfer grille clear (unblocked) and of the purpose of the grille.
  - Client shall be instructed on clothes dryer operation safety including information on items that shall not be placed in the clothes dryer enclosure (flammable items, foam, rubber, plastic or other heat-sensitive fabric, glass fiber materials).

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NOTES

AIR CONDITIONER AND HEAT PUMP—CENTRAL SYSTEM

Lead Paint Risk Factor
LOW

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AIR CONDITIONER AND HEAT PUMP—CENTRAL SYSTEM

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

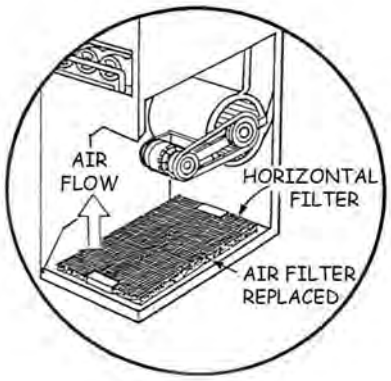
1. DOCUMENTATION REQUIREMENTS

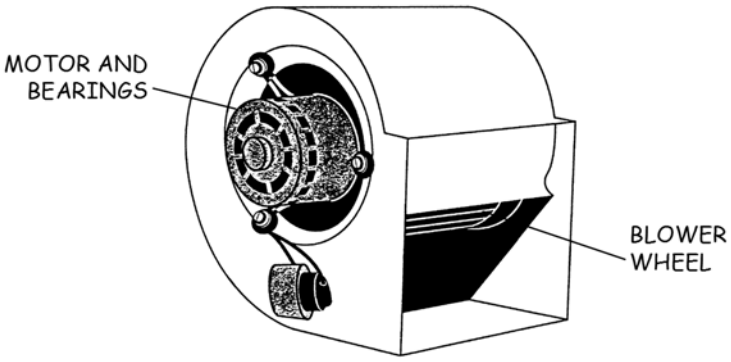
- **All Appliance Repairs and Replacements**
  - Following the assessment by an agency assessor, operational or safety issues with an existing appliance shall be diagnosed by a qualified technician and fully described in writing for the agency before any repair or replacement work shall be allowed. The agency also shall accept or decline this scope of work in writing. These additional documents shall become part of the assessment record.

AIR CONDITIONER (CENTRAL)/HEAT PUMP REPAIR

2. REPAIR CONDITIONS

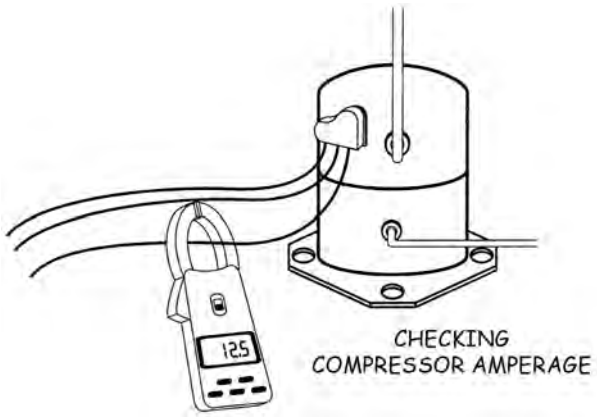
- **The scope of repairs must also take into consideration, but are not limited to, the following Health and Safety repairs in Items 2-9:**
  - Cooling Unit Integrity
    - System evaluation, cleaning, and repair as needed for: air filter(s), motor operation, blower fan, indoor evaporator coil, outdoor condenser coil by a qualified technician.
    - Loose items shall be tightened (e.g., screws, bolds, panels, etc.).
    - Missing/damaged components critical to proper operation shall be replaced/repaired
    - Improper alterations that adversely affect unit operation shall be corrected.
  - Appliance Filter(s)
    - Dirty, defective, or missing air conditioner filter shall be corrected.
      - *Exception:* Electrostatic filters shall be cleaned (but shall not be replaced).
    - Improperly supported filter shall be properly supported to prevent being drawn toward the air handler, per CSD WIS Section 28 (Air Filters).
  - Blower Chamber
    - Dirty blower chamber and fan blades shall be cleaned and bearings shall be lubricated.
    - Bearings in need of repair shall be replaced.





3. CONDENSER COIL

- **Visually inspect capacitors and wiring.**
  - Check compressor contact points and compressor terminal block to ensure all connections are proper and tight.
  - Check compressor with unit operating in air conditioner mode:
    - Check condenser fan amperage.
    - Check compressor amperage.
  - Check fan motor bearings for wear, and oil as needed.



CHECKING COMPRESSOR AMPERAGE

4. EVAPORATOR COIL

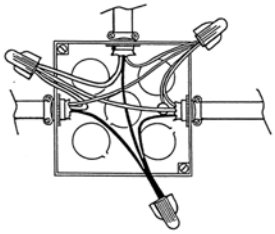
- **Dirty or damaged evaporator coil shall be cleaned or repaired.**
- **Visually inspect capacitors and wiring.**
  - Check blower:
    - Check motor bearings for wear, and oil as needed.
    - Check blower wheel, and clean as needed.
    - Check blower motor amperage for compliance with manufacturer's specified range.
      - With blower operating at high speed and with access panel in place.
  - Air leaks at plumbing or wiring penetrations shall be sealed (i.e., with cork tape).

5. RETURN AND SUPPLY

- **Duct System Testing**
  - See CSD Field Guide Appendix B (Duct Leakage Test Protocol).
- **Duct System Sealing**
  - See CSD WIS Section 6 (Duct System Repair and Sealing).
  - Return leaks in plenum/cabinet/duct that could draw in pollutants shall be repaired as Duct Sealing.
  - Unit-to-floor/plenum gaps/leaks shall be sealed.

6. APPLIANCE ELECTRICAL SYSTEM

- **All Units**
  - Electrical disconnection or defects shall be repaired (e.g., frayed or burned wires, loose or improper connections, etc.).
- **Wiring splices shall be:**
  - Located in junction boxes.
  - Secured with pressure splicing connectors (e.g., wire nuts).
- **Aluminum-To-Copper Wiring Splices**
  - Shall <u>not</u> be made *unless:*
    - Splicing connectors used are identified for that purpose, <u>and</u>
    - Conditions of use are met (e.g., application of antioxidant).


SPLICES IN JUNCTION BOX SECURED WITH WIRE NUTS


ANTIOXIDANT AND ELECTRICIAN'S TAPE

7. THERMOSTATS AND CONTROLS

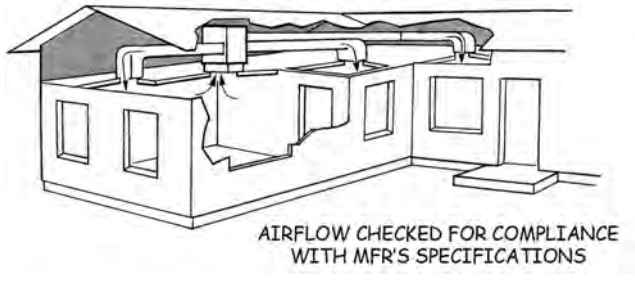
- **Wall thermostat shall function properly:**
  - Anticipator shall be correctly set to 24-volt cooling control circuit amperage, when applicable.
  - Wiring connections shall be correct and tight.
  - Unit shall be level and securely installed.
- **Air Conditioner Controls**

- Controls, including limit switch and blower fan switch, shall operate in accordance with manufacturer's specifications.
- Improperly adjusted controls shall be corrected.

- **Power switches shall function properly, including:**
  - Blower access lockout/safety switch.
  - Switch controlling power to the unit (disconnect).
  - Blower speed control switch.

8. DIAGNOSTIC TUNE-UP AND REFRIGERANT CHARGE REPAIR

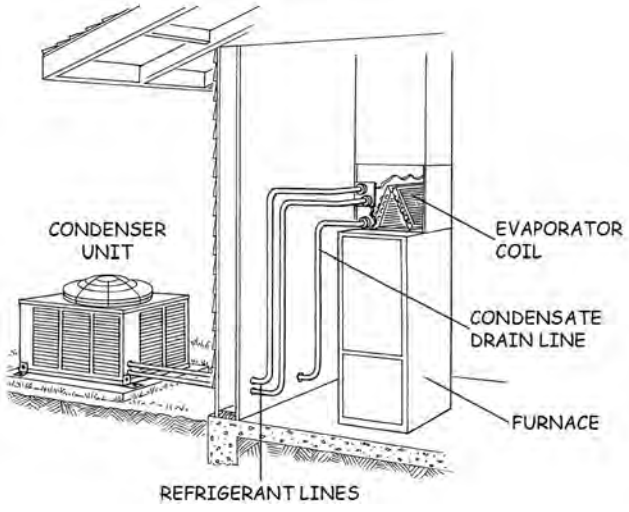
- **Qualifying Units**
  - Tune-up shall be performed on existing package units and split systems when a qualified technician identifies an operational issue that will be resolved by this tune-up procedure.
- **Procedures**
  - Tune-up procedures shall be not be performed that will violate the equipment manufacturer's warranty and shall only be performed by a qualified technician as described below.
  - Procedures shall include the following:

PROCEDURE	STEPS
Diagnostic Tune-Up	• Diagnostic tune-up shall include: - Airflow assessment; and - Refrigerant charge when required by airflow assessment.
Refrigerant Charge Feasibility	• Airflow and refrigerant charge assessment shall be performed *only* by an EPA-approved Type II or Universal Technician to determine whether airflow is adequate to justify a refrigerant charge repair. • Tune-up is not feasible when: - Airflow is below minimum specifications of the manufacturer or HERS inspector (e.g., determined by Sub-cooling Airflow Range Calculator, or is measured at *less* than 350 cfm/ton), and - Airflow cannot be brought into conformance.
Methods of Checking Airflow	• Acceptable methods shall include: - Duct Blaster plenum pressure matching method; or - Flow grid; or - Flow capture hood  AIRFLOW CHECKED FOR COMPLIANCE WITH MFR'S SPECIFICATIONS
Refrigerant Charge Diagnostic Procedure	• After determining airflow, the proper refrigerant charge metering procedure shall be used: - Superheat—fixed-orifice metering device; - Sub-cooling—thermal expansion valve (TXV) metering device; - Other manufacturer recommended methods, or - Weigh-in.

PROCEDURE	STEPS
	• Minimum Outdoor Temperature - Outdoor temperature shall be minimum required for diagnostic procedure used (e.g., 55°F for Superheat and Sub-cooling). - If lower outdoor temperature (<55°F), manufacturer-approved "weigh-in" procedure must be utilized.

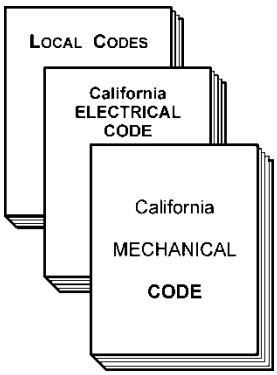
9. AIR CONDITIONER/HEAT PUMP SYSTEM CLEANING REPAIR

- **Qualifying Units**
  - Applies to existing air conditioners and heat pumps and shall be performed when a qualified technician identifies an operational issue that will be resolved by this tune-up procedure.
- **Procedures shall be performed by a qualified technician and include the following:**

PROCEDURE	STEPS
System Verification	• A qualified technician shall confirm: - Temperature of supply air (unit must be cooling), and - Temperature of suction line (must be cold).
Air Filter Replacement	- See CSD WIS Section 28 (Air Filters)
Unit Set-Up	• All register dampers shall be open, and duct dampers and zone dampers shall be correctly positioned.
Evaporator (Indoor) Coil	• Evaporator coil checked and cleaned, when it can be accessed through removable panels. - Coil cleaned using a brush, vacuum and/or air pressure. - Components shall be allowed to dry before proceeding, if water or chemicals are used. - Condensate drain system (including pump, when present) shall be checked and cleaned as needed. - Accessible coil fins checked for damage and combed as needed. - Access panels closed and sealed with UL 181A/B or B-FX metallic tape with non-butyl adhesive. - Note: When removable access panels are not present, coil removal for cleaning is beyond the scope of these standards. 

Condenser Coil	• Condenser coil checked and cleaned. - Coil shall be cleaned using: • Vacuum and/or air pressure, and/or • Chemicals (spray and hose down). - Components shall be allowed to dry before proceeding, if water or chemicals are used.
Air Handler	• Air handler blower wheel shall be brushed and cleaned.

AIR CONDITIONER (CENTRAL)/HEAT PUMP INSTALLATION

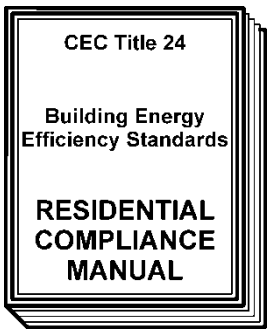


10. GENERAL REQUIREMENTS

- **All Installations**
  - Installation shall be in compliance with:
    - Manufacturer's instructions and specifications.
    - Currently-adopted California Electrical Code (CEC) and California Mechanical Code (CMC).
    - Local building code.

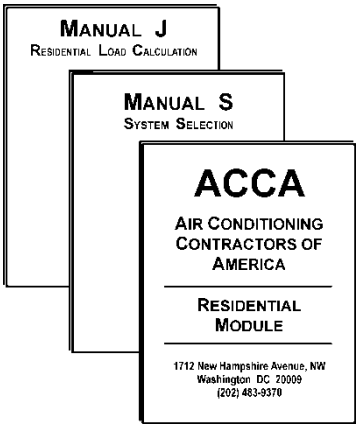
11. TITLE 24 REQUIREMENTS

- **Title 24 Requirements**[1]
  - The following Title 24 HVAC requirements[2] must be met and verified by a HERS Rater when applicable (also see CSD Field Guide Appendix B, Duct Leakage Test Protocol).
  - Duct Leakage Verification (all climate zones)
    - In all climate zones, when a package unit, air handler, air conditioner condenser, air conditioner evaporator coil, heating coil, furnace heat exchanger or more than 40' of ducts in unconditioned space are replaced, duct leakage must be verified by a HERS rater by one of the CEC approved methods.
  - Refrigerant Charge Measurement (CEC Climate Zones 2 and 8-15)
    - When new or replacement or altered split system air conditioner or heat pump is installed, correct refrigerant charge must be measured by the installer and verified by a HERS Rater.
    - To ensure that refrigerant charge and airflow are correct, a third-party verification service shall be used, such as:
      - "Enalasys" (http://www.enalasys.com)
      - "CheckMe!" (http://www.proctoreng.com/checkme/checkme.html)
      - "The Verified™ RCA Program" (http://www.verify-rca.com/)
  - Minimum Airflow and Maximum Fan Wattage (CZ 10-15)
    - When an entirely new space-conditioning system is installed (all equipment and ducts replaced), the central forced air fan of split system air conditioners and heat pumps must simultaneously meet prescribed minimum airflow and maximum fan watt draw. (Note: The requirement for duct leakage to be less than 6% does not apply when the new entire new system is installed).
    - Replacement of an entire system will typically be outside of the program scope.
    - HERS Rater verification is required.



12. SYSTEM DESIGN AND PERFORMANCE

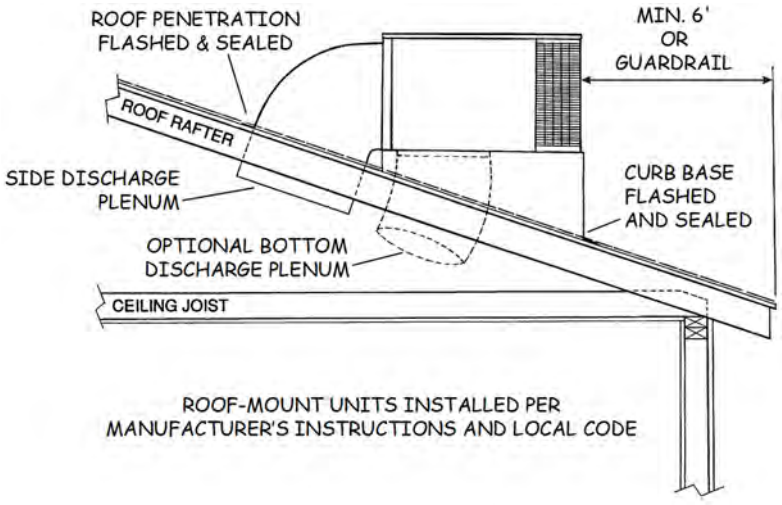
- **System Sizing**
  - Cooling equipment shall be sized in accordance with Title 24.
  - Building cooling load, which is used for equipment sizing and selection, shall be determined using a method based on one of the following:
    - ACCA Manual J, or
    - SMACNA Residential Comfort System Installation Standards Manual, or
    - ASHRAE Handbook (Equipment, Applications and Fundamentals Volumes).
  - Cooling capacity (tonnage) of the new system shall be sized to meet the minimum requirements but not *larger* than necessary.



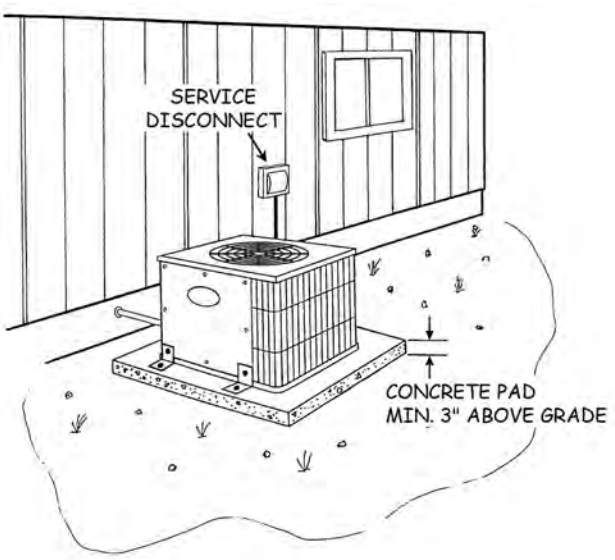
- **Refrigerant Lines**
  - Shall be properly sized per manufacturer's specifications.
  - Shall provide the rated SEER for the combination condenser and evaporator coil match, per the AHRI directory.
  - All liquid refrigerant lines shall be insulated to a minimum of R-4.
  - Vapor or high side lines shall not be insulated unless specified by the manufacturer.
  - Suction lines will be insulated to a minimum of R-4.
  - If exposed to sunlight, refrigerant line insulation shall be protected from UV degradation in accordance with manufacturer specifications or local code.
  - Refrigerant lines shall be installed without kinks, crimps, or excessive bends.
  - Refrigerant lines shall be routed, supported, and secured to house in a manner that protects the line from damage by workers or occupants.

13. LOCATION

- **Roof Mount**
  - The roof shall be structurally adequate to properly support the installed equipment.[3] in conformance with the current CRC and local code.
  - Design and installation of support frame or curb and installation of air conditioning equipment and applicable safety apparatus (e.g., guard-rail) shall be in conformance with manufacturer's instructions and local code.
  - Curb base and exposed roof penetrations shall be properly installed, flashed and sealed watertight.
  - Roofing materials shall be in good condition and not in need of repair or replacement.



- **Ground Mount**
  - Air conditioning equipment shall be installed in conformance with local code[4].
  - The unit shall rest on concrete or other approved base extending at least 3" above the adjoining ground level.

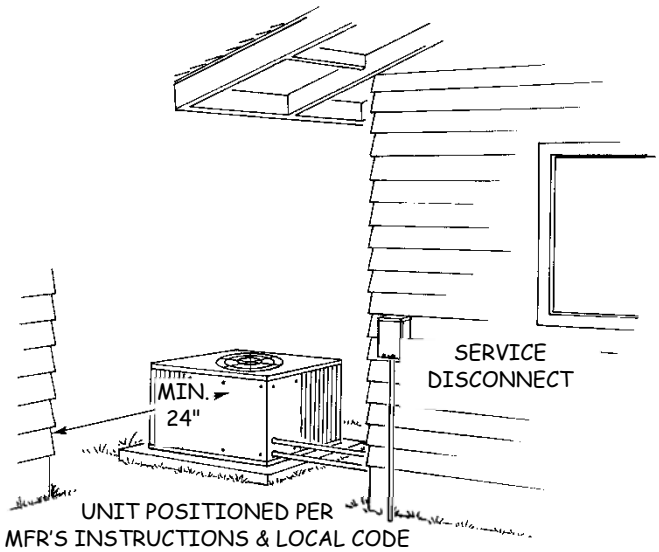


14. UNIT PROTECTION

- **All Units**
  - Units subject to mechanical damage shall be protected.[5].
  - Unit shall be attached to base with seismic straps, when required by local code.
- **Refrigerant Theft**
  - When an air conditioner is repaired or replaced, locking caps shall be installed on accessible refrigerant service valves, under the following conditions:
    - The geographic area is known to have had occurrences of refrigerant theft.
    - In any area after theft has occurred, and the contractor has had to install additional refrigerant to restore proper refrigerant charge in an air conditioner that was repaired or replaced.

15. ACCESS AND SERVICE SPACE

- **All Equipment Installations**
  - Access and working space shall be provided in conformance with manufacturer's instructions and local code.
- **Accessibility for Equipment**
  - Air conditioning equipment shall be accessible for inspection, service, repair and replacement without removing permanent construction[6].
  - Minimum clearance between air conditioning equipment or electrical panels, and the adjacent structure/wall/obstruction, shall be:
    - 24" on side(s) containing service access panels, and
    - 12" on all other sides, or
    - As specified by manufacturer and local jurisdiction.
    - 5' from clothes dryer moisture exhaust.



- **Overhead Clearance**
  - Overhead clearance shall be provided in conformance with manufacturer's specifications and local code.

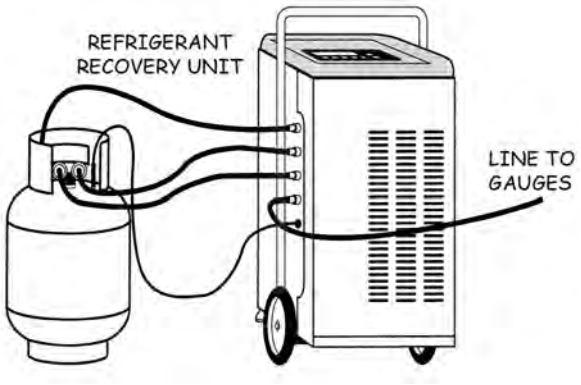
16. CENTRAL AIR CONDITIONER UNIT TYPES

- **Split-System**
  - Outdoor cabinet contains the condenser and compressor.
  - Indoor cabinet contains the evaporator coil.

- **Package Unit**
  - The evaporator, condenser, and compressor are all located in one cabinet, which usually is placed on a roof or on a concrete slab next to the house's foundation.
  - Packaged air conditioners often include electric heating coils or a natural gas furnace.
- **Heat Pump**
  - In cooling mode, heat pumps exchange heat with the outside air (for air-source pumps) or with the ground (with geothermal pumps) to move heat from a home. In heating mode, they draw heat from outside into a home. Heat pumps are available in Split System and Package Unit types.

17. INSTALLATION REQUIREMENTS—ALL UNIT TYPES

- **Installation of Unit**
  - A new air conditioner/heat pump with damage or defects shall not be installed.
  - The unit shall be installed in accordance with:
    - Manufacturer's instructions, and
    - Requirements of the local jurisdiction.
- **Air Flow**
  - Air flow through the indoor coil shall be adequate to meet manufacturer's specifications.
- **Condensate Drain Line**
  - Shall be installed for roof-mount units in accordance with air conditioner manufacturer's instructions and local code.
    - Condensate drain line shall be run to a nearby gutter, when present, or shall otherwise conform to local code to prevent moisture collection.
    - Drain line shall be equipped with a trap; and
    - Painted to resist UV degradation, if PVC is used.
- **Refrigerant System Charging**
  - Refrigerant system shall be properly charged using methods specified by the manufacturer.
  - Refrigerant charge shall be charged in accordance with ANSI/ACCA 5 QI-2010 HVAC Quality Installation Specification refrigerant charging requirements for mixed humid, hot humid, marine, and hot dry climates.
  - Refrigerant recovery shall be performed in accordance with Federal law by a technician with EPA-approved certification as a Type II or Universal technician.

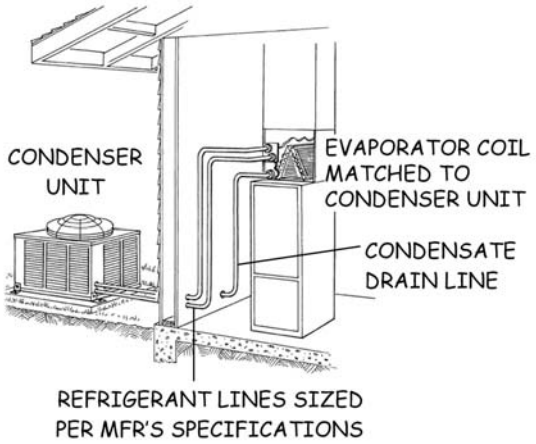


18. COMBINED FURNACE AND AIR CONDITIONER INSTALLATION

- **Package Unit**
  - Installation of furnace, vent system, combustion air, and gas piping for a Split System, Package Unit, or Heat Pump system shall be in conformance with this section, CSD WIS Section 24 (Furnace—Central Forced Air), the CSD Field Guide, and Field Guide Appendix A (CAS Protocol).

19. SPLIT SYSTEM INSTALLATION

- **All Units**
  - An evaporator coil shall be installed which is verified to be a rated match with the condenser unit, as listed in current AHRI Directory.
  - The evaporator coil and condenser unit labels shall be visible.
  - Condenser unit and evaporator coil shall be verified to function properly.
  - An access panel shall be provided for coil cleaning.
- **Evaporator Coil Replacement**
  - Prior to charging, vacuum shall be drawn on the refrigerant lines to test for leaks and remove water vapor.
  - Depth of vacuum and length of time shall be as specified by the manufacturer.



20. HEAT PUMP INSTALLATION

- **Replacement heat pump systems shall be:**
  - Installed in compliance with the current Title 24 Residential Compliance Manual, based on heat pump type and fuel source.
  - Heat pump systems shall be package unit or split system type.
    - For natural gas units, appliance vent system, combustion air, and gas piping for the heat pump shall be installed in compliance with CSD WIS Section 24 (Furnace—Central Forced Air) and the CSD Field Guide Appendix A (CAS Protocol).
    - For electric units, all appliance installation shall conform to the electrical requirements of this section.

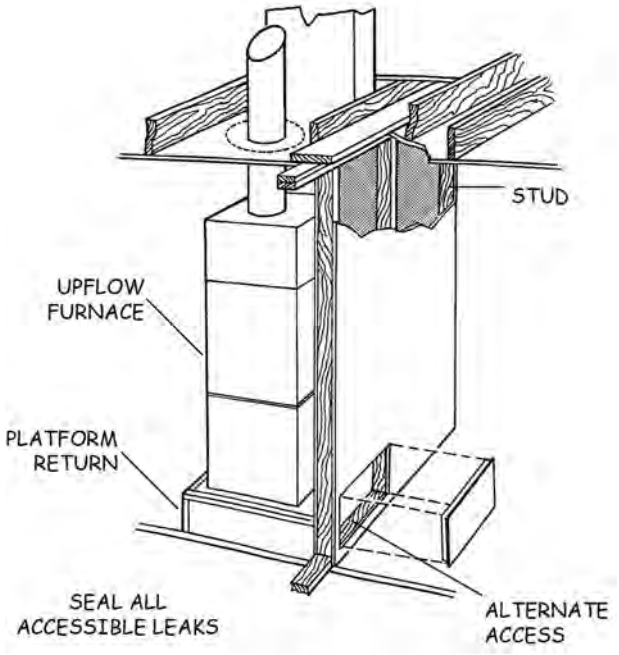
21. AIR DISTRIBUTION (DUCT) SYSTEM

- **Distribution system shall be in conformance with HVAC manufacturer's specifications.**
  - Retrofit Units Utilizing Existing Duct System
    - Testing the existing duct system shall be performed in accordance with Title 24 requirements and Field Guide Appendix B (Duct Leakage Test Protocol).
    - Repairs and sealing shall be made in accordance with CSD WIS Section 6 (Duct System Repair and Sealing).
  - New ductwork shall be installed in conformance with:
    - Manufacturer's instructions, and
    - Title 24 requirements[7] shall apply when more than 40' of duct is installed in unconditioned space.[1]
    - If new installation or replacement is necessary, ACCA Manual J or Manual S, and Manual D will be referenced to determine if the existing duct system is adequate for the sizing of the furnace, and the procedures outlined in ANSI/ACCA 5 QI-2010 HVAC Quality Installation Specification will be followed.

22. PREPARATION OF PLATFORMS AND PLENUMS

- **Return Air Plenum shall be free of leaks which:**
  - Affect combustion air.
  - Draw in outside air (*except* economizer units).

- **Platform Returns**
  - Platform bypasses (unlined cavities) shall be blocked/sealed with a liner of fiberglass duct board or sheet metal.
  - Uninsulated platforms shall be insulated by:
    - Filling stud cavities inside the plenum with flexible insulation, when lining/sealing with sheet metal, or
    - Installing fiberglass duct board (which both lines/seals and insulates the plenum).
  - Platform return accessed by swinging appliance enclosure door (full-length door containing a return grille near the bottom):
    - Door-mounted grille shall not interfere with proper closure of door.
    - Return shall be isolated from furnace enclosure (e.g., with weatherstripping that seals the gap between the platform and inside surface of the door).



- **Housing and Plenum**
  - Components shall be mechanically attached and sealed around the perimeter (e.g., housing-to-platform, housing-to-plenum).
    - The supply and return plenums shall be securely attached to the forced air unit (FAU).
    - The supply and return ductwork shall be securely attached to the respective plenums.
  - Wiring and plumbing penetrations into the return air chamber shall be sealed (e.g., with cork tape).

23. ELECTRICAL WIRING AND GROUNDING

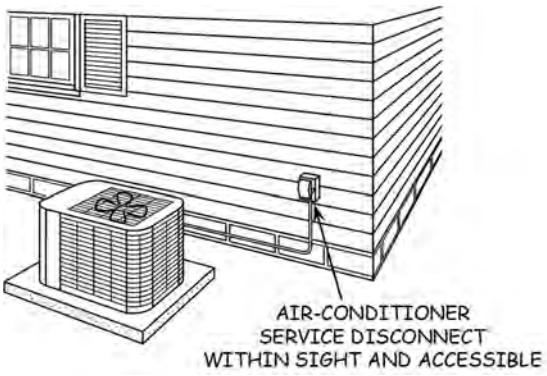
- **Service Receptacle**
  - A 120-volt grounded service receptacle shall be:
    - Grounded in conformance with manufacturer's instructions, local code, and CSD WIS Appendix D.
    - Located within sight of the equipment.
    - On the supply side of the disconnect switch.
    - On the roof, adjacent to the equipment (if unit is roof-mounted).

24. BRANCH-CIRCUIT PROTECTION

- **General Requirements**
  - Air conditioning equipment shall be provided with: overcurrent protection, disconnecting means, and branch-circuit short-circuit and ground-fault protection in accordance with the CEC and local code.[8].
- **Protection Device Type**
  - The overcurrent protection device shall be the type specified on the air conditioning equipment nameplate.
- **Branch Circuit Conductors**
  - Branch circuit shall be in conformance with the California Electrical Code for:
    - Ampacity and rating of conductors.
    - Voltage drop and wire length.

25. SERVICE DISCONNECT

- **All Installations**
  - Unit shall have a service disconnect installed that is capable of disconnecting the air conditioning equipment from the circuit feeder.
  - Service disconnect shall be installed in conformance with the CEC and local code.
- **Service Disconnect Location**
  - It shall be located within sight from, and readily accessible from the air conditioning equipment, or as required by local code.
  - It shall be installed on or within the air conditioning equipment.



- **Rating**
  - The rating of the disconnecting means shall not exceed the over-current rating of the installed equipment.
  - The rating of the installed fuses or circuit breakers shall not exceed:
    - The overcurrent rating of the installed air conditioning equipment.
    - The rating of the box in which they are located.

26. THERMOSTAT

- **Programmable Thermostat**
  - *Unless* a properly-functioning one is present, a new programmable thermostat shall be installed in accordance with CSD WIS Section 27 (Thermostats—Programmable and Manual).
  - Thermostat shall be tested and verified to operate properly per manufacturer's instructions.

27. AIR FILTERS

- **Filter Condition**
  - All air filters shall be installed and new for installed air conditioner units as part of the air conditioner unit installation.
  - Unframed filters shall be properly supported to prevent being drawn into the air handler, as prescribed in CSD WIS Section 28 (Air Filters).

28. WALL AND FLOOR REPAIRS

- **All Installations**
  - Surface of repair shall match plane of adjacent material.
  - Patching shall match texture of, and blend with, surrounding surfaces.
  - Floor openings shall be closed in a workmanlike manner.

PART 2: MOBILE HOME CRITERIA

29. GENERAL REQUIREMENTS

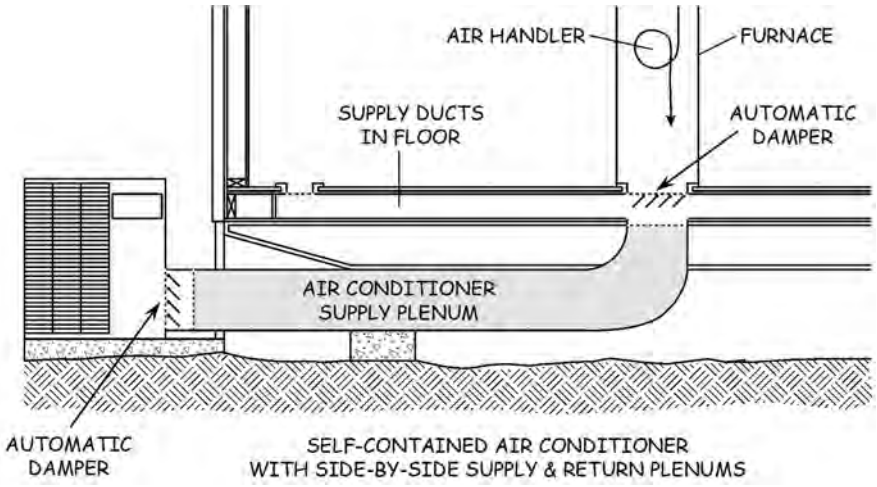
- **Permit**
  - A permit shall be obtained from and finalized by:
    - HCD for installations inside the mobile home.
    - HCD, or as applicable, the local building department for installations outside the mobile home.
- **Standards and Specifications**
  - Installation shall be in compliance with manufacturer's instructions and specifications, and as applicable, with requirements of HCD and/or the local building department.
- **Materials installed within a manufactured home:**

- Shall be in compliance with HCD regulations and HUD MHCSS.[9].

- **Materials installed outside a manufactured home:**
  - Shall be in compliance with HCD regulations or, as applicable, requirements of the local building department.
- **Vent pipe, gas valves, and fuel-gas piping:**
  - Shall be in conformance with CSD WIS Section 24 (Furnace—Central Forced).

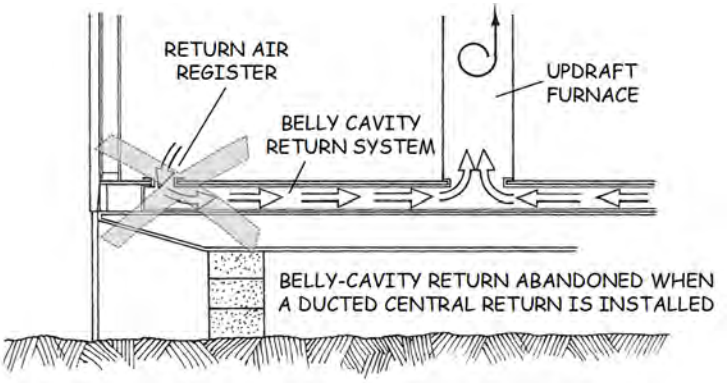
30. MOBILE HOME SELF-CONTAINED AIR CONDITIONER

- **Installation**
  - Installation of a self-contained air conditioner sharing a common supply duct system with the furnace shall comply with the following requirements for damper and function control.
- **Automatic Damper**
  - Furnace shall have an automatic barometric damper installed to prevent cold air from entering the furnace when the HVAC system is in cooling mode.
  - Air conditioner shall have an automatic damper installed to prevent hot air from entering the air conditioner unit when the HVAC system is in heating mode.
- **Function Control**
  - Controls shall prevent the air conditioner and furnace from coming on at the same time.



31. MOBILE HOME AIR DISTRIBUTION SYSTEM

- **Existing Duct System and New Ductwork**
  - Examination and testing shall be in conformance with CSD Field Guide Appendix B (Duct Leakage Testing Protocol).
  - Repair and sealing of existing/new ducts shall be in conformance with CSD WIS Section 6 (Duct System Repair and Sealing).
- **Belly-Cavity and Roof-Cavity Returns**
  - When specified by program policy:
    - Existing belly-cavity return shall be abandoned, and a new ducted central return shall be installed.
    - Existing leaky roof-cavity return shall be repaired as applicable, and replaced with a new central return when repair is needed but not feasible.
  - New central return shall be



designed and installed in conformance with CSD WIS Section 6 and HCD requirements.

- **Housing and Plenum**
  - Components shall be mechanically attached and sealed around the perimeter (housing-to-duct connector, housing-to-plenum) in conformance with CSD WIS Section 6.
  - Plumbing and wiring penetrations into the evaporator coil box and return air chamber shall be sealed with cork tape.
- **New Ductwork**
  - Components shall be installed in conformance with HVAC manufacturer's instructions and CSD WIS Section 6 requirements.

32. ELECTRICAL WIRING, GROUNDING, AND ACCESSIBILITY

- **Electrical wiring, grounding, and unit accessibility shall be in conformance with:**
  - Manufacturer's instructions,
  - HUD[10] and/or, as applicable, requirements of the local building department.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

33. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

34. OPERATIONAL CHECKS

- **Testing**
  - The installed unit and thermostat shall be tested for proper operation to ensure proper cooling.
  - External static pressure shall be measured and documented.
- **Refrigerant Charge Log**
  - EPA refrigerant charge log shall will be maintained and provided.
- **Commissioning**
  - Equipment will be fully tested for proper operation following procedures outlined in ANSI/ACCA 5 QI-2010.
  - The sequence of operation of the system will be verified in accordance with the manufacturer installation, operation, and maintenance manual.
  - Property manager/occupant will be educated on how to operate and maintain system, including thermostat operation and system changes.

35. SPECIAL DISPOSAL CRITERIA

- **All Units**
  - Refrigerant shall be recovered and all hazardous waste materials shall be disposed of in conformance with federal, state and local codes.
  - Non-salvageable components and waste will be removed and disposed of properly.

INFORMATION ABOUT HANDLING REFRIGERANT AND OTHER HAZARDOUS MATERIALS IS AVAILABLE FROM EPA'S STRATOSPHERIC OZONE INFORMATION HOT LINE

36. CLIENT EDUCATION

- **Basic Operation**
  - Operation of the equipment shall be explained to the client (e.g., design conditions, efficiency measures, differences from previous system or situation).
- **System Controls (e.g., Thermostat, Humidistat)**
  - Proper operation and programming of system controls to achieve temperature and humidity control shall be explained.
- **System Disconnects**
  - Indoor and outdoor electrical disconnects and fuel shut-offs shall be demonstrated.
- **Air Inlets**
  - Location of combustion air inlets shall be identified.
  - Importance of not blocking inlets shall be explained.
- **Blocking Air Flow**
  - Importance of cleaning dust and debris from return grilles shall be explained.
  - Proper placement of interior furnishings with respect to registers shall be explained.
  - Negative consequences of closing registers shall be explained.
  - Importance of leaving interior doors open as much as possible shall be explained.
- **Routine Maintenance**
  - Proper filter selection and how to change the filter shall be explained.
  - Importance of keeping outside unit clear of debris, vegetation, decks, and other blockage shall be explained.
  - Importance and timing of routine professional maintenance shall be explained.
- **Calling Heating, Ventilation, and Air Conditioning (HVAC) Contractor**
  - Situations when the client should contact an HVAC contractor shall be explained, including:
    - Fuel odors
    - Water draining from secondary drain line
    - Emergency heat indicator always on for a heat pump system
    - System blowing cold air during heating season and vice versa
    - Icing of the evaporator coil during cooling mode
    - Outside unit never defrosts
    - Unusual noises
    - Unusual odors

REFERENCED STANDARDS

[1] At the CEC website http://www.energy.ca.gov/title24/2013standards/ the Residential Compliance Manual may be downloaded.

[2] CEC Residential Compliance Manual Section 8.4.2

[3] CRC

[4] CMC Section 1106.0

[5] CMC Section 308

[6] CRC §1106.3

[7] CEC Residential Compliance Manual, Sec. 8.4

[8] CEC Article 440, Part III

[9] Code of Federal Regulations, Chapter XX, Part 3280

[10] MHCSS, Section 3280, Subpart I

AIR CONDITIONER—WALL AND WINDOW

Lead Paint Risk Factor
VARIABLE

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AIR CONDITIONER—WALL AND WINDOW

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

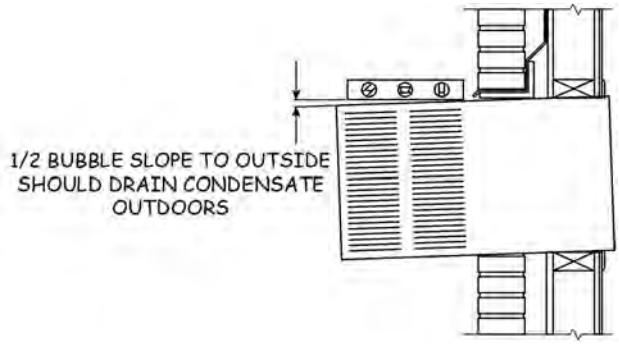
1. DOCUMENTATION REQUIREMENTS

- **All Appliance Repairs and Replacements**
  - Following the assessment by an agency assessor, operational or safety issues with an existing appliance shall be diagnosed by a qualified technician and fully described in writing for the agency before any repair or replacement work shall be allowed. The agency also shall accept or decline this scope of work in writing. These additional documents shall become part of the assessment record.

AIR CONDITIONER REPAIR

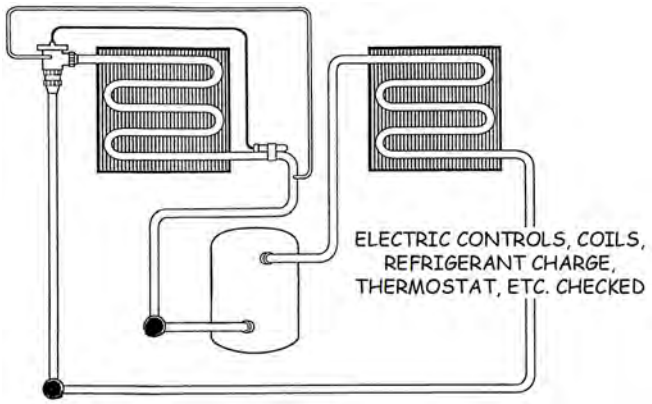
2. REPAIR CONDITIONS

- **The scope of repairs must also take into consideration, but is not limited to, the following Health and Safety repairs:**
- **Unit Position**
  - Unit shall be level and securely installed.
  - When water drips from the air conditioner into the room:
    - If the unit is sloped downward into the home, it shall be adjusted to slope one-half bubble downward to the outside, or as instructed by the manufacturer.
    - Check condensate drain for obstructions and clean as needed, per Item 3(G).



- **Cooling Unit Integrity**
  - Loose items shall be tightened (e.g., screws, bolts, panels, etc.).
  - Missing/damaged components critical to proper operation shall be replaced/repaired.
  - Improper alterations that adversely affect unit operation shall be corrected.
- **Wiring**
  - Unit shall be free of wiring defects (e.g., frayed or charred wires, loose or improper connections, etc.).
- **Thermostat**
  - Unit thermostat shall function properly:
    - Wiring connections shall be correct and tight.
    - With front grille and control panel removed, mark the location of the temperature sensing bulb.
    - Remove the thermostat, clip ohm meter leads to thermostat terminals, and turn thermostat to the coldest setting.
    - If meter does not read zero, replace thermostat with a new one of the same kind.
    - Properly secure wires to thermostat, install it, and reposition the sensor bulb to its proper location.

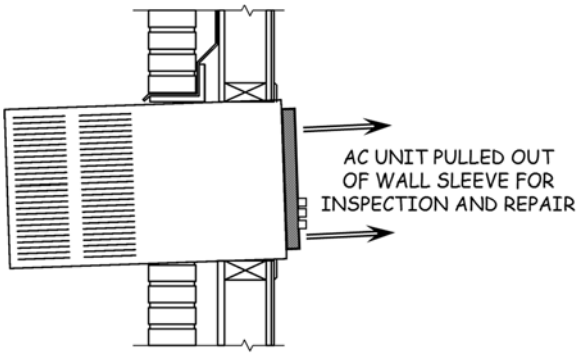
- **Electric Controls**
  - Unit controls shall operate and cool in accordance with manufacturer's specifications.
  - If the selector switch does not function properly, compressor and fan controls shall be inspected for evidence of wear and defects.
  - With front panel removed, selector switch shall be examined for evidence of loose or defective terminals.
  - Loose connections shall be tightened, and worn/defective controls shall be replaced.



- **Sealed Units and Refrigerant Charge**
  - The following services shall be performed by a qualified contractor/technician licensed to perform HVAC repairs:
    - Service to sealed units (i.e., coils, compressor, and fan motor).
    - Repair of refrigerant leaks.
    - Adjustment of refrigerant charge.
- **Fan Motor**
  - Unit fan motor shall function properly and be free of operating defects.

3. AIR CONDITIONER UNIT/COIL MAINTENANCE

- **(A) Air Conditioner Unit Removal for Coil Inspection/Cleaning**
  - With the unit unplugged, remove the front grille (e.g., release retaining clips with a stiff blade, or remove screws, as applicable).
  - Remove the air filter to expose the evaporator coil.
  - Remove the air conditioning unit:
    - Remove the outdoor cover and remove the air conditioning unit from is mounting frame, or
    - Pull the air conditioning unit out of the wall sleeve, if applicable.



  - Discharge the capacitor(s) behind control panel, if terminals/wires are exposed (e.g., short across terminals with a screwdriver blade).
- **(B) Coil Cleaning**
  - Coils shall be visually inspected for dirt, obstructions, and fin damage.
  - Coils shall be cleared of obstructions and cleaned as needed to restore proper airflow.
- **(C) Evaporator (Inside) Coil**
  - Evaporator coil shall be cleaned, per Item 3(E).
  - Bent fins shall be corrected, per Item 3(F).
  - A clean and properly-fitting filter must be in place, per Item 3(H).
  - Ensure that the thermostat sensor is correctly positioned.
- **(D) Condenser (Outside) Coil**
  - The area around the coil shall be clean and free of debris (e.g., leaves, lint from a dryer vent, lawn mower clippings, etc.).
  - If foliage is nearby, it shall be trimmed back at least 2' from the coil.
  - Condenser coil shall be cleaned, per Item 3(E).
  - Bent fins shall be corrected, per Item 3(F).

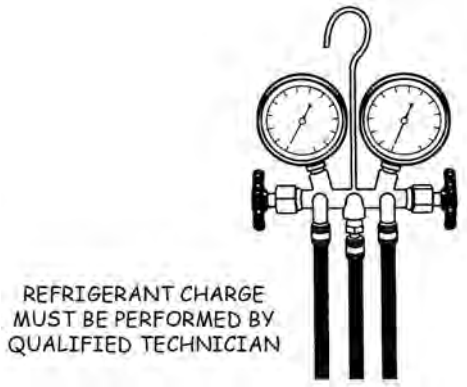
3. AIR CONDITIONER UNIT/COIL MAINTENANCE (cont.)

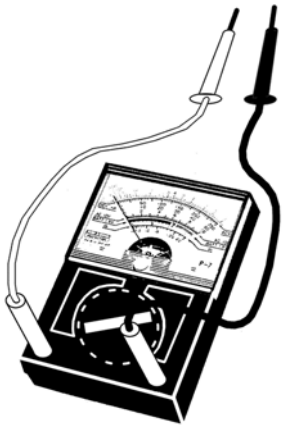
- **(E) Coil and Fan Blade Cleaning**
  - Remove dirt with a coil brush, brushing in the direction of the slots between the fins.
  - Vacuum coils with brush attachment.
  - If dirt remains, use a water-based, non-acid, non-corrosive coil cleaning spray or foam, applied per product instructions.
  - Water may be sprayed on coils to clean or rinse, with care taken to avoid wetting the electronics or motor.
    - Control switches and fan motor shall be covered as needed to protect them from water (e.g., with plastic and/or tape).

  - Wet coils must be dry before operating the unit.
    - Excess moisture should be removed with a wet-dry vacuum.
  - Dirty fan blades shall be cleaned with a brush and/or vacuum hose.
  - Dirt, lint, etc. inside the unit shall be removed with a vacuum cleaner.
- **(F) Coil Fin Straightening**
  - Bent coil fins shall be straightened, using a fin comb that matches the fins-per-inch spacing of the coil.
  - Fin comb manufacturer's instructions shall be followed.
- **(G) Drain Port Cleaning**
  - Condensate drain(s) shall be checked and cleaned if dirty or clogged.
  - Drain port(s) on the evaporator side shall be cleaned (e.g., with a stiff wire or small brush) in conjunction with coil cleaning.
  - Condenser side drain port(s), if present, shall be checked/cleaned.
- **(H) Filter Cleaning**
  - Air filter shall comply with manufacturer's instructions, when available.
  - If not available, guidelines in CSD WIS Section 28 (Air Filters) shall be followed.
  - Damaged/defective filter shall be replaced.
  - Washable filters (usually foam rubber) shall be cleaned with detergent and water (also bleach, if there is evidence of mold) and allowed to dry before operating the unit.
- **(I) Air Conditioner Unit Reassembly**
  - Following unit, coil, and filter cleaning and drying:
    - Replace the air conditioner unit into its frame, and secure properly.
    - Ensure that thermostat sensor is properly positioned and secured.
    - Reinstall the filter and front cover, and secure properly.
- **(J) Window Seals (Inserts)**
  - Check inserts and seals between the air conditioner and window frame.
  - Insert shall make contact with both the unit's metal case and the surrounding surfaces.
  - Defective gaskets and caulking shall be repaired or replaced.

Section 32

AIR CONDITIONER REPAIR TROUBLESHOOTING GUIDE

CATEGORY	PROBLEM	CORRECTIVE STEPS
Fan motor is defective	If the fan is noisy	• Examine the fan blades for looseness, damage, and dirt, and check the housing bolts for looseness. • Tighten housing bolts and motor mounting bolts, if loose. • If fan is loose on the shaft, tighten fan set-screw. • If the fan is dirty, clean it per Item 3(E). • If the fan is defective (damaged, crooked, broken), replace it with the same model. • If the fan motor has oil ports, lubricate each with 10 drops of 20-weight non-detergent motor oil.
	If the fan does not operate	• Make sure power is reaching the motor. • If fan does not operate with power on: - Unplug unit, disconnect wires from motor terminals, and clip an ohm meter to motor terminals. - With meter on Rx1 scale, it should read between 3 & 30 ohms. - If reading is zero or very high, replace motor with same model. - If motor defect is in doubt, it should be checked by a motor repair specialist.
	If compressor or condenser coil must be moved to remove fan motor	• Motor replacement shall be performed by a qualified contractor/technician. • Refrigerant-carrying components (compressor and coils) shall not be moved, adjusted, repaired, or charged by persons not trained and qualified to handle refrigerant. 
Thermostat or controls malfunction	Air conditioner cycles on and off too frequently	• Check thermostat sensor behind front grille to make sure it is positioned near but not touching the evaporator (inside) coil, and adjust as needed by carefully bending the wire that holds it in place. • If the front panel is obstructed by curtains/drapes or furniture, remove the obstruction. • If the air filter behind the front panel is not clean and/or does not properly cover the evaporator coil, clean or replace it as needed, per Item 3(H). • If the condenser (outside) coil is obstructed by leaves or debris,

CATEGORY	PROBLEM	CORRECTIVE STEPS
		clean it and remove the obstruction, per Item 3(D). • If condenser fins are severely damaged or bent, repair them with a fin comb, per Item 3F). • If performance does not improve, a qualified technician should: - Check the unit for a refrigerant leak. - Locate and repair leak(s) and properly recharge the system.
Unit is inoperable	Air conditioner will not turn on.	• Check for tripped breaker or blown fuse. - Reset the breaker or replace the fuse, after making sure the amp rating of the overcurrent protection is adequate for the amp draw of the air conditioner. - If overcurrent protection continues to trip, see Item below. • Ensure that the plug is properly seated in the receptacle. - Replace the plug and/or receptacle, if defective or not making solid electrical contact. • Check power cord for defective screw terminal or broken conductor. - Tighten loose terminals. - Check conductor continuity with an ohm meter.
Use of the air conditioner unit trips the breaker/fuse	Air conditioner unit trips the overcurrent protection device	• Check the amperage rating of the overcurrent protection device and the circuit conductors (e.g., maximum 15-amp breaker/fuse for 14 AWG wiring, and maximum 20 amp breaker/fuse for 12 AWG wiring). • Check for loose wire connections at the receptacle and service panel. - With power off, tighten loose screw connections and “wire nuts”. • Check for other appliances drawing current from the same circuit. - Total amp draw of all appliances on the circuit shall not exceed the amp rating of the conductors and overcurrent protection device. • Overcurrent protection for the air conditioner circuit must be upgraded, if existing breaker/fuse is underrated for air conditioner’s amp draw. • A new dedicated circuit is needed for the air conditioner if: - Conductors supplying the air conditioner are inadequate AWG for the unit’s amp draw, and/or - Other appliances on the same circuit cause an overload and nuisance tripping.  ELECTRICAL CONNECTIONS AND CONDUCTORS CHECKED TO FIND PROBLEMS

Section 32

AIR CONDITIONER INSTALLATION

4. GENERAL REQUIREMENTS

- **All Units**
  - Installation shall be per manufacturer's instructions, and in compliance with the CRC, the CEC, and local codes.

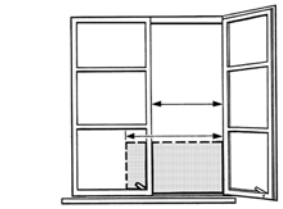
5. LOCATION

- **A location that conforms to manufacturer's instructions shall be present.**
  - Location shall be provided which allows:
    - For air circulation, free of obstruction.
    - Stable and safe installation.
    - Protection from both vehicular and pedestrian traffic.
- **Window-Mount Units**
  - All Windows
    - Air conditioner shall be placed in center of window opening.
    - Permanent window panels shall be installed to completely fill empty spaces over 12" wide.
    - Side window panels over 12" wide shall be transparent.
    - Window panels shall be sealed in place.
    - Unit shall be placed on north or east side of home out of direct sun, when possible.
    - Unit shall be placed in the shade of trees and shrubs, when feasible.
  - Vertical Sliding Windows
    - Air conditioner shall be installed in lower sash opening.
    - Lower sash shall seal against unit and side panels.
  - Awning and Jalousie Windows
    - Displaced panels/panes shall be removed and left with client.
    - Pivots, operators, or other hardware damaged during removal shall be repaired or replaced.

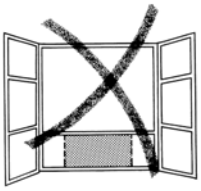
AIR CONDITIONER CENTERED IN WINDOW OPENING

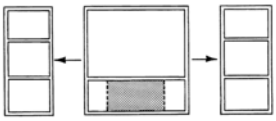
- **All Casement Windows**
  - Owner shall be informed about the final appearance and give written consent before installation.
- **Single-Vent Casement Windows**
  - Sash shall be removed.
  - Air conditioner shall be permanently installed and sealed.
  - Transparent glazing shall be installed above air conditioner: glass or polycarbonate.

- **Double-Vent Casement Windows**
  - When unit is too large for one sash opening, air conditioner may be installed only under one of the following two conditions:
    - Condition A:
      - Window frame assembly is adequate to support the weight of the air conditioner, and
      - A slim line unit is installed.
    - Condition B:
      - Both sashes are removed, and
      - Air conditioner is permanently installed and sealed.



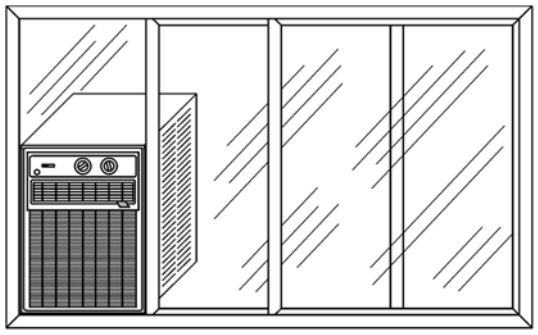
AIR CONDITIONER TOO WIDE FOR ONE SASH OPENING





BOTH SASHES REMOVED AND TRANSPARENT GLAZING INSTALLED ABOVE AIR CONDITIONER

  - Transparent glazing shall be installed above air conditioner: glass or polycarbonate.

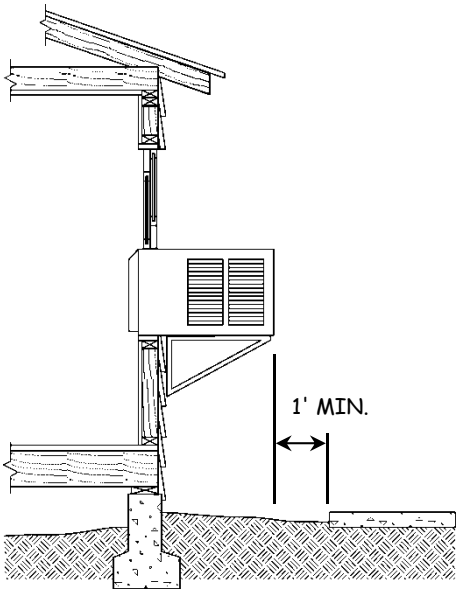


AIR CONDITIONER IN HORIZONTAL SLIDING WINDOW

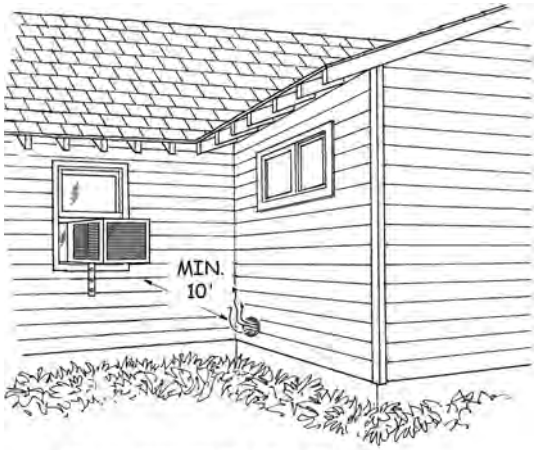
- **Horizontal Slider Windows**
  - The unit shall fit properly into opening created by sliding one sash.
  - The window frame may serve as support for the unit.
  - The movable sash shall be secured in place per manufacturer's instructions.
  - Air conditioner shall be installed and sealed per manufacturer's instructions.
  - Transparent glazing shall be installed above the unit: glass or polycarbonate.

6. CLEARANCES

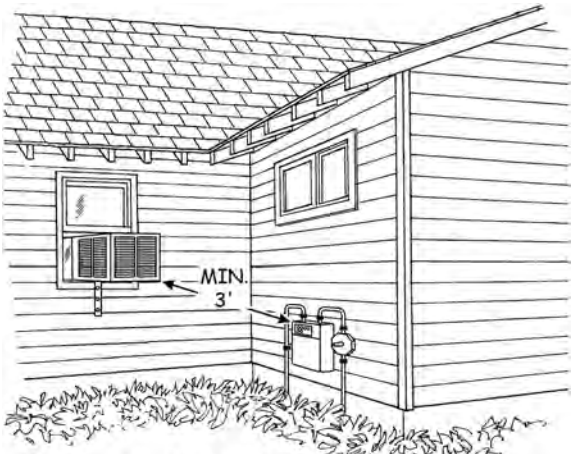
- **Interior Clearance**
  - Unit shall be free of obstructions, such as furniture, curtains, plants, etc.
- **Exterior Clearance**
  - There shall be at least 1' between the air conditioner and adjacent walkway or wall.
  - Unit's air intake shall be located at least 10' away from, or 3' below combustion appliance vent terminations.



- Unit's air intake shall be located at least 10' from:
  - Clothes dryer moisture exhaust termination.
  - Plumbing vent terminations.
  - Exhaust fan vent termination.
- There shall be at least a 3' clearance from air conditioner inlet to the gas meter.
- Unit shall not be installed if clearance requirements cannot be met.
- Property setback requirements shall not be violated.
- Unit shall be free of obstructions, such as landscaping, plants, structures, etc.



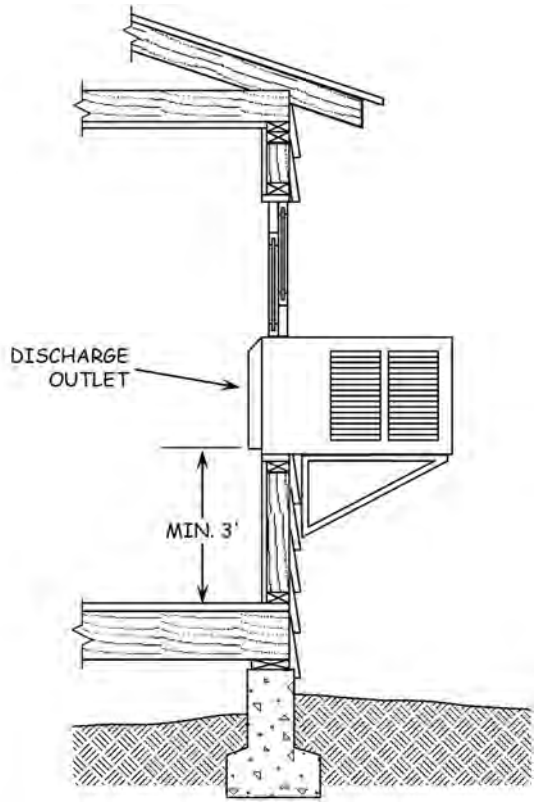
AIR CONDITIONER MIN. 10' FROM CLOTHES DRYER MOISTURE EXHAUST



AIR CONDITIONER MIN. 3' FROM GAS METER

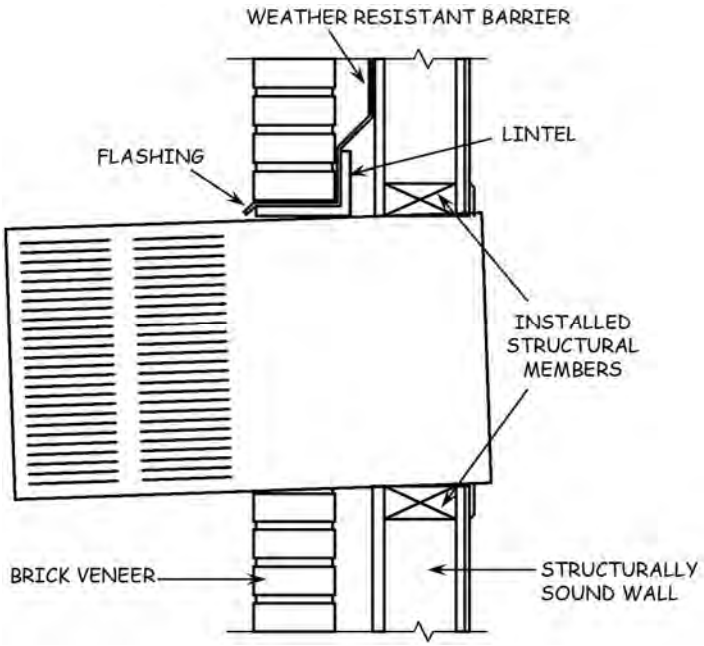
7. MINIMUM HEIGHT

- **All Units**
  - Unit shall be installed only in a window or wall opening.
  - Exterior portion of unit shall be located a minimum of 2' above grade.
- **Wall-Mount Units**
  - Installations in new locations allowed only in conventional homes and in mobile homes with wood siding.
  - Air discharge outlet shall be located a minimum of 3' above the floor, *unless* mounted below a window or in an existing location that is lower.
  - Replacement unit shall be installed in existing location, if the location meets requirements of local code and is allowed by manufacturer.
  - Discharge grille shall be equipped with directional louvers on units located *less* than 3' above the floor.



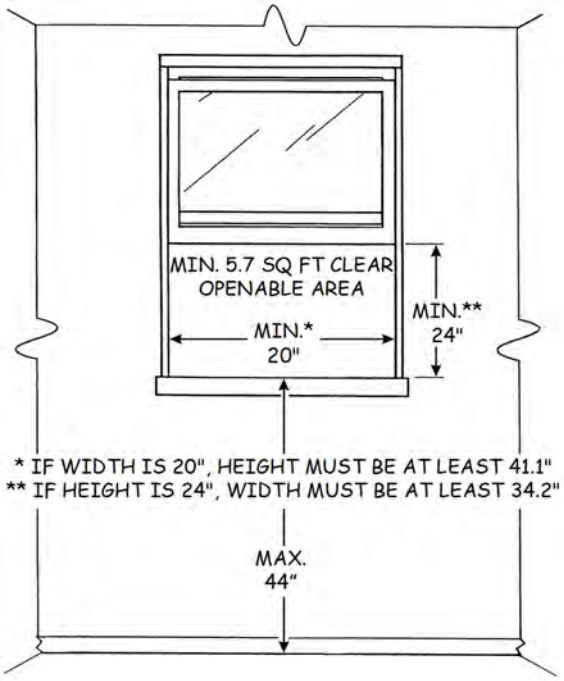
8. WALL OPENING

- **Wall Openings**
  - Wall shall be structurally sound and able to support unit's weight and vibration.
  - The opening shall be framed with structural members.
  - Opening in brick veneer and block walls shall have:
    - Lintel and flashing installed above opening when required.
    - Flashing (drip rail) installed below unit.
  - Unit shall be sealed in place.
- **Wall Opening Modification**
  - The hole shall be enlarged or reduced to meet manufacturer's hole size and clearance specifications.
  - Opening shall be structurally sound and framed.
  - Interior and exterior sheathing shall be neatly patched and trimmed, with all exposed wood primed and painted to match adjacent trim appearance.



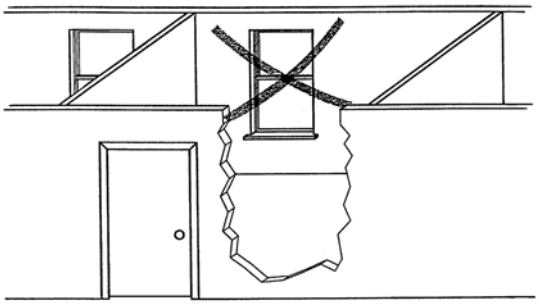
9. EGRESS WINDOWS IN CONVENTIONAL HOMES

- **Coolers Installed in Egress Windows**
  - Unit shall <u>not</u> violate egress requirements, which apply to <u>all rooms used for sleeping</u>.
  - When a sleeping room has no operable exterior door, at least one window shall meet the egress requirements of (a) local code or (b) the current CRC[1], which places the following requirements on egress windows:
    - Minimum net clear openable area and dimensions:
      - Area of 5.7 sq. ft. (*<u>Exception</u>*: 5.0 sq. ft. minimum is allowed on a "grade-floor" opening/window [a window with sill height not *more* than 44" above the finished ground level adjacent to the opening].)
      - Minimum width of 20" and height of 24".
    - Maximum finished sill height of 44" above the floor.



10. EGRESS WINDOWS IN ALL HOMES

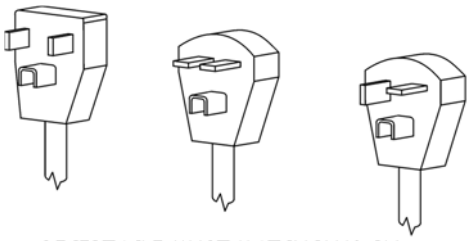
- **It is acceptable to install and air conditioner in a sleeping room window when:**
  - Allowed by client, and
  - One of the following is present in the same room:
    - Another operable window which meets egress requirements, or
    - An operable exterior door which meets egress requirements.



AIR CONDITIONER NOT INSTALLED
IN THE ONLY EGRESS OPENING

11. ELECTRICAL SUPPLY

- **Electrical outlet and circuit shall be examined for:**
  - Missing cover plate or damaged receptacle.
  - Evidence of a hazardous condition (e.g. charring, frayed insulation, loose wires or box, etc.).
  - Presence of grounding.
  - Overcurrent protection (i.e. fuse or breaker).
- **Receptacle**
  - The receptacle shall:
    - Conform to manufacturer's instructions and local code or HCD (for mobile home).
    - Be in good or correctable condition (wiring, receptacle, and cover plate).
    - Be securely installed in an electrical box.
    - Provide grounding to the appliance.
    - Match the plug on the unit's power cord.



RECEPTACLE MUST MATCH PLUG ON
AIR CONDITIONER'S POWER CORD

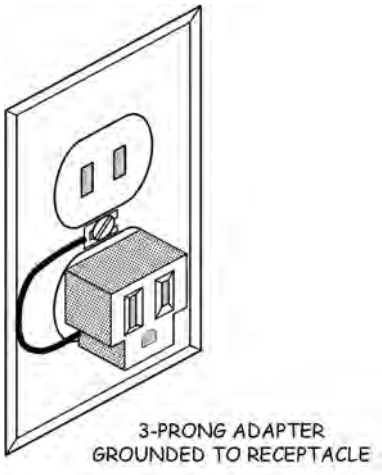
- **Electrical Circuit**
  - The electrical circuit shall have:
    - Proper overcurrent protection.
    - Adequate current capacity available to avoid nuisance tripping of breaker/fuse by the air conditioner.
- **120 Volts and Lower**
  - Unit shall be plugged into its own separate receptacle when required by the manufacturer.
- **208 Volts and Higher**
  - Unit shall be plugged into its own separate receptacle outlet.

12. GROUNDING

- **Non-Grounded Receptacles**
  - Units shall not be connected to a non-grounded 2- or 3-prong receptacle.
  - A non-grounded 2-prong receptacle may be replaced with a new 3-prong receptacle, if the new receptacle will be grounded.

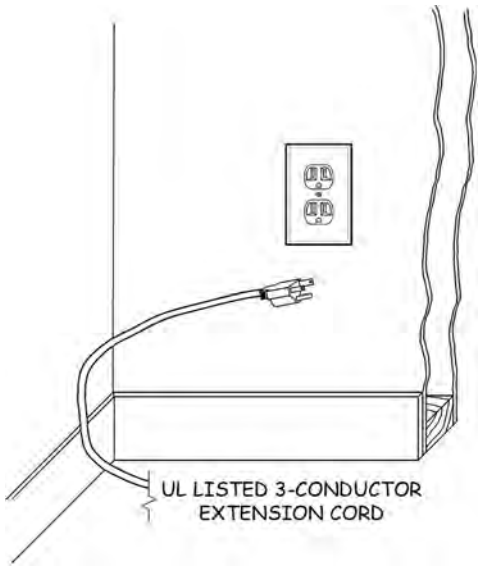
13. ADAPTER

- **Non-Grounded 3-prong Adapters**
  - Shall not be used.
- **A grounded 3-prong adapter may be used only when:**
  - Not prohibited by manufacturer's instructions.
  - Adapter provides proper polarity and grounding to the appliance.
  - The adapter ground lug/wire is securely attached to a grounding source, such as a:
    - Grounded receptacle.
    - Grounded electrical box.
  - Alternate grounding conductor exists.



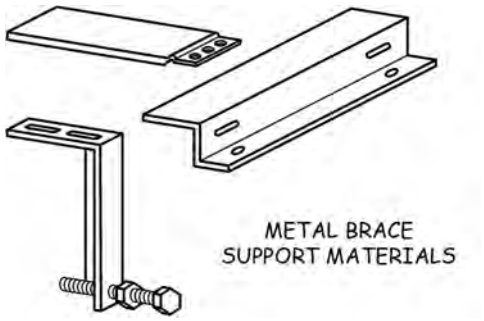
14. EXTENSION CORD

- **Use**
  - One extension cord may be used with unit rated at 120 volts or less, if allowed by appliance manufacturer's instructions.
  - An extension cord shall not be used with a unit rated at 208 volts or greater.
- **Extension cord shall be:**
  - UL Listed and in conformance with manufacturer's specifications.
  - A 3-conductor cord with 3-prong grounding plug.
  - Rated appropriately for the appliance.
  - The shortest feasible length and not in conflict with manufacturer's instructions.
- **Cord Location**
  - Appliance cord and extension cord shall not be draped over a countertop or furnishings in a manner which:
    - Allows access to children (to reach and pull on them).
    - Creates a walking hazard (where people may trip).



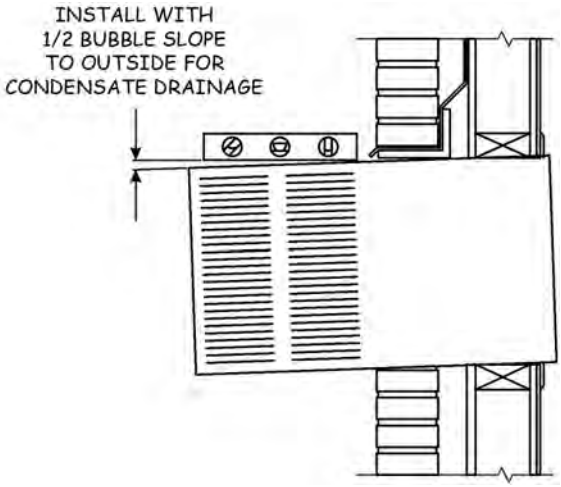
15. UNIT SUPPORTS

- **All Installations**
  - Air conditioner shall be supported per manufacturer's instructions.
- **Brace Supports**
  - Brace shall be anchored with non-corrosive screws to solid wood, such as:
    - Minimum 3/4" siding.
    - Structural framing.
    - 2-by ledger board.
  - All brace support materials shall be metal.



16. LEVEL AND PLUMB

- **Side-to-Side**
  - Air conditioner shall be installed level side-to-side.
- **Front-to-Back**
  - The air conditioner shall not be installed level front-to-back.
  - The unit shall be sloped 1/2 bubble downward to the outside for condensate drainage.
  - *Exception:* Manufacturer's instructions take precedence, if they specify a level mount or a different slope.

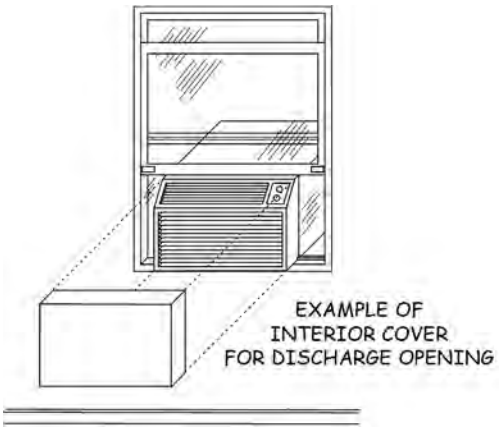


17. CONDENSATE CARE

- **Drain water condensate shall:**
  - Flow away from the house.
  - Not flow or splatter against the wall.
  - Not puddle.
- **A drain hose/line is required when:**
  - The air conditioner is located above first floor.
  - Condensate will drain onto a patio or walking surface.

18. WINTER PROTECTION/CLOSURE

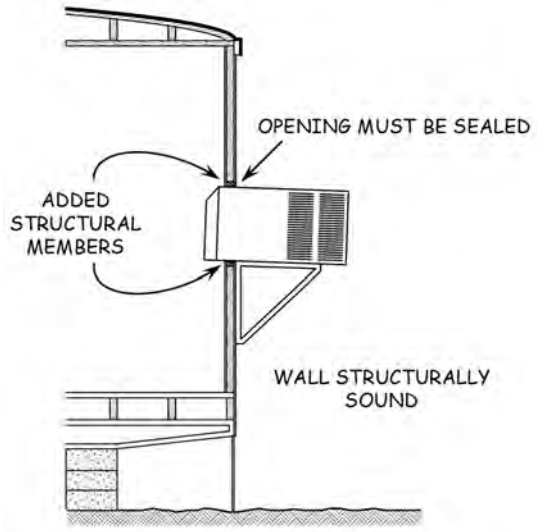
- **Interior or Exterior Means**
  - Means shall be present to close off the air conditioning system during winter, to protect against infiltration of unconditioned air.
- **Interior closure shall be created by:**
  - Grills which have positive closed positions, or
  - A damper in the face grill, or
  - Cover/closure for the discharge openings of the air conditioning unit, when agreed to by the client.
- **Exterior Closure**
  - When acceptable to occupants, closure may be created by an exterior cover/closure that seals the intake openings of the unit.
  - Cover shall be installed in accordance with CSD WIS Section 10 (Vent Covers).



PART 2: MOBILE HOME CRITERIA

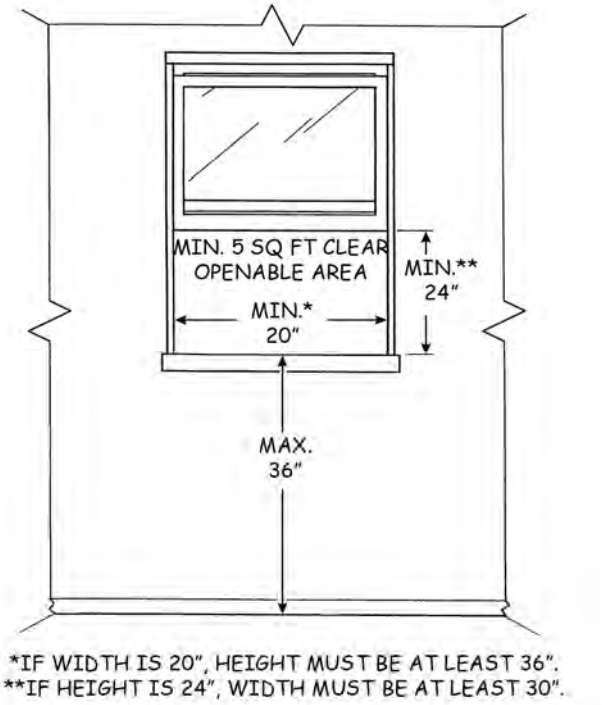
19. LOCATION OF WALL-MOUNT UNIT (MOBILE HOMES)

- **Mobile Homes with Wooden Siding**
  - Hole (opening) shall not be cut if one does not already exist.
  - See Part 1: Installation Requirements for Conventional Homes.
  - Wall shall be structurally sound and able to support unit's weight and vibration.
  - The opening shall be framed with structural members.
  - Unit shall be sealed in place.
- **Mobile Homes with Metal Siding**
  - Air conditioner shall be installed only in a window opening or an existing wall opening.
  - Cutting new wall openings is not allowed.



20. EGRESS WINDOWS IN MOBILE HOMES

- **Installation shall be in compliance with HCD regulations and HUD MHCSS[2].**
- **Units Installed in Egress Windows**
  - Unit shall not violate egress requirements, which apply to all rooms used for sleeping.
  - When a sleeping room has no operable exterior door, at least one window shall meet the egress requirements of:
    - Authority having jurisdiction, or
    - HUD MHCSS[3], which places the following requirements on egress windows:
  - Minimum net clear openable:
    - Area of 5 sq. ft.,
    - Width of 20", and
    - Height of 24".
  - Bottom of window maximum 36" above the floor.



PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

21. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

22. OPERATIONAL CHECK

- **Before operation:**
  - Installation shall be checked to ensure that the air conditioning unit is:
    - Mounted level.
    - Sloped downward 1/2 bubble to the outside.
    - Securely attached and braced.
  - Electrical circuitry shall be checked for:
    - Proper grounding of cabinet, electrical boxes and conduit.
    - Safe and secure connections.
    - Adequate circuit capacity and overcurrent protection.
- **Unit shall be operated *in each mode* to determine that it is functioning properly.**

23. CLIENT EDUCATION

- **Basic Operation**
  - Operation of the equipment shall be explained to the client, with proper operation of system controls to achieve desired temperature.
  - Client shall be shown how to remove and install winterizing materials.
- **Routine Maintenance**
  - Client shall receive instruction on proper filter selection and how to change the filter, when applicable.
- **Blocking Air Flow**
  - Client shall be advised of the importance of cleaning dust and debris from heat source grilles.
  - Safe placement of interior furnishings with respect to heat source shall be explained.
- **Routine Maintenance**
  - Client shall be advised of the importance of:
    - Maintaining the outside of unit/or interior of enclosure clear of debris, hazardous chemicals, and other blockage.
    - Routine professional maintenance.

24. DISPOSAL REQUIREMENTS

- **Replaced Wall/Window Air Conditioner**
  - Shall be removed from the property and disposed of properly, per the Clean Air Act 1990, section 608, as amended by 40 CFR 82, 5/14/93.

REFERENCED STANDARDS

[1] CRC §R310.1

[2] Code of Federal Regulations (CFR) Chapter XX, Part 3280

[3] CFR Part 3280

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NOTES

CEILING FANS

Lead Paint Risk Factor
NONE-LOW

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CEILING FANS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

CEILING FAN REPAIR

Not applicable to this measure.

CEILING FAN INSTALLATION

1. SIZING

- **Fan size shall be appropriate for room dimensions and by manufacturer specification.**
  - When manufacturer specification is not available, the table below is a Ceiling Fan Sizing Guide from the ENERGY STAR website that shall be followed as closely as is possible and reasonable:

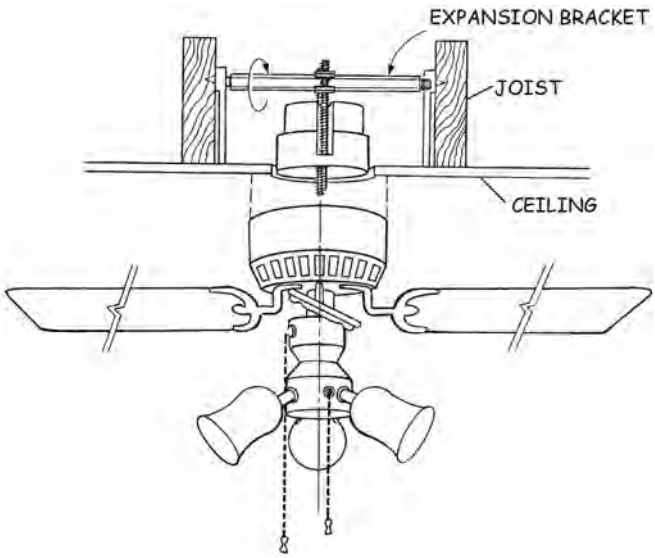
ROOM DIMENSIONS	CEILING FAN DIAMETER
Up to 75 sq. ft.	29-36"
76-144 sq. ft.	36-42"
144-225 sq. ft.	44"
225-400 sq. ft.	50-54"

2. MOUNTING METHODS

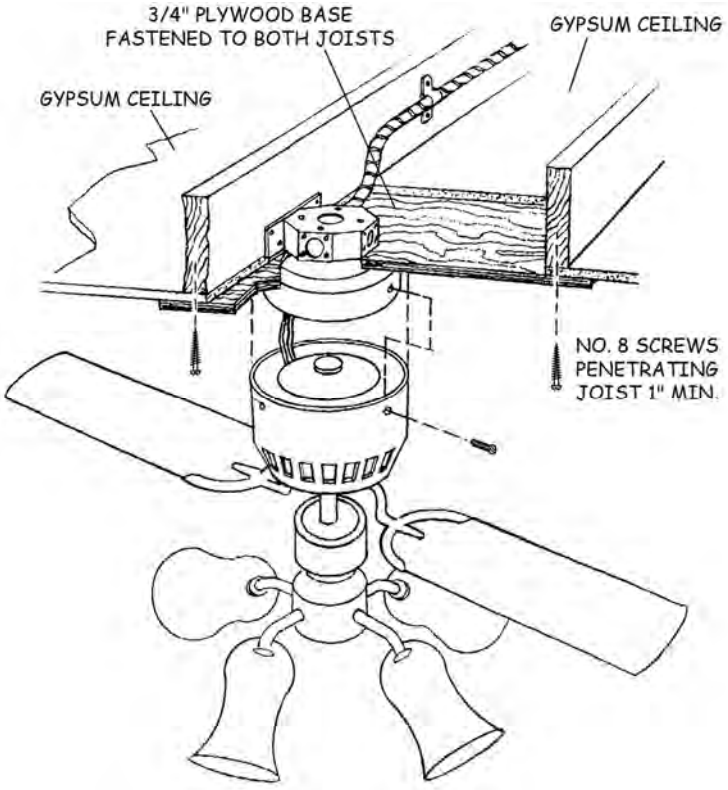
- **Wooden Block Between Ceiling Joists**
  - 2" x 4" minimum cross sectional dimensions.
  - Shall be secured to minimum 2” x 4” joists at each end with:
    - 2 #16 nails, or
    - 2 #8 x 2-1/2" (minimum) screws.
  - Electrical box and ceiling fan shall be attached to block in accordance with manufacturer's instructions.
- **Ceiling Joist**
  - Electrical box and ceiling fan shall be secured to the 2” x 4” or larger joist in accordance with manufacturer’s instructions.
    - *Exception*: Smaller joists are acceptable when a plywood mounting base can safely be installed, as described in this section.
  - Exposed wiring (not in wall or attic) shall be enclosed in a raceway and installed in accordance with the CEC and local code.

2. MOUNTING METHODS (cont.)

- **Expansion Bracket**
  - An expansion bracket may be used to secure the electrical box and fan to ceiling joists.
  - Commercial attachment bracket between ceiling joists shall be:
    - Manufactured for ceiling fan installation.
    - Installed per manufacturer's instructions.

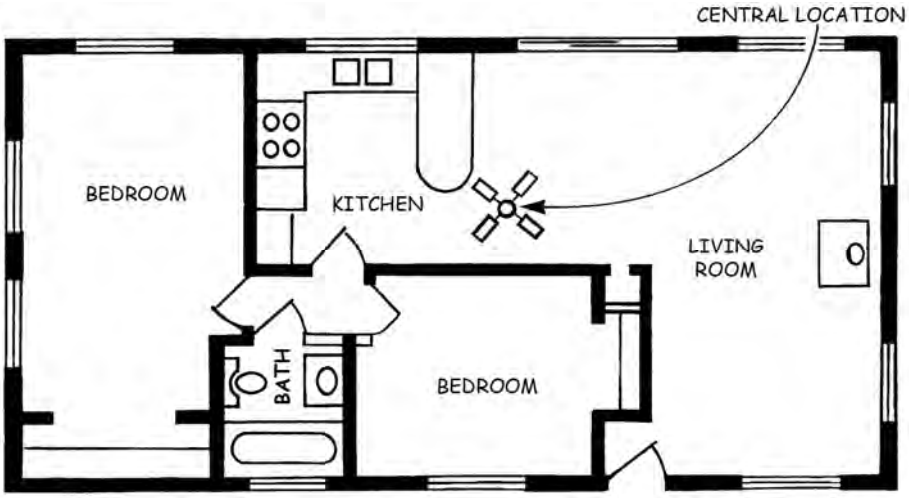


- **Plywood Mounting Base**
  - Requirements for a plywood mounting base attached to ceiling joists:
    - Minimum 3/4" plywood base.
    - Width of base must be a minimum of 1/2 the length.
    - Base shall be secured to each joist with 2 or more #8 screws which penetrate joist at least 1".
    - Electrical box and fan shall be secured to plywood base or joist per manufacturer's instructions.



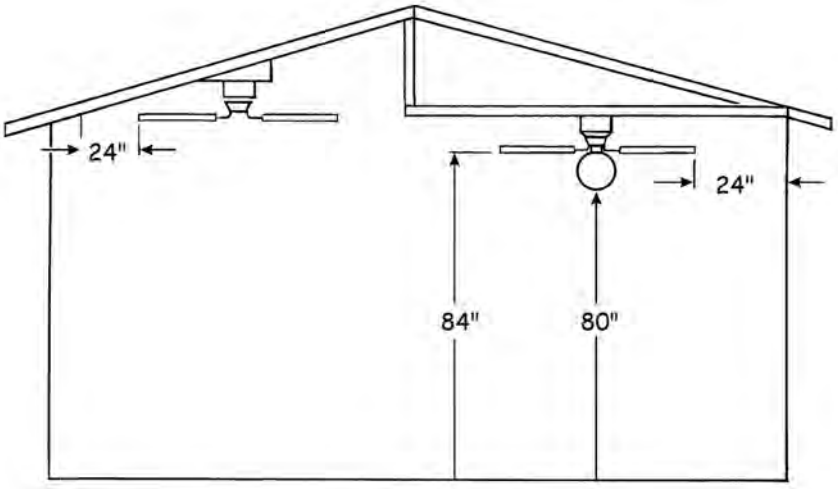
3. LOCATION

- **Ceiling fans shall be installed in:**
  - Conditioned area only.
  - Central living area for maximum comfort and air distribution, but not near an entrance door.
  - Room with exaggerated cooling load.
  - *Exception*: Installation in a bedroom shall not be near a bunk bed.



4. CLEARANCES

- **All Fans**
  - Fan blades shall be a minimum of 84" from floor. (Note: If installed over or near a bed, fan shall be a flush-mount type).
  - End of blades shall be kept a minimum of 24" from all obstructions, including open cabinet doors and the adjacent ceiling.
  - Electrical mounting box shall be metal when fan is attached to it.
  - Bottom of light fixture shall be a minimum of 80" from floor.



5. DROP ROD

- **Optimum height for ceiling fan blades is 8-10 feet from the floor.**
  - For dwellings with high ceilings, a drop rod shall be used to maximize airflow efficiency, unless prohibited by the fan manufacturer.
  - Standard drop rod lengths are:

CEILING HEIGHT (IN FEET)	DROP ROD LENGTH (IN INCHES)
9'	12"
10'	18"
11'	24"
12'	36"
13'	48"

6. ELECTRICAL WIRING

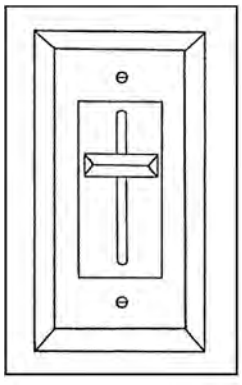
- **All Fans**
  - Existing wiring shall be a minimum of 14-gauge copper or equivalent.
  - Fan, and light when present, shall be wired in conformance with manufacturer's instructions and local code.
  - Exposed wiring must be housed in a raceway, except when a swag chain is used.
- **Swag Chain Kit**
  - Shall be used when hard-wiring is not feasible, *unless* prohibited by manufacturer or local code.
  - A properly-connected separate grounding conductor must accompany the power cord, *unless* a grounded three-conductor cord is used.

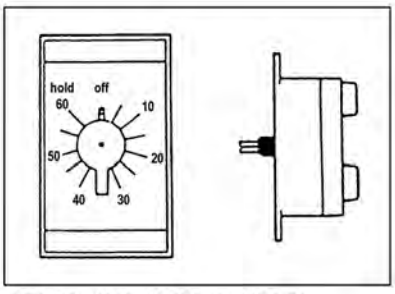
7. LIGHT FIXTURE

- **LEDs shall be installed in the ceiling fan light fixture in compliance with CSD WIS Section 53 (LED Bulbs).**
  - Shall be high-efficacy (ENERGY STAR–qualified) in accordance with CSD WIS Appendix A (Material Specifications).
  - Shall not be enclosed inside a globe, *unless* listed for that application.

8. CONTROLLERS

- **Remote Control**
  - Control shall be compatible with the fan wiring, and remote receiver shall properly fit inside fan body or canopy.
  - DIP switches shall be set per manufacturer's instructions, with a unique code for each fan when more than one is installed in the same dwelling.
- **Dimmers and Speed Controllers**
  - A dimmer (including light dimmer on a remote control) shall not be used to control:
    - The fan motor.
    - Fluorescent lighting, *unless* it is listed for control by a dimmer.





DIMMER, TIMER, AND SPEED CONTROL MUST BE APPROVED BY MANUFACTURER

- A separate speed controller shall not be:
  - Installed, *unless* supplied with fan or specified by the manufacturer.
  - Used to control fan lighting.

PART 2: MOBILE HOME CRITERIA

9. MOUNTING METHODS

- **Ceiling Joist**
  - Electrical box and ceiling fan shall be secured to the 2" x 4" or larger joist in accordance with manufacturer's instructions.
    - *Exception*: Smaller joists may be acceptable in a mobile home:
      - If joists are capable of safely bearing the weight of the fan; and
      - When a plywood mounting base can safely be installed, as described in Item 2 of this section.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

10. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

11. OPERATIONAL CHECKS

- **Fan and Light**
  - The fan and light (when installed) shall be checked for proper operation.
  - All controls shall work properly.
  - The light kit set screws shall be tight, for quiet operation.
- **Blade Balance**
  - The fan shall rotate smoothly, without undue wobbling.
  - Blades shall be balanced (e.g., using supplied balancing kit) as needed to ensure smooth operation at all speeds.

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NOTES

COMPACT FLUORESCENT LAMPS—THREAD-BASED

Lead Paint Risk Factor
NONE

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COMPACT FLUORESCENT LAMPS—THREAD-BASED

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

CFL REPAIR

Not applicable to this measure.

CFL INSTALLATION

1. EXISTING FIXTURE AND CIRCUIT

- **Prior to CFL installation, check the existing fixture for compliance with requirements of this section and the CSD Field Guide, including:**
  - Rating for “damp” or “wet” locations, as applicable, for outdoor installations.
  - Hazardous electrical condition.
  - Control by a dimmer or other prohibited controller, per Item 4.

2. INSTALLATION

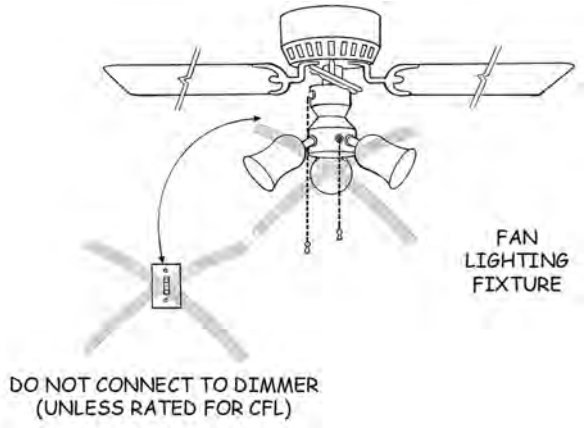
- **All Types**
  - All lamps, without exception, shall be installed by the contractor.
  - Only incandescent and halogen lamps shall be replaced.
  - Manufacturer’s recommendations shall be followed.
  - CFLs shall be allowed to be installed in LIHEAP and DOE programs, as follows:
    - DOE: Light type to be determined by application of the Priority List.
    - LIHEAP: Light type to be determined by best energy savings.
  - Replacement bulbs for fixtures <40 watts shall only be installed when allowed by LIHEAP or by the DOE Priority List.

3. LUMENS

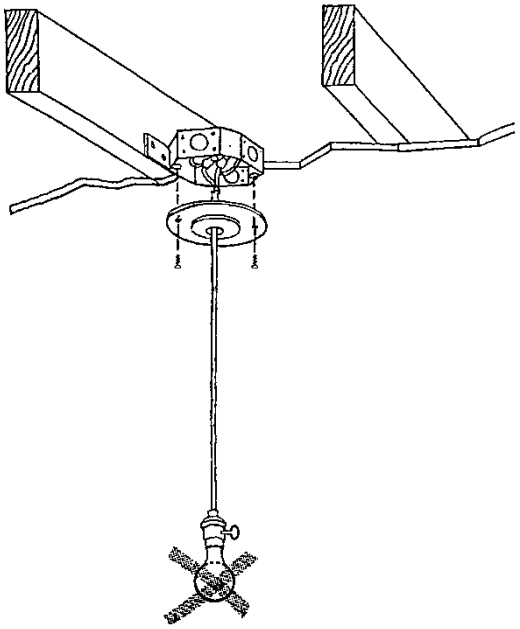
- **Installed CFLs**
  - CFLs must provide light output (lumens) levels sufficient to maintain pre-existing levels.

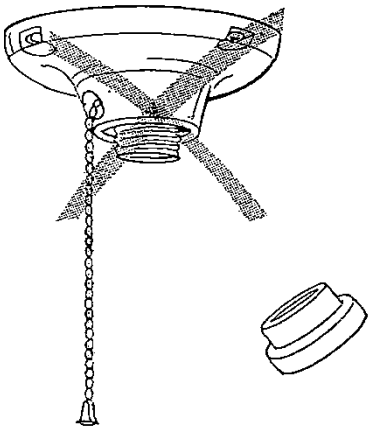
4. GENERAL LOCATIONS FOR CFLS

- **Globes**
  - CFLs shall not be installed in an enclosed globe, if prohibited by the CFL manufacturer.
- **Fan Lighting**
  - All Fixtures
    - CFLs designated by the manufacturer for installation in fan lighting should be installed, when feasible.
    - CFLs shall not be installed in fan lighting fixtures, if prohibited by the CFL manufacturer.
    - Armed light fixtures (cluster lighting) shall remain level after installation of CFLs.



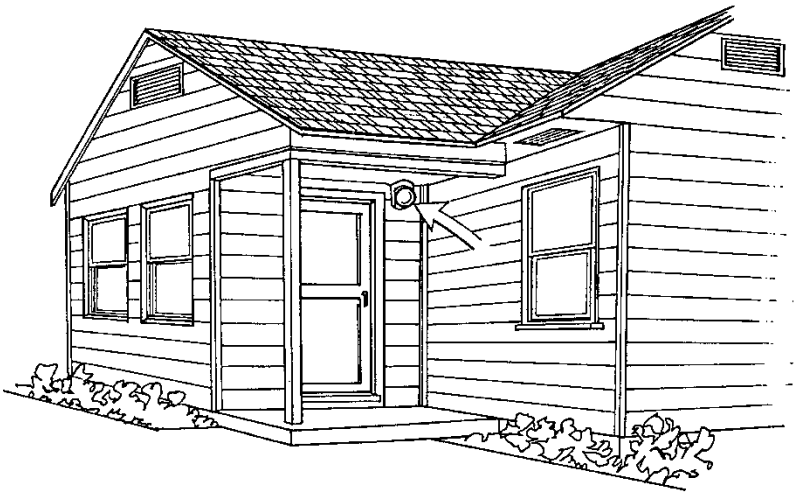
- **Dimmers, Photosensors, and Occupancy Sensors**
  - All Fixtures
    - Only CFLs rated for use with dimmers, photosensors, and occupancy sensors shall be installed in fixtures controlled by such devices.
- **Timers**
  - Mechanical
    - CFLs are acceptable to install in fixtures equipped with mechanical timers.
  - Solid State
    - CFLs shall not be installed in fixtures equipped with solid state timers.
- **Lamp Cord Supported**
  - All Types
    - CFLs shall not be installed in fixtures supported only by a lamp cord, unless the manufacturer allows the use of CFLs in such fixtures.
- **Missing Caps**
  - Porcelain Bases
    - CFLs shall not be installed in lamp bases with missing caps.





5. OUTDOOR LOCATIONS FOR CFLS

- **Installed CFLs**
  - When CFLs are installed in outdoor locations:
    - The requirements in Item 4 shall apply; and:
    - The CFL shall be protected from the weather (e.g., on a porch or in a garage), and
    - The fixture shall be rated for damp or wet locations.



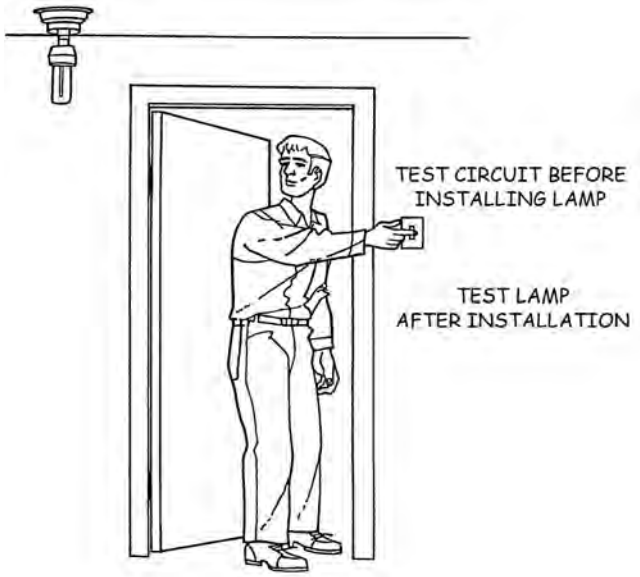
PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

6. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.
- **All CFL Locations**
  - Replacing incandescent lamps with CFLs shall be determined by Energy Audit only.



PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

7. OPERATIONAL CHECKS

- **All Fixtures**
  - The installer and QC inspector shall:
    - Test all installed CFLs before leaving.
    - Confirm that the lighting level is adequate for the client.

8. DISPOSAL REQUIREMENTS

- **All CFLs**
  - All replaced halogen and incandescent bulbs and fixtures shall be de-manufactured, recycled, and disposed of in accordance with the requirements of the local jurisdiction.
  - Existing incandescent bulbs shall not be left with the client.

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NOTES

COMPACT FLUORESCENT FIXTURES—HARD-WIRED

Lead Paint Risk Factor
LOW

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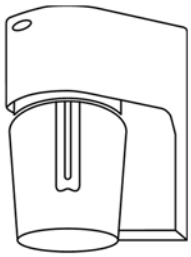
COMPACT FLUORESCENT FIXTURES—HARD-WIRED

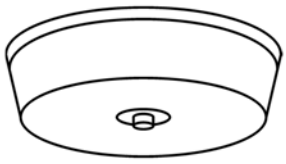
PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

CFF REPAIR

Not applicable to this measure.



WALL-MOUNT
FLUORESCENT FIXTURE
WITH PHOTO CELL CONTROL



CEILING-MOUNT
COMPACT FLUORESCENT
REPLACEMENT FIXTURE

CFF INSTALLATION

1. GENERAL INSTALLATION

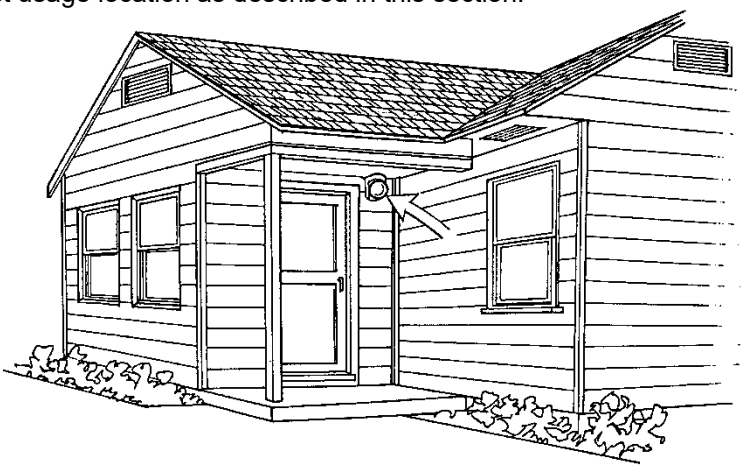
- **All New and Retrofit Installations**
  - All fixtures shall be installed in accordance with the current CEC, local codes, and CSD WIS Appendix D (Grounding Guidelines).
  - Fixtures shall replace only existing surface-mount fixtures.
  - Installation shall not damage, disable, alter, or result in the removal of any existing emergency lighting fixtures, lamps, controls, inverters, etc.

2. FIXTURE REQUIREMENTS

- **High Efficacy**
  - Replacement fixtures shall be “high-efficacy” per CSD WIS Appendix A (Material Specifications) and Title 24.
  - When required by the local jurisdiction, a building permit shall be obtained for replacing an existing lighting fixture with high-efficacy fixture.
- **Fixtures meeting the CSD Field Guide measure-specific policies for replacement shall be installed in:**
  - Kitchens (kitchen requirement also applies to the adjacent dining area);
  - Bedrooms;
  - Bathrooms;
  - Exterior “attached” dwelling locations such as: garages, utility rooms, and laundry rooms
  - Outdoor lighting pertaining to the dwelling being served.

3. LOCATION

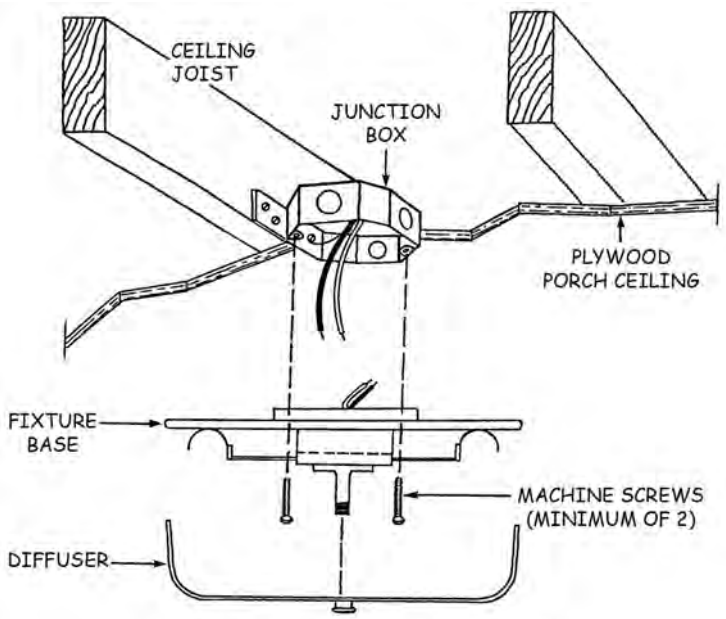
- **Installation Location**
  - CFFs shall be installed in interior or exterior locations, as long as they meet the minimum usage requirements stated in the CSD Field Guide measure-specific policy and are rated for the correct usage location as described in this section.



- **Fixtures marked "Suitable for Wet Locations" shall be:**
  - Installed in damp locations and in unprotected outdoor locations *more* than 4' above ground.
  - Exposed to precipitation and/or sprinklers.
- **Fixtures marked "Suitable for Damp Locations" shall be installed:**
  - Out of direct contact with precipitation,
  - In partially protected locations (e.g., under canopies, in closed porches, and in carports).

4. SUPPORT

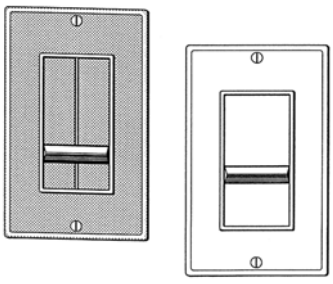
- **The fixture shall be:**
  - Attached to a properly-installed electrical box.
  - Secured to the box with at least two screws.
- **Securing Fixtures**
  - Fixtures installed inside the dwelling shall be secured to a plate, electrical box, or to structural members – not to interior sheathing (plaster, drywall, etc.).
  - Mounting plates and fixtures attached directly to the electrical box, shall be secured with a minimum of two fasteners.
  - Additional fasteners/screws are not required for fixtures attached by a properly-installed treaded nipple and nut.
  - Fixtures attached to structural members shall be secured with screws that penetrate solid wood at least 3/4".



CEILING-MOUNT COMPACT FLUORESCENT REPLACEMENT FIXTURE

5. DIMMERS, PHOTOSENSORS, AND VACANCY SENSORS

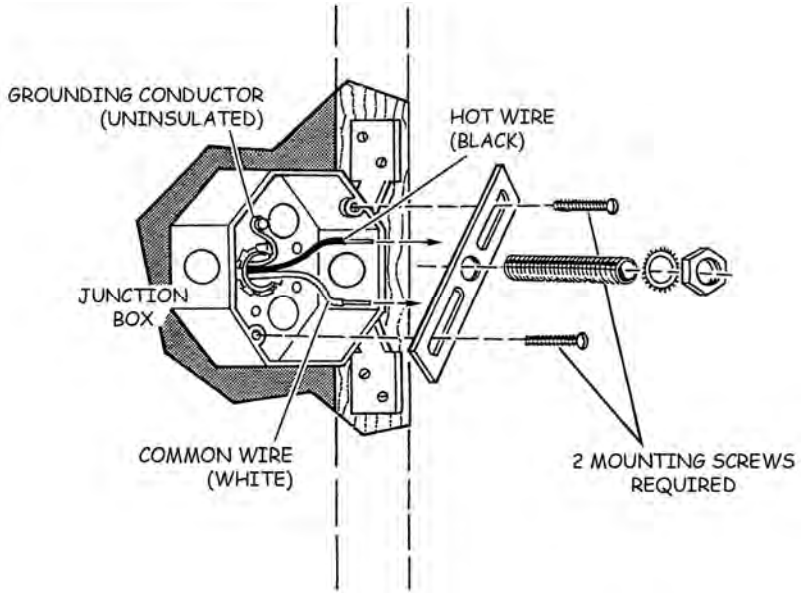
- **All Types**
  - Only CFFs rated for use with dimmers and vacancy sensors shall be installed on circuits/fixtures controlled by such devices.
  - When a dimmer or sensor is present in the light circuit:
    - Dimmer/sensor shall be in conformance with lamp manufacturer's specifications, or
    - It shall be replaced by a standard switch.



DIMMER CONTROLS

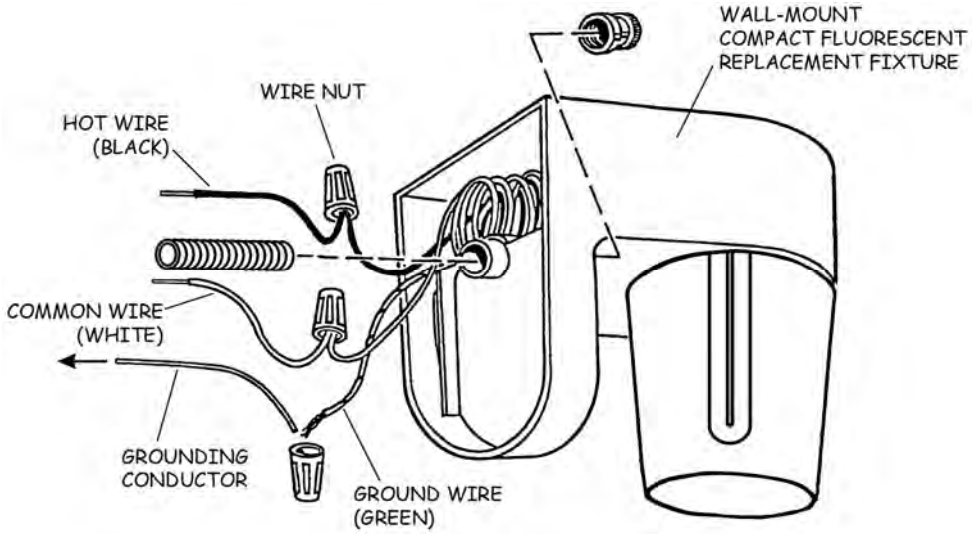
6. ELECTRICAL REQUIREMENTS

- **Existing Electrical Box and Circuit**
  - Shall be determined to meet program requirements before installation of CFF.
  - If any electrical system repair is required to install a CFF, it shall be part of the measure installation.
- **Switching Requirements**
  - High-efficacy fixtures must be on a circuit separate from, and not switched with, low-efficacy fixtures.
- **Voltage**
  - Fixtures shall be installed only in 110-120 volt circuits.
  - Grounding shall be as prescribed in Item 7.
- **Interior Installations**
  - All wiring not inside a building cavity shall be housed in a raceway.
- **Exterior Installations**
  - All wiring, conduit, accessories, fasteners, and controls shall be designed for exterior use.
  - All fixtures shall be installed in a manner which prevents water from entering or accumulating in wiring compartment, lamp holder or electrical parts.



7. GROUNDING

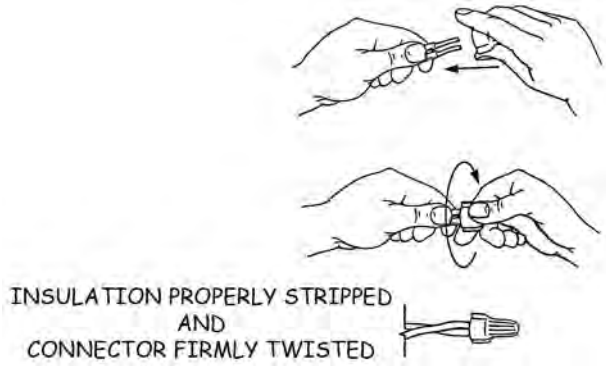
- **Fixtures in Wet Locations**
  - Fixtures shall be grounded in compliance with manufacturer's specifications and local code.
  - The fixture shall be properly bonded to the building's ground system, or shall be a plastic fixture, or controlled by a GFCI-protected switch.



- **Fixtures in Dry Locations**
  - Three-wire Systems: Fixture ground lead shall be properly connected to the system grounding conductor.
    - When grounding conductor is not available in the box a:
      - Plastic fixture may be installed, or
      - GFCI-protected switch may be installed in lieu of ground.
  - Two-wire Systems
    - When no grounding conductor is present in the box, grounding the fixture is not required, unless mandated by local code.
    - When protection is required, a:
      - Plastic fixture may be installed, or
      - GFCI-protected switch may be installed in lieu of grounding.
    - When a separate grounding conductor is present in the box, fixture ground lead shall be connected to it.

8. WIRING

- **Splicing Connectors**
  - All connections shall be secured with properly sized pressure splicing connectors (e.g., wire nuts).
  - If those provided with the fixture are not satisfactory, the installer shall provide the correct size.
  - Twist type Pressure Splicing Connectors (e.g., Wire Nuts)
    - Connectors shall be:
      - UL Listed and new.
      - Properly sized (type, size and number of conductors).
    - All connectors shall be firmly twisted to hold them securely in place.
  - "Poke-in" and "stab-in" type electrical connections may be used instead of twist-type splicing connectors in accordance with fixture manufacturer's instructions and local code.
  - Wire shall be stripped to length specified by connector manufacturer.
  - Wiring shall not be damaged (e.g., no slices, cuts, nicks or other damage).



  - Splices shall be contained within a fixture, ballast cover, junction box, etc.
- **Electrical Tape**
  - Tape may be used only as a supplement to a properly-installed pressure splicing connector; however, it shall not be relied upon to secure the connection.
- **Dissimilar Wires**
  - Aluminum and copper wires shall not be spliced together, except in accordance with manufacturer's instructions and local code.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Standards for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

9. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.
- **All CFF Locations**
  - Replacing incandescent fixtures with CFFs in dwelling units and common areas shall be determined by Energy Audit only in whole-building weatherization projects.
  - When only an individual dwelling unit is served, see Part 1: Installation Standards for Conventional Homes.
- **Outdoor Lighting—Low-Rise Multi-family**
  - Shall be high-efficacy lighting.
- **Outdoor Lighting—High-Rise Multi-family**
  - Fixture that is controlled from within a dwelling unit shall meet the high efficacy requirements of single-family residential outdoor lighting.
  - Fixture that is not controlled from within a dwelling unit shall meet the Title-24 requirements of nonresidential buildings.
- **Common Area Lighting—Multi-Family**
  - In low-rise multi-family buildings where common areas are *20% or less* of the building area, lighting for common areas must be high efficacy.
  - Occupant sensors used in common areas shall have the capability of turning the lights on automatically.
  - In buildings where common areas are *more than 20%* of the building area, lighting in those common areas must comply with the Title-24 nonresidential lighting requirements.
  - Lighting in corridors and stairwells of multi-family buildings must be controlled by occupant sensors that reduce the lighting by at least 50%.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

10. CLIENT EDUCATION

- **Lumens**
  - Light output (lumens) level shall be sufficient to maintain pre-existing light level, unless a lower level is acceptable to the client.

11. DISPOSAL REQUIREMENTS

- **All CFFs**
  - All replaced halogen and incandescent torchiere lamps and fixtures shall be de-manufactured, recycled, and disposed of in accordance with the requirements of the local jurisdiction.

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NOTES

FLUORESCENT TORCHIERE LAMP EXCHANGES

Lead Paint Risk Factor
NONE

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FLUORESCENT TORCHIERE LAMP EXCHANGES

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

FLUORESCENT TORCHIERE REPAIR

Not applicable to this measure.

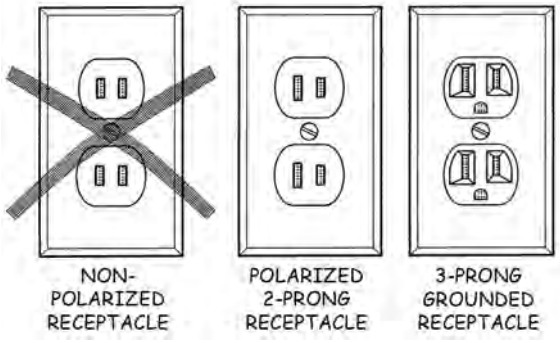
FLUORESCENT TORCHERE INSTALLATION

1. REPLACEMENT LIMITATIONS

- **Fluorescent torchieres shall only be installed to replace one of the following existing lamp types:**
  - Halogen torchiere; or
  - Other incandescent torchiere with dimmer or 3-way switch, and/or with screw base not compatible with standard CFLs; or
  - An incandescent table lamp that cannot be retrofitted with CFLs.

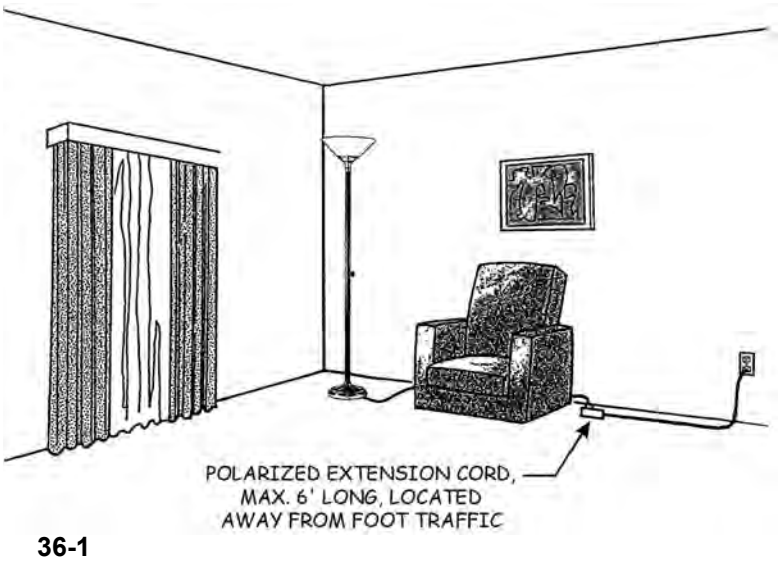
2. ELECTRICAL SUPPLY

- **Electrical Circuit**
  - The electrical circuit shall be in working order.
  - If on a switch, the switch shall function properly.
  - The circuit shall not be equipped with a dimmer switch or solid state timer.
- **Electrical Receptacle**
  - The receptacle shall be:
    - In conformance with manufacturer's specifications and instructions.
    - In good condition (for the wiring and receptacle), and an intact cover plate shall be in place.
    - Securely installed in an electrical box.
  - Lamps with polarized plugs shall be plugged into a properly-installed 2-prong polarized receptacle (one slot is wider than the other) or 3-prong grounded receptacle.
  - The lamp's plug shall not be altered to fit a non-polarized receptacle.
  - If the lamp is plugged into a multi-plug adapter, the adapter shall be in good condition and polarized to match the receptacle.



3. EXTENSION CORD

- **All Lamps**
  - An extension cord may be used only when necessary to place the fluorescent torchiere in an acceptable location; and
  - Use is not prohibited by lamp manufacturer.



- **The extension cord shall be:**
  - UL Listed and polarized (one blade is wider than the other).
  - In conformance with manufacturer's instructions, if addressed.
  - Rated appropriately for the torchiere, minimum 16 AWG.
  - The shortest feasible length, up to 6' maximum.

4. ASSEMBLY AND INSTALLATION

- **Lamp**
  - The fluorescent torchiere lamp shall be fully assembled, plugged in and operating properly.
- **Cord**
  - The appliance cord, and extension cord if applicable, shall be located away from foot traffic, where a tripping hazard shall not be created.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

5. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

6. DISPOSAL REQUIREMENTS

- **All Torchieres**
  - All replaced halogen and incandescent torchiere lamps and fixtures shall be de-manufactured, recycled, and disposed of in accordance with the requirements of the local jurisdiction.

REFRIGERATORS

Lead Paint Risk Factor
NONE

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REFRIGERATORS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

REFRIGERATOR REPAIR

1. REPAIR CONDITIONS

- **All Units**
  - When a refrigerator does not qualify for replacement, defects that compromise operating efficiency shall be repaired, such as:
    - Damaged door gaskets;
    - Ice build-up (Note: This is a Client Advisory Condition. Defrosting by the client would be required before measure feasibility would accurately be determined.);
    - Ungrounded receptacle; etc.
  - Repair of items issues not related to energy conservation shall not be allowed (i.e., replacement of door handle, refrigerator racks, etc.).

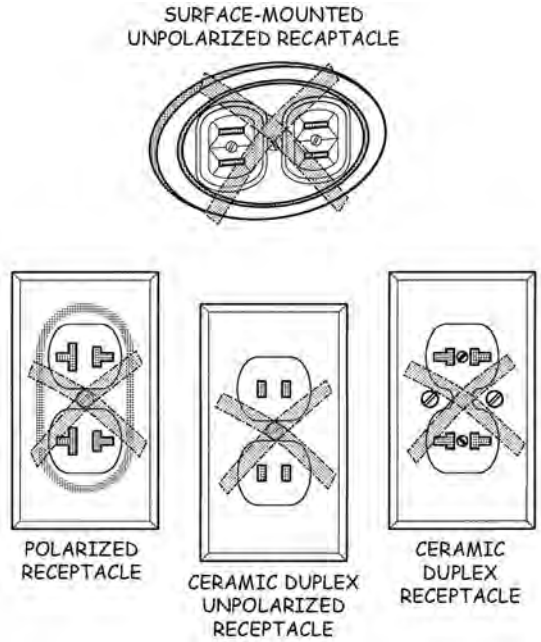
REFRIGERATOR INSTALLATION

2. GENERAL CONDITIONS

- **Installation**
  - Appliance will be installed in accordance with manufacturer specifications and local codes.

3. GROUNDED RECEPTACLE

- **Existing Receptacle**
  - Refrigerators shall not be connected to 2-prong, non-grounded outlets.
  - A non-grounded 2-prong receptacle shall be replaced with a new properly-grounded 3-prong receptacle.
- **New Grounded Receptacle**
  - The new 3-prong receptacle shall be properly grounded in conformance with the California Electrical Code (CEC), local code, and the CSD WIS Appendix D (Grounding Guidelines).
  - The ground lug shall be located in the bottom position, unless refrigerator cord has a right-angle plug designed to be installed with ground lug at top.

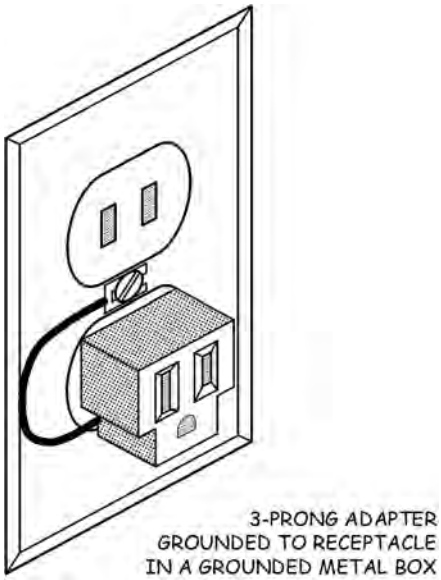


4. ELECTRICAL REQUIREMENTS

- **Electrical Circuit**
  - Overcurrent protection and conductor size shall be in conformance with manufacturer's specifications and local code.
  - A GFCI-protected circuit or receptacle, or outlet operated by a switch shall not be used.
- **Electrical Outlet**
  - Broken or missing outlet cover pertaining to the Replacement Refrigerator shall be replaced before the measure shall be installed.
  - Refrigerator shall be plugged directly into a single-plug or duplex receptacle (multi-plug adapter not allowed).
  - If a duplex receptacle is used, a maximum of one other appliance may be plugged into the other outlet.
    - The second outlet shall not be used by a toaster, microwave oven, hot plate, hair dryer, curling iron, or other high-wattage appliance.
    - Maximum amp draw of the refrigerator plus the other appliance shall not exceed 80% of circuit capacity (determined by conductor gage and overcurrent protection rating, such as 14 AWG wires with 15-amp breaker).
  - The receptacle and cover plate shall be in good condition and intact.
- **Extension Cord**
  - One extension cord may be used, when allowed by manufacturer's instructions.
  - Extension cord shall be:
    - UL Listed, 3-conductor cord, with 3-prong plug and receptacle.
    - Minimum 14 AWG.
    - Maximum 6' in length.
  - Appliance cord and extension cord shall not be located where either can create a walking/tripping hazard.

5. PERMANENT ADAPTERS NOT ALLOWED

- **Three-prong adapters:**
  - Shall not be used to permanently connect a refrigerator.
  - May be used as a temporary measure, if allowed by local code and the refrigerator manufacturer's instructions, and approved by the owner/occupant.
- **Temporary Adapters**
  - Must be grounded to a screw as illustrated—allowed only when box is metal and is grounded.
  - Must be removed and replaced with a grounded receptacle within 30 days after refrigerator installation and before final inspection.
- **When adapters are used, they shall be:**
  - Aligned to provide proper polarity with the outlet and the power cord.
  - Connected to a ground source (e.g., a metal outlet box with grounding conductor, such as described in CSD WIS Appendix D (Grounding Guidelines), that enables circuit tester to show a grounded circuit is present,).



6. REPLACEMENT UNIT CHARACTERISTICS

- **New (Replacement) Units**
  - Maximum capacity of 23 cu. ft. (per Sizing Guide below).
  - White in color. Client-requested color is allowed only if available at no cost increase.
  - Freezer normally on top, but side-by-side is allowed in larger sizes, when top freezer is not available or bottom freezer costs more.
  - Not equipped with ice maker or water dispenser.
  - Shall be an ENERGY STAR–rated.

7. REPLACEMENT SIZING LIMITATIONS

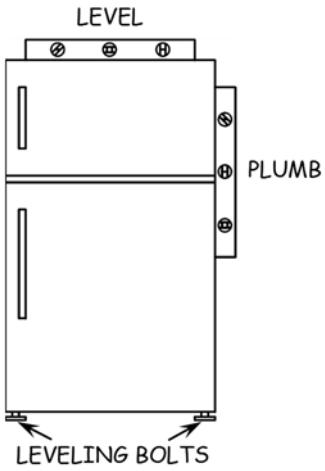
- **Sizing Guide below shall be followed as closely as is possible and reasonable.**

REPLACEMENT SIZE	CRITERIA
15-17 cubic feet (cu. ft.)	• 1 or 2 bedrooms with up to 3 residents
18-20 cu. ft.	• 3 bedrooms with up to 5 residents, or • 2 bedrooms with 4 residents
21-23 cu. ft.	• 4 or more bedrooms, or • 5 or more residents

- **Additional Sizing Limitations**
  - A replacement refrigerator shall be no more than 2 cubic feet larger than the storage capacity of the existing unit, except when:
    - A larger unit may be installed when justified by SIR of 1.0 or greater.
  - If a second refrigerator is used to provide additional capacity, a larger unit up to 23 cubic feet shall be installed, but only if:
    - The second refrigerator is also removed; and
    - Written agreement allowing disposal of the second unit is obtained from the owner.
    - If client is not willing to give up a second refrigerator, client education shall be provided regarding the energy cost to operate a second unit.

8. INSTALLATION OF NEW REFRIGERATOR

- **Access**
  - Access route to the refrigerator location shall be adequate to be negotiated without causing damage to the home or furnishings.
- **Location and Fit**
  - Appliance shall fit in the available space without blocking access to light switches, cabinets, etc.
  - The floor shall be structurally adequate to safely support the refrigerator.
  - Clearances shall meet manufacturer's specifications.
- **Installation**
  - The refrigerator shall be installed in a level, plumb, and stable position.
    - Leveling devices on the refrigerator shall be adjusted accordingly.
    - Supplementary supports (e.g., shims) shall be used as needed.
  - Installation shall not damage the floor covering or interior finishes.
  - Any damages/penetrations to the building shell created during installation shall be repaired and sealed.



PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

9. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

10. OPERATIONAL CHECK

- **Controls**
  - Temperature controls shall be set appropriately before leaving jobsite and demonstrated to occupants.

11. CLIENT EDUCATION

- Specific information on the proper maintenance and operation of the appliance shall be demonstrated to the client.
- Operation manuals and installer contact information shall be provided to the occupant.

12. DISPOSAL REQUIREMENTS

- **Existing Refrigerator**
  - The existing refrigerator shall be:
    - Removed from the customer's premises by the installer, and
    - Disposed of properly, per Clean Air Act 1990, section 608, as amended by 40 CFR 82, 5/14/93.
- **Decommissioning and Disposal**
  - Appliances replaced by new units will be recycled or disposed of in accordance with federal, state, or local regulations.
  - Existing appliances infested with pests shall be enclosed before moving.

MICROWAVE OVENS

Lead Paint Risk Factor
NONE

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MICROWAVE OVENS

PART 1: PRE-INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

MICROWAVE OVEN REPAIR

Not applicable to this measure.

MICROWAVE OVEN INSTALLATION

1. GROUNDED RECEPTACLE

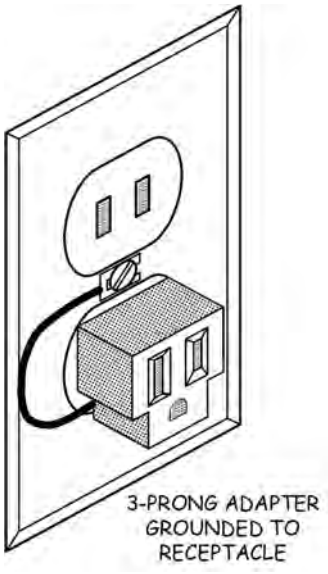
- **Existing Receptacle**
  - Microwave ovens shall not be connected to 2-prong or 3-prong non-grounded outlets.
  - A non-grounded receptacle shall be replaced with one of the following:
    - A GFCI-type receptacle installed in conformance with CEC requirements and marked “GFCI Protected” and “No Equipment Ground”.
    - A standard 3-prong receptacle when an equipment grounding conductor is provided
- **New Grounded Receptacle**
  - If installed, a new 3-prong receptacle shall be properly grounded in conformance with the California Electrical Code (CEC), local code, and the CSD WIS Appendix D (Grounding Guidelines).
  - If required by the local jurisdiction to install a new, grounded receptacle, a permit shall be obtained.

2. ELECTRICAL REQUIREMENTS

- **Electrical Circuit**
  - Overcurrent protection and conductor size shall be in conformance with manufacturer’s specifications and local code.
  - Adequate current capacity available to avoid nuisance tripping of breaker/fuse by the microwave oven.
- **Electrical Outlet**
  - Microwave oven shall be plugged into its own separate receptacle, when feasible.
  - The receptacle shall:
    - Conform to manufacturer’s instructions and local code.
    - Be in good condition (wiring, receptacle, and with an intact cover plate).
    - Be securely installed in an electrical box.
    - Provide grounding or GFCI protection to the appliance when appliance is sold with a grounded power cord.

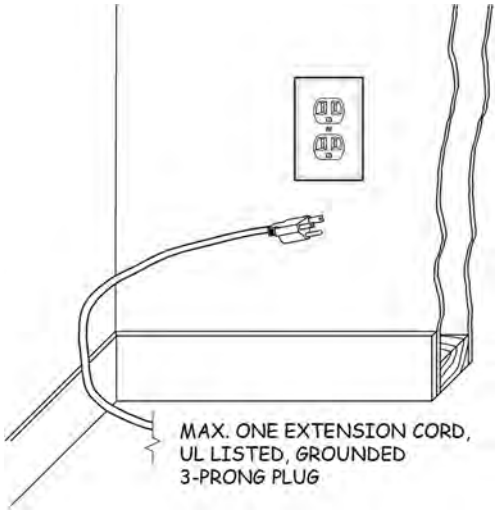
3. ADAPTERS

- **3-Prong Adapters**
  - Ungrounded 3-prong adapters shall not be used.
  - A grounded 3-prong adapter may be used (instead of installing a grounded 3-prong receptacle) only if:
    - Manufacturer's instructions allow an adapter, and
    - Adapter provides proper polarity and grounding to the appliance, with the adapter ground lug/wire securely attached to a grounding source, such as a:
      - Grounded receptacle.
      - Grounded electrical box.
      - Alternate grounding conductor, per CSD WIS Appendix D (Grounding Guidelines).



4. EXTENSION CORD

- **One extension cord may be used when allowed by appliance manufacturer's instructions.**
- **Extension cord shall be:**
  - UL-listed and in conformance with manufacturer's specifications.
  - A 3-conductor cord with 3-prong grounding plug.
  - Rated appropriately for the appliance, minimum 14 AWG.
  - The shortest feasible length, 6' maximum.
- **Appliance cord and extension cord shall not be draped over a countertop or furnishings in a manner that:**
  - Allows access to children (to reach and pull on them).
  - Creates a walking hazard (where people could trip).



5. INSTALLATION OF MICROWAVE OVEN

- **Location**
  - The counter or tabletop shall be structurally adequate to safely support the microwave oven.
  - Clearances shall meet manufacturer's specifications.
- **Installation Requirements**
  - The microwave shall be installed in a level, plumb, and stable position.
    - Leveling devices on the microwave oven shall be adjusted accordingly.
  - Installation shall not damage the counter or tabletop covering or interior finishes.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

6. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

7. CLIENT EDUCATION

- **Crew Responsibilities**
  - Crews shall provide additional education to occupants that addresses:
    - Importance of checking meal and recipe instructions regarding power level required.
    - Cooking limitations at lower wattages (longer cooking time, inability to properly cook some items, etc.).

8. DISPOSAL REQUIREMENTS

- **Unit Removal**
  - Crews shall remove an existing inoperable/damaged microwave from the home for proper disposal and replacement. Crews shall also:
    - Remove the microwave oven door (to permanently remove the unit from the grid); and
    - Dispose of the decommissioned appliance properly, in accordance with state and local regulations.

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NOTES

COOKTOP/RANGE—GAS

Lead Paint Risk Factor
NONE

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COOKTOP/RANGE—GAS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

COOKTOP/RANGE REPAIR (GAS)

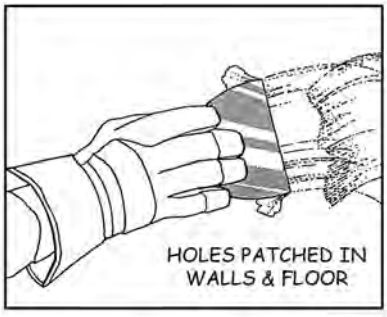
1. APPLIANCE REPAIR

- **When assessment indicates operational fail of the cooking appliance:**
  - Applicable repairs shall be made in conformance with the CSD Field Guide and by a qualified technician.
- **Abandonment of Appliance**
  - When correction of the cooking appliance operation is beyond the program scope, it shall be offered to the client to abandon the appliance per the CSD Field Guide 4.5 and Appendix A (CAS Protocol).
- **Flexible Gas Connector**
  - Check shall be made for presence of unsafe gas connector, which shall be replaced per the CSD Field Guide Appendix A.

COOKTOP/RANGE INSTALLATION (GAS)

2. INSTALLATION LOCATION

- **Floors and Walls**
  - Floor must be stable, solid, level, and capable of properly supporting the appliance.
  - Floor covering:
    - Shall meet manufacturer's guidelines.
    - Shall not be carpeting (*unless* protected per manufacturer's recommendation).
  - Wall coverings adjacent to the cooking appliance shall meet manufacturer's guidelines for temperature tolerance.
  - Holes and gaps in the walls and floor that create a draft and affect operation of the appliance shall be sealed before the cooking appliance shall be installed.
  - Nothing in the location shall obstruct openings in the base of the cooking appliance that supply combustion and ventilation air to the unit.

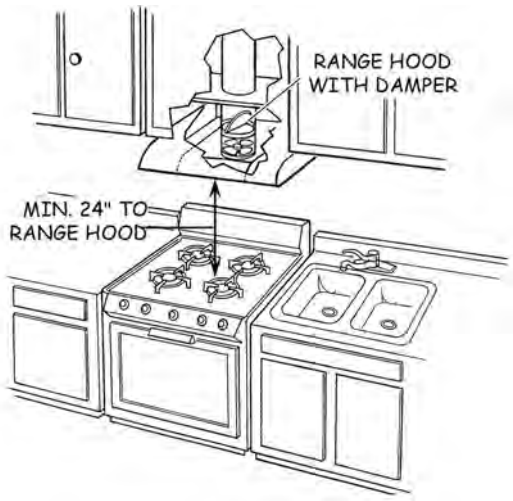


3. CONVENTIONAL HOME CLEARANCES

- **Horizontal and vertical clearances specified by the cooking appliance manufacturer (or local code, if more stringent) shall be verified to be available.**
  - *Unless* manufacturer's instructions are more stringent, minimum vertical clearances shall be:
    - Minimum 30" vertical clearance between the cooking surface and overhead combustible material or metal cabinets; and
    - Minimum 24" vertical clearance between the cooking surface and overhead ventilating hood (Kitchen Exhaust) or sheet metal-clad insulating board.
    - If vertical clearance to unprotected cabinets above is *less* than 30" and a protective shield or kitchen exhaust is not present that is at least 24" above the cooktop, then:
      - A code-compliant protective shield shall be installed, or
      - A qualifying kitchen exhaust shall be installed (in conformance with CSD WIS Section 41, Kitchen Exhaust), or
      - Cooking appliance replacement is not feasible and shall not be attempted.

- If a listed microwave oven is located above the cooking appliance, vertical clearance from it to the cooktop shall be in compliance with microwave oven listing and manufacturer's instructions.

- **If modifications are required to adjust clearances to meet requirements, feasibility shall be verified prior to installing the new cooking appliance.**

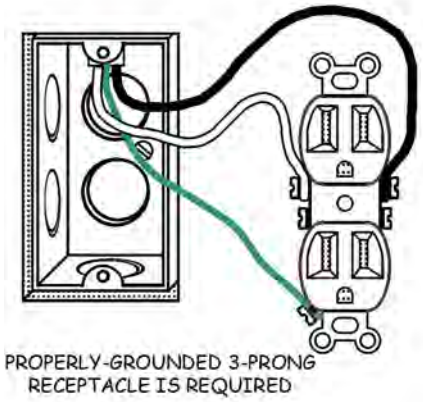


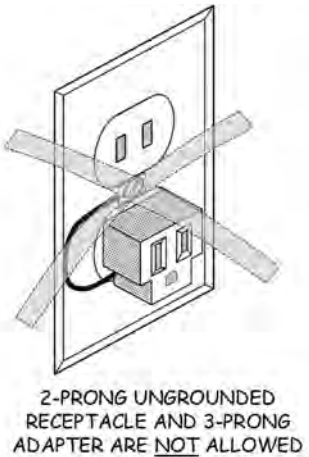
4. INSTALLATION PROCEDURES

- **Installation of Unit**
  - A new appliance with damage or defects shall not be installed.
  - The cooking appliance shall be installed in accordance with:
    - Manufacturer's instructions, and
    - Requirements of the local jurisdiction, if any.

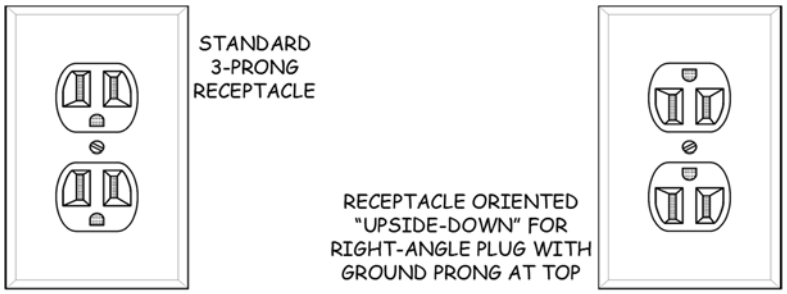
5. ELECTRICAL CONNECTION

- **Power Source**
  - The power source used for the cooking appliance shall be properly grounded and in conformance with the criteria in this item.
  - Power cord for the replacement unit shall not be plugged into a receptacle that is not properly secured or has an electrical hazard.
- **Electrical Supply Circuit**
  - The circuit supplying power to the cooking appliance shall be verified to be in compliance with manufacturer's specifications, including:
    - Correct voltage,
    - Safe conductors, and
    - Proper overcurrent protection.
- **Receptacle**
  - The receptacle shall be a properly-grounded 3-prong type.
    - 3-prong adapters shall not be allowed.
  - The receptacle shall be in a location that can be reached by the appliance power cord.
    - Extension cords shall not be allowed.



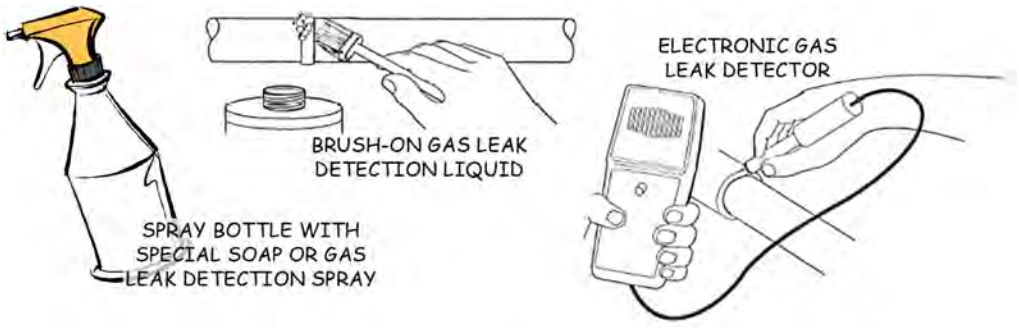


- **GFCI Option**
  - A GFCI-protected receptacle may be used instead of a grounded 3-prong receptacle; however, in that case:
    - The location for resetting must be easily accessible, and
    - Occupants shall be:
      - Advised of the possibility of nuisance tripping (and they must agree to that option), and
      - Instructed in the use and resetting of the GFCI circuit.
    - If a GFCI receptacle is not acceptable to the occupants, one shall not be installed.
  - The receptacle may be oriented "upside-down" (with the ground slot positioned upward), if the power cord has a right-angle plug designed to hang properly with the ground prong positioned at the top.
  - Range power cord shall be plugged directly into the receptacle.
    - An extension cord shall not be used.



6. GAS PRE-CHECK

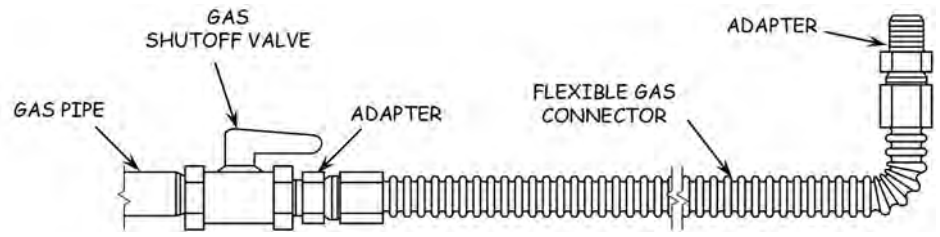
- **Gas Supply**
  - The gas supply to which the cooking appliance is connected shall be in conformance with the criteria in this item.
    - Gas pressure shall be within prescribed limits.
    - The gas piping and shutoff valve shall be free of gas leaks.
- **Gas Leaks**
  - Prior to removal of the existing cooking appliance, gas piping shall be checked for gas leaks, using procedures prescribed in the CSD Field Guide Appendix A (CAS Protocol).
- **Gas Pressure**



  - The gas supply line must have a pressure regulator.
  - When a cooking appliance is replaced, and flame appearance is over- or under-sized, the pressure shall be checked by a qualified technician.
  - Gas pressure in the gas line serving the cooktop/range shall be within limits prescribed by the manufacturer.

7. GAS CONNECTION

- **Gas Shutoff Valve**
  - A new gas shutoff valve shall be installed.
  - The gas shutoff valve shall be:
    - Located in the room where the stove is installed, and
    - In an easily-accessible location within reach of the flexible gas connector.
- **Supply Valve at Gas Meter**
  - The gas supply shall be turned off at the main valve when:
    - A gas shutoff valve shall be installed or replaced.
    - The gas line to the stove is altered (moved, extended, etc.).
  - When the main gas supply valve is turned back on, pilot lights on all affected gas appliances shall be re-lighted.
- **Gas Shutoff Valve, Flexible Connector, and Adapters**
  - Gas shutoff valve, flexible connector, and adapters shall be new (existing ones shall not be reused).
  - If a gas shutoff valve is not present, one shall be installed in an easily-accessed location, in the room where the stove is installed.
  - The flexible gas connector shall not exceeding 6' in length.



- **Connections**
  - Manufacturer's instructions shall be followed exactly.
  - Specified adapters shall be installed at the ends of the flexible gas connector (it shall not connect directly to standard pipe fittings).
  - Sealant (i.e., pipe joint compound or thread seal tape) shall be applied to all male (external) threads.
  - Connections shall be tightened as instructed.
- **Gas Line Check**
  - All cooking appliance controls and the gas shutoff valve shall be in the off position before the main gas supply valve is turned on.
  - With the gas shutoff valve turned on,
    - All connections and valves shall be checked for gas leaks by:
      - Application of liquid leak detector (wiped off afterward), or
      - Electronic leak detector.
    - Leaks, if any, shall be corrected before the appliance is placed in its final location.
  - When it is necessary to pressure test the gas supply system of the residence, the cooking appliance shall be isolated from the gas supply system per manufacturer's instructions.

8. PLACEMENT

- **Leveling of a Freestanding Range**
  - With oven shelves installed, and the stove in the location where it will be installed:
    - A spirit level shall be placed on an oven shelf to check levelness.
    - At least two readings shall be taken with the level placed diagonally, first in one direction and then the other.
  - The leg levelers shall be adjusted per manufacturer's instructions until the stove is level side-to-side and front-to-back.

- When the stove is level, leg levelers shall be secured, if applicable.

- **Anti-Tip Device for a Freestanding Range**
  - When an anti-tip device shall be installed (only when required by manufacturer), the manufacturer's template and instructions shall be applied.
  - The anti-tilt mechanism (if installed with a freestanding range) shall be checked and verified to be functioning properly.
  - Proper installation shall be verified by carefully attempting to tilt the appliance forward.
- **Positioning**
  - The cooking appliance shall be placed in its final position.
  - The flexible gas connector shall be guided into a safe position, with no sharp bends or kinks.
  - Specified clearances (horizontal and vertical) shall be present.
  - The appliance shall not be sealed (e.g., with caulk) to the side cabinets.

9. FUEL SWITCHING

- **Cooking appliance replacement requires that the same type of fuel is used.**
  - The stove shall be verified to be equipped for the type of fuel used.
  - *Exception*: In-field fuel conversion is allowed only with written permission by CSD.
    - Correct fuel conversion installation and proper stove performance shall be confirmed by testing, in strict conformance with manufacturer's instructions.
    - If conversion to a different fuel type is necessary, manufacturer's supplied/ recommended conversion kit shall be installed.

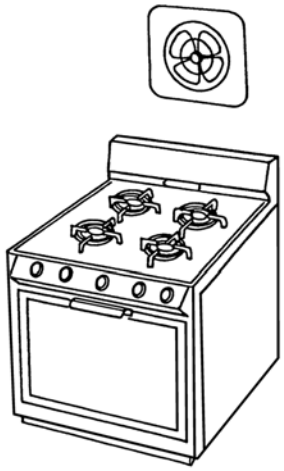
PART 2: MOBILE HOME CRITERIA

10. GENERAL REQUIREMENTS

- **Standards**
  - Replacement shall be in conformance with standards specified by HCD.[1]
- **Vertical Clearance above Cooktop**
  - Minimum 24" vertical clearance is required from the cooktop to the bottom of combustible cabinets.[2]
- **Floor Anchors**
  - The Range shall be secured to the floor, when required by HCD regulations or manufacturer's instructions.[3]

11. COOKING AREA VENTILATION

- **Requirement**
  - One of the following shall be located within 10' of the replacement gas range, and it shall be vented outdoors[4]:
    - An operable exhaust fan with manual or automatic damper, or
    - A metal duct located above the cooktop, with a cross-sectional area of at least 12.5 sq. in., and minimum dimension of 2" (e.g., 2" x 6.25" rectangular duct, or 4" round duct).
  - If a kitchen exhaust fan must be repaired or installed to meet this requirement, it shall be done in accordance with CSD WIS Section 41 (Kitchen Exhaust).
  - If required ventilation is not present and cannot be provided, a replacement cookstove shall not be installed.



FUNCTIONAL VENTILATION REQUIRED IN COOKING AREA OF A MOBILE HOME

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

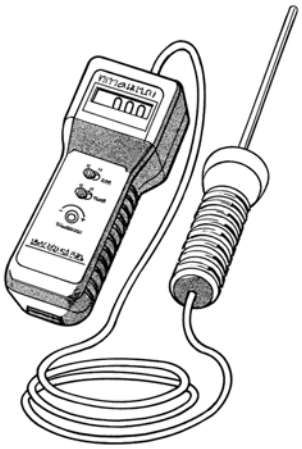
12. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

13. CAS CHECKS

- **Post-Repair/Replacement CAS Test**
  - Post-repair/replacement CAS testing must be completed on the same day repair/replacement is finished, if feasible, and no later than 5 calendar days afterward in accordance with CSD Field Guide Appendix A.
  - The flow of combustion and ventilation air shall be verified to not be obstructed by any part of the installation.
  - The room volume shall be adequate to supply combustion air in accordance with requirements of the local jurisdiction.

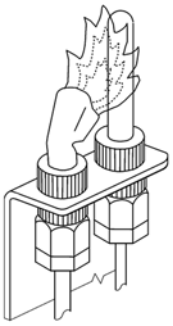


CO CHECKED IN ACCORDANCE WITH WIS SECTION 3 (CAS INSPECTION)

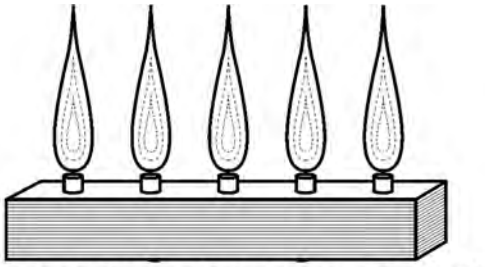
- **Carbon Monoxide (CO) Levels**
  - Post-CAS Appliance Repair and Replacement testing for CO shall be made in accordance with CSD Field Guide Appendix A.
  - Corrections shall be made as needed to limit CO to acceptable levels.

14. OPERATIONAL CHECKS

- **Pilot Lights**
  - All pilot lights turned off during the installation (i.e., by closing the main gas supply valve) shall be re-lighted.
- **Burner and Control Checks**
  - Operation of the cooktop and oven burners shall be checked after the appliance is in place.
    - Manufacturer's start-up/test procedures shall be followed.
    - After air is purged from the line, burners must light and burn properly.
    - If adjustments (e.g., air shutter changes) are needed to produce proper flame characteristics, they shall be performed per appliance installation instructions.
  - Burners
    - The burner ignition systems shall operate properly.
    - Each burner in succession (cooktop and oven/broiler) shall be verified to light and burn properly over its full range (high to low).



PILOTS ON ALL OTHER APPLIANCES RE-LIT AFTER MAIN GAS VALVE IS TURN BACK ON



AIR SHUTTERS ADJUSTED PER MANUFACTURER'S INSTRUCTIONS TO ACHIEVE PROPER FLAME

- Electronic Controls
  - Clock, timer, and electronic function controls shall be verified to operate properly.
  - Troubleshooting per manufacturer's recommendations shall be performed as needed to correct problems.

- **Appliance Cleaning**
  - Marks and residue left by protective shipping material, and smudges occurring during shipping and installation, shall be removed.
    - The cabinet, oven, cooktop, and controls shall be clean.
    - Manufacturer's cleaning recommendations shall be followed.

15. CLIENT EDUCATION

- **Crew Responsibilities**
  - Client shall receive verbal instructions for, and demonstration of, features and operation of the cooking appliance, including the troubleshooting guide in the owner's manual.
  - All clients shall be instructed about the following:
    - Location of the gas shut-off valve, and how to turn gas to the cooking appliance on and off.
    - Location of the circuit breaker (or fuse) that controls the receptacle powering the appliance, and how to turn power to the appliance on and off.
  - If power to the cooking appliance is GFCI-protected, users shall be:
    - Advised about the possibility of nuisance tripping, and
    - Taught how to reset the system after it trips.

REFERENCED STANDARDS

[1] Manufactured Home Construction and Safety Standard 24 CFR, Part 3280

[2] Manufactured Home Construction and Safety Standard 24 CFR, Part 3280.204

[3] Manufactured Home Construction and Safety Standard 24 CFR, Part 3280.709(a)

[4] Manufactured Home Construction and Safety Standard 24 CFR, Part 3280.710(e)

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NOTES

COOKTOP/RANGE—ELECTRIC

Lead Paint Risk Factor
NONE

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COOKTOP/RANGE—ELECTRIC

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

COOKTOP/RANGE REPAIR (ELECTRIC)

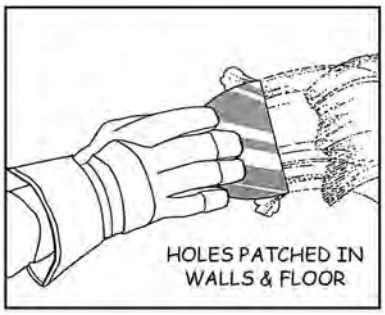
1. APPLIANCE REPAIR

- **When assessment indicates operational fail of the cooking appliance:**
  - Applicable repairs shall be made in conformance with the CSD Field Guide and by a qualified technician.
- **Abandonment of Appliance**
  - When repair or replacement of the cooking appliance is beyond the program scope, it shall be offered to the client to abandon the appliance per the CSD Field Guide.

COOKTOP/RANGE INSTALLATION (ELECTRIC)

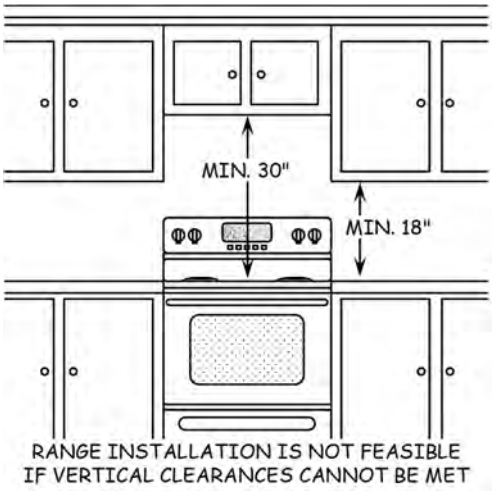
2. INSTALLATION LOCATION

- **Floor and Walls**
  - Floor must be stable, solid, level, and capable of properly supporting the cooking appliance.
  - Floor covering shall meet manufacturer's guidelines.
  - Wall coverings adjacent to the cooking appliance shall meet manufacturer's guidelines for temperature tolerance.
  - Holes and gaps in the walls and floor that create a draft and affect operation of the appliance shall be sealed, in accordance with shell sealing criteria in CSD WIS Sections 7 (Minor Envelope Repair) and 8 (Caulking), before the cooking appliance shall be installed.
  - Openings in the base of a cooking appliance that supply cooling/ ventilation air to the unit shall not be obstructed.



3. CONVENTIONAL HOME CLEARANCES

- **Horizontal and vertical clearances specified by cooking appliance manufacturer (or local code, if more stringent) shall be verified to be available.**
  - *Unless* manufacturer's instructions specify different clearances, the following minimum guidelines apply:
    - Minimum 30" vertical clearance between the cooking surface and overhead combustible material or metal cabinets.
    - Minimum 24" vertical clearance between the cooking surface and an overhead metal-clad insulating board, per range manufacturer's instructions.
    - Minimum 18" vertical clearance between the cooking surface and cabinets located within 6″ of the range, on either side of it.
    - If a listed microwave oven is located above the cooking appliance, vertical clearance from it to the cooktop shall be in compliance with microwave oven listing and manufacturer's instructions.



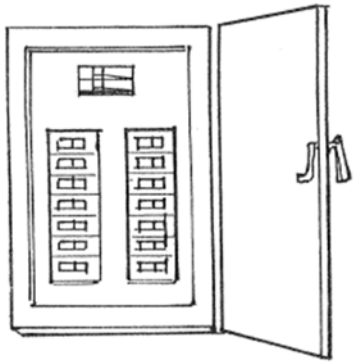
- If a kitchen exhaust is present, clearance may reduce if manufacturer's instructions specify reduced vertical clearance to the exhaust fan.
- If modifications are required to adjust clearances to meet requirements, feasibility shall be verified prior to installing the new cooking appliance.

4. INSTALLATION PROCEDURES

- **Installation of Unit**
  - A new appliance with damage or defects shall not be installed.
  - The cooking appliance shall be installed in accordance with:
    - Manufacturer's instructions,
    - The CMC, and
    - Requirements of the local jurisdiction, if any.

5. ELECTRICAL CONNECTION

- **Power Source**
  - It shall be verified that the electrical circuit is satisfactory or can feasibly be brought into conformance.
  - A permit shall be obtained and finalized when alterations are made to the electrical circuit (e.g., change in amperage, conductors, or location), and when required by the local jurisdiction.
  - The power source used for the cooking appliance shall be properly grounded and in conformance with the criteria in this item.
- **Electrical Supply Circuit**
  - The existing electrical circuit must be checked to determine whether the following are in conformance with manufacturer's instructions and local code:
    - Circuit capacity (voltage, phase, and amperage).
    - Circuit conductors shall be properly sized for the amp draw of the cooking appliance.[1]
    - The appliance circuit shall be protected with a circuit breaker or time-delay fuse that meets the specifications of the cooking appliance manufacturer and local code.
    - Grounding conductor, if required by the local jurisdiction.



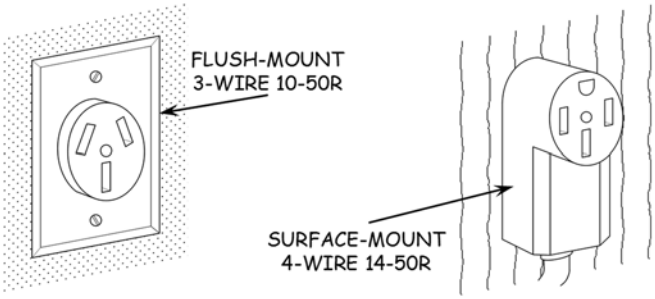
SERVICE PANEL CHECKED FOR CORRECT RANGE BREAKER

CORRECT VOLTAGE AT RECEPTACLE CHECKED WITH MULTI-METER

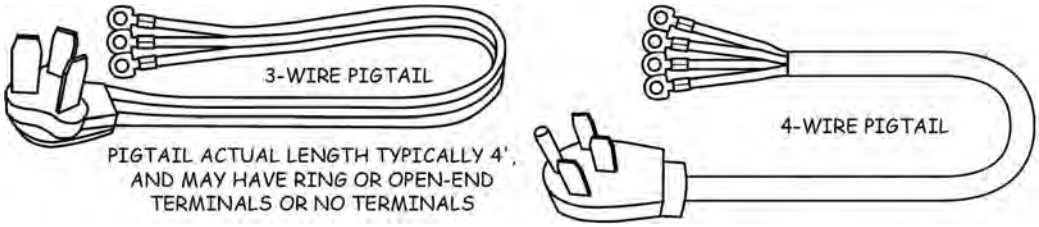
- **Receptacle**
  - The existing receptacle shall be checked for compliance.
    - A properly-installed 120/240 volt receptacle is required (e.g. NEMA type 14-50R 4-wire or 10-50R 3-wire).
    - *Exception:* If required by local code, the cooking appliance shall be "direct wired" with a continuous conductors and armored conduit (rigid or flexible) from the main service panel to the cooking appliance terminal block.
  - The receptacle shall be properly installed and, if applicable, grounded.
    - If flush-mount, the receptacle shall be housed in a securely-installed electrical box.

- If surface-mount, the receptacle shall be:
  - Located where specified by the cooking appliance manufacturer, and
  - Securely attached to solid wood in the wall or floor.

- If the existing electrical circuit does not meet the requirements of the appliance manufacturer or local code (e.g., a 3-wire receptacle exists, but a 4-wire connector and receptacle are required), and correction is beyond the scope of the program, a replacement cooking appliance shall not be installed.



- **Power Supply Cord (Pigtail), or Direct Wire Cable, and Strain Relief**
  - The power supply cord (or "direct wire" cable) shall meet, and be installed in compliance with, manufacturer's specifications.
  - Power cord for the replacement unit shall not be plugged into a receptacle that is not properly secured or has an electrical hazard.
  - If not factory-installed, the conductors shall be prepared (stripped, if applicable) for attachment to the cooking appliance main terminal block.
  - The appropriate diameter hole in the mounting plate shall be used, excess wire shall be pulled out of appliance compartment, and strain relief shall be installed as instructed (on the pigtail or "direct-wire" conduit).
- **Range Main Terminal Block**
  - Conductors from the pigtail (or "direct-wire" power line) shall attach to the cooking appliance main terminal block per manufacturer's instructions.
    - Factory-installed connections (wiring to terminal block) shall not be loosened.
    - Field-installed connections (incoming power conductors to terminal block) shall be tightened securely per instructions.
    - All connections shall be rechecked for tightness prior to replacing the rear access cover.
  - If a 4-wire power supply cord is used:
    - The ground strap connecting the neutral post to the cooking appliance chassis shall be removed, and
    - The grounding conductor (4th wire) shall be attached to the chassis, using the ground screw and hole previously used to connect the ground strap to the chassis.



6. PLACEMENT

- **Leveling of a Freestanding Range**
  - With oven shelves installed, and the stove in the location where it will be installed:
    - A spirit level shall be placed on an oven shelf to check levelness.
    - At least two readings shall be taken with the level placed diagonally, first in one direction and then the other.
  - The leg levelers shall be adjusted per manufacturer's instructions until the stove is level side-to-side and front-to-back.
  - When the stove is level, leg levelers shall be secured, if applicable.

- **Anti-Tip/Tilt Device for a Freestanding Range**
  - When an anti-tip device shall be installed (only when required by manufacturer), the manufacturer's template and instructions shall be applied.
  - The anti-tilt mechanism) shall be checked and verified to be functioning properly.
  - Proper installation shall be verified by carefully attempting to tilt the range forward.
- **Positioning**
  - The cooking appliance shall be placed in its final position.
  - The power supply cord (or "direct-wire" cable) shall be guided into a safe position, with no kinks.
  - Specified clearances (horizontal and vertical) shall be present.
  - The cooking appliance shall not be sealed (e.g., with caulk) to the side cabinets.

7. FUEL SWITCHING

- **Cooking appliance replacement requires that the same type of fuel is used.**
  - The stove shall be verified to be equipped for the type of fuel used.
  - *Exception*: In-field fuel conversion is allowed only with written permission by CSD.

PART 2: MOBILE HOME CRITERIA

8. GENERAL REQUIREMENTS

- **Standards**
  - Replacement shall comply with standards specified by HCD.[2]
- **Electrical Circuit**
  - Installed receptacle shall be a grounded 4-wire type (e.g., NEMA 14-50R), if 4-wire circuit is present or required by HCD.
- **Vertical Clearance above Cooktop**
  - Minimum 24" vertical clearance is required from the cooktop to the bottom of combustible cabinets.[3]
- **Floor Anchors**
  - The range shall be secured to the floor, when required by HCD regulations or manufacturer's instructions.[4]

9. COOKING AREA VENTILATION

- **Requirement**
  - One of the following shall be located within 10' of the replacement electric cooking appliance, and it shall be vented outdoors[5]:
    - An operable exhaust fan, or
    - A metal duct located above the cooktop, with a cross-sectional area of at least 12.5 sq. in., and minimum dimension of 2" (e.g., 2" x 6.25" rectangular duct, or 4" round duct).
  - If a range hood must be repaired or installed to meet this requirement, it shall be done in accordance with CSD WIS Section 41 (Kitchen Exhaust).
  - If required ventilation is not present and cannot feasibly be provided, home shall not be NIM.

FUNCTIONAL VENTILATION REQUIRED
(FAN OR PASSIVE VENT)
IN MOBILE HOME COOKING AREA
(GAS OR ELECTRIC)

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

10. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

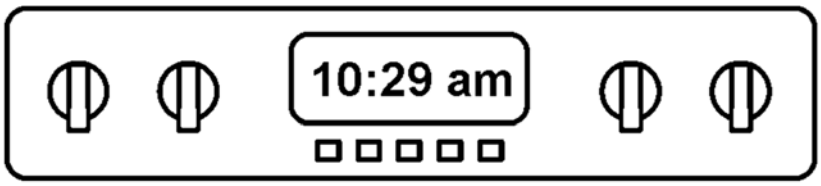
PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

11. OPERATIONAL CHECKS

- **Burner and Control Checks**
  - Operation of the cooktop and oven burners shall be checked after the appliance is in place.
    - Manufacturer's start-up/test procedures shall be followed.
  - Burners
    - Each burner in succession (cooktop and oven/broiler) shall be verified to operate properly.
  - Electronic Controls
    - Clock, timer, and electronic function controls shall be verified to operate properly.
    - Troubleshooting per manufacturer's recommendations shall be performed as needed to correct problems.
- **Appliance Cleaning**
  - Marks and residue left by protective shipping material, and smudges occurring during shipping and installation, shall be removed.
    - The cabinet, oven, cooktop, and controls shall be clean.
    - Manufacturer's cleaning recommendations shall be followed.

12. CLIENT EDUCATION

- **Crew Responsibilities**
  - Client shall receive verbal instructions for, and demonstration of, features and operation of the cooking appliance, including the troubleshooting guide in the owner's manual.
  - All users shall be shown the location of the circuit breaker (or fuse) that controls power to the cooking appliance, and instructed how to turn power to the appliance on and off.



RANGE CONTROLS AND FEATURES ARE DEMONSTRATED AND EXPLAINED TO USERS

REFERENCED STANDARDS

[1] NEC Table 310.16

[2] Manufactured Home Construction and Safety Standard (MHCSS), 24 CFR, Part 3280

[3] Manufactured Home Construction and Safety Standard (MHCSS), 24 CFR, Part 3280.204.

[4] Manufactured Home Construction and Safety Standard (MHCSS), 24 CFR, Part 3280.709(a)

[5] Manufactured Home Construction and Safety Standard (MHCSS), 24 CFR, Part 3280.710(e)

KITCHEN EXHAUST

Lead Paint Risk Factor
NONE

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KITCHEN EXHAUST

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

KITCHEN EXHAUST REPAIRS

1. RECIRCULATING FAN WITH A CHARCOAL FILTER

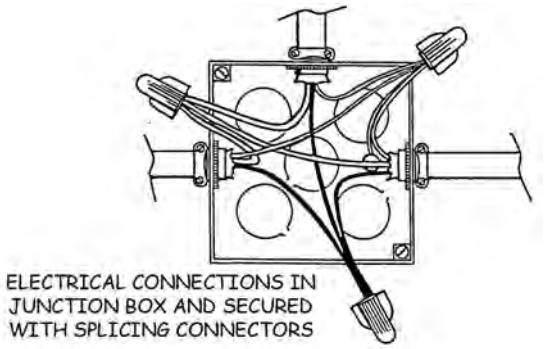
- **This is not an acceptable kitchen exhaust unit under the program.**
  - Repair of a recirculating fan shall not be allowed.
  - Replacement of a recirculating fan with a ducted kitchen exhaust shall only be allowed in a mobile home with a gas cooking appliance.

2. PASSIVE VENT

- **Existing Ventilation Source**
  - If a passive vent is present (typically a metal duct above the cooking appliance that goes to the outdoors without a fan or damper) that was originally intended to serve as an exhaust system for the kitchen:
    - Contact the local building department.
    - Describe the passive air inlet and ask if it is acceptable to block the passive vent as long as a kitchen exhaust system with a damper is installed in its place.
    - If the building department does not allow blockage of the passive vent, stop.
      (Note: Addition of 1/4" mesh to the vent that terminates in the attic shall be performed if installing ceiling insulation as part of weatherization).
    - If allowed by the building department, a program waiver is required (since it would require installing a kitchen exhaust in a conventional/multi-family home where none existed previously).

3. DUCTED WALL AND CEILING FAN UNITS

- **Materials and Workmanship**
  - Shall be in compliance with applicable code (HUD or CMC), for the following repair categories.
- **Repairs are not necessarily limited to the list below, but will require a program waiver:**
  - Motor
    - For a motor that is not operating, electrical tests shall be made to determine if the problem is in the circuit, the switch, or the motor.
    - Feasible repairs shall be made.
    - If repair is not feasible, the unit shall be replaced.
  - Fan Switch
    - Switch shall be replaced with manufacturer's replacement when feasible, or with a compatible retrofit switch.
  - Fan Blade
    - When the fan blade is replaced, it shall fit securely onto the motor shaft, fit properly into the fan housing, and operate smoothly (without excess noise or vibration).
  - Wiring
    - All splices shall be secured with new splicing connectors and housed in a junction box.
    - Electrical tape may be used as a supplement, but shall not be used instead of splicing connectors.



ELECTRICAL CONNECTIONS IN JUNCTION BOX AND SECURED WITH SPLICING CONNECTORS

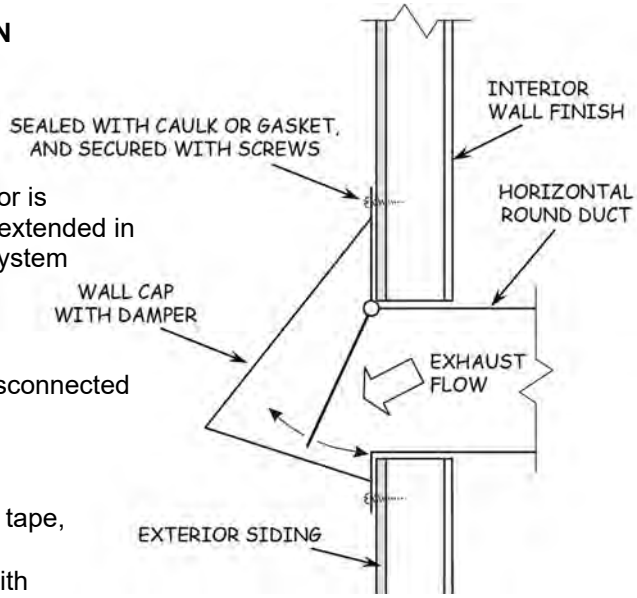
- Light
  - Defective switch and/or lamp holder shall be replaced with manufacturer's replacement when feasible, or with a compatible retrofit replacement.
- Filter
  - Dirty grease filter(s) shall be removed and thoroughly washed/cleaned.
  - Damaged, defective, excessively dirty, missing, or non-functioning filters shall be replaced with like kind or a compatible retrofit model.
- Damper
  - If function is impeded by greasy buildup, the damper shall be cleaned so it will operate freely.
  - If function is impeded by damage, repair shall be attempted.
  - If the existing damper cannot be made to operate freely, it shall be replaced with manufacturer's replacement or a compatible damper.
  - If a ducted kitchen exhaust unit is missing a damper, the damper shall be installed as catastrophic leakage.

4. RETROFIT DAMPER REPLACEMENT

- **If damper replacement is not available or feasible, a retrofit damper duct section shall be installed in the exhaust duct.**
- **Sealing/Patching of Gaps**
  - Gaps small enough to caulk shall be sealed in accordance with CSD WIS Section 8 (Caulking).
  - Gaps too large to caulk shall be repaired/sealed (e.g., with a collar or metallic tape) in accordance with CSD WIS Section 7 (Minor Envelope Repair).

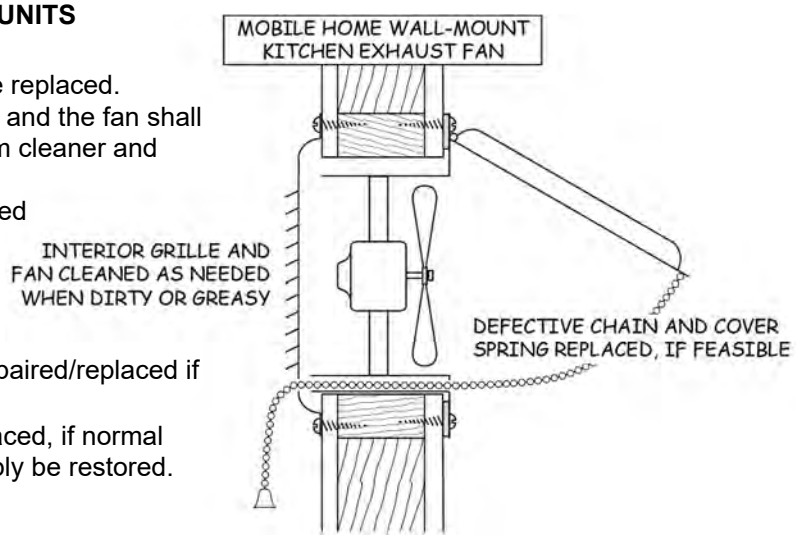
5. REPAIRS TO EXHAUST DUCT AND TERMINATION

- **Exhaust Duct**
  - Repairs and extensions to the exhaust duct to the outdoors shall be in compliance with Item 10.
  - When a kitchen exhaust terminates in an attic or is missing the duct, the duct shall be installed or extended in conformance with CSD WIS Section 6 (Duct System Repair and Sealing).
  - Duct shall terminate outdoors in an approved termination device.
  - Existing duct shall be examined for loose or disconnected joints.
  - Accessible loose joints shall be:
    - Secured with a clamp or short screws, and
    - Sealed with UL Listed metallic or butyl duct tape, duct mastic, or mesh tape and mastic.
  - Gaps too large for sealants shall be patched with compatible sheet metal and screws, then sealed.
  - Defective ducts shall be replaced when replacement is a better option than repair.
- **Sidewall Damper at Duct Termination**
  - If dirt or grease impedes proper function, the damper shall be cleaned.
  - If mechanical defect prevents proper function, the damper shall be repaired if feasible, or replaced (e.g., by replacing the entire termination assembly).



6. CHAIN-OPERATED WALL MOUNT UNITS

- **Repairs**
  - Broken/defective chain shall be replaced.
  - Interior grille shall be removed, and the fan shall be cleaned (e.g., with a vacuum cleaner and crevice tool).
  - Dirt and grease shall be removed from the fan blade.
  - If spring-loaded outer cover does not lift when chain is released:
    - Defective spring shall be repaired/replaced if feasible.
    - Entire fan unit shall be replaced, if normal cover function cannot feasibly be restored.



KITCHEN EXHAUST INSTALLATION

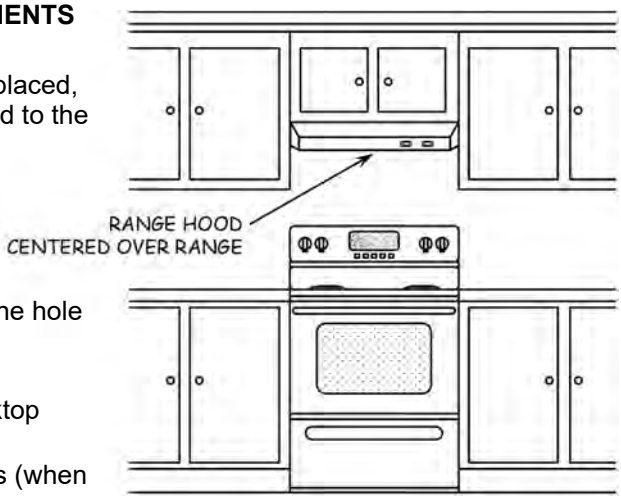
7. ALL INSTALLATIONS

- **Standards for Installation**
  - The unit shall be installed in accordance the terms of the listing, manufacturer's instructions, and local jurisdiction.
  - Wiring shall be installed in accordance with original equipment manufacturer specifications and local and national electrical codes.
- **Minimum CFM Rating**
  - Recirculating range hood fans shall not be allowed.
  - The replacement fan airflow capacity shall be rated at a minimum of 100 CFM.
  - Make-up air shall be provided for kitchen range exhaust fans exhausting more than 200 CFM.
  - The replacement unit shall be an operable exhaust fan equipped with an automatic or manual damper.
  - Verify that this minimum airflow is available *before* removing the existing unit.

8. REQUIRED LOCATION AND CLEARANCES

- **Location shall be assessed to determine that a new exhaust unit can be properly installed before a hole is cut in the ceiling, roof, or wall.**
  - Repairs to the mounting location, if needed, shall be made prior to fan installation.
  - Range Hood shall be:
    - Within 10' if the appliance, and
    - Centered over the cooktop, and
    - Hood width shall equal or exceed that of the cooktop surface.
    - Located a minimum of 24" above cooking surface, or as specified by hood manufacturer.
    - Installed with top clearance specified my manufacturer (e.g., with minimum 1/4" clearance between the hood and the underside of combustible material or metal cabinet above).

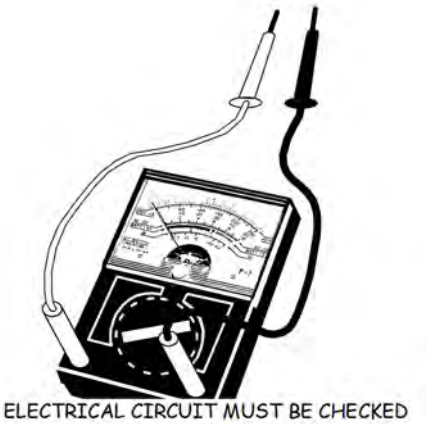
9. KITCHEN EXHAUST INSTALLATION REQUIREMENTS



- **Interior Finish**
  - When an existing exhaust unit is repaired/replaced, or a new system is installed, it shall be ducted to the outdoors.
  - All Units
    - The finished installation shall have a neat, clean appearance.
  - Wall-Mount and Ceiling-Mount Fans
    - The interior grille shall completely cover the hole cut for the duct/unit.
  - Range Hoods
    - The hood shall be centered over the cooktop (when possible), and
    - Installed securely to the adjacent cabinets (when present).
- **Attachment of Range Hood**
  - Hood shall be secured with new screws driven into wall studs and/or adjacent cabinets.
  - If pre-existing holes are used, longer or larger screws shall be used as needed to ensure a secure installation.

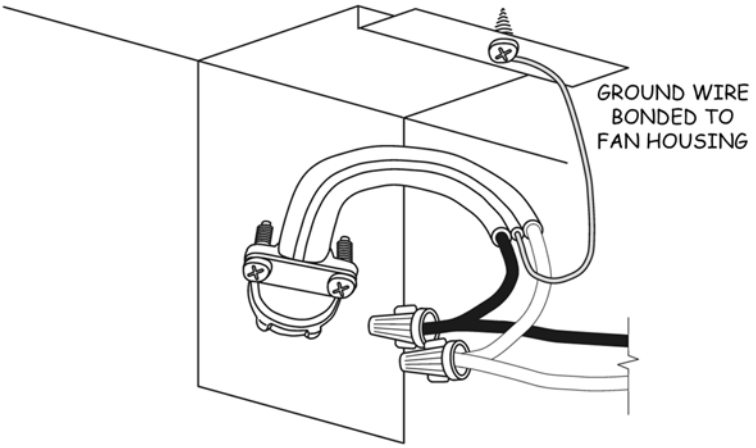
10. ELECTRICAL REQUIREMENTS

- **It shall be confirmed to be feasible to provide an acceptable power source before installation begins.**
  - When repairing, replacing, or creating a new fan installation, care shall be taken to ensure that power to the circuit for the fan is off while working with exposed conductors.
- **Electrical Circuit**
  - An acceptable electrical circuit that meets fan manufacturer's specifications shall be verified to be present.


ELECTRICAL CIRCUIT MUST BE CHECKED FOR SAFETY AND COMPLIANCE WITH MANUFACTURER'S SPECIFICATIONS

- **Wiring**
  - The new fan shall be hard-wired.
    - *Exception*: Plug-in installation is allowed under the following conditions:
      - The existing fan unit plugs into a receptacle (e.g., in the cabinet above).
      - The receptacle is properly installed in an electrical box, is safe, and has a proper cover plate.
      - Plug-in installation is approved by fan manufacturer (e.g., unit has a factory-supplied plug-in line cord).
      - Excess cord is secured out of the way and protected from damage.
  - The exhaust fan shall be controlled by a switch dedicated to the fan (does not operate any other electrical device).
- **Hard-Wired Connectors**
  - All electrical connections shall be secured with a properly-applied pressure splicing connector (e.g., "wire nut").
  - All connections shall be housed in a junction box.

- **Conductor Protection**
  - All exposed wiring (not inside a building cavity) shall be housed in a listed raceway.
- **Grounding**
  - When specified by code or manufacturer's instructions, the circuit controlling the fan shall be properly grounded.
  - The grounding conductor shall be connected to the exhaust fan per manufacturer's instructions.

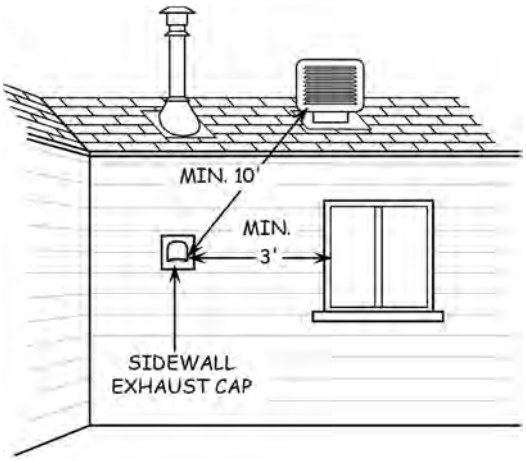


HARD-WIRED AND PROPERLY GROUNDED CONNECTION

  - GFCI protection is acceptable instead of a grounding conductor, per Appendix C (Grounding Guidelines).

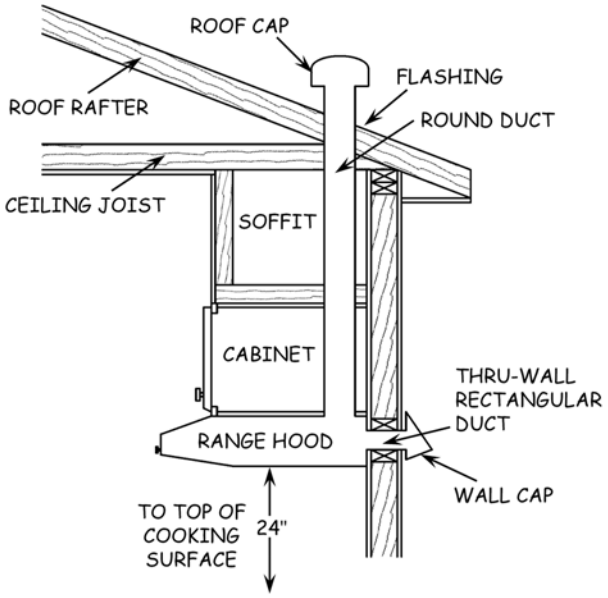
11. EXHAUST DUCT

- **Sizing and Route**
  - Duct airflow capacity shall conform to manufacturer's instructions.
  - Smooth-walled metal duct shall be used, in accordance with manufacturer specifications.
- **Duct Location**
  - Hole for duct shall be located where it will not interfere with structural members, plumbing, or electrical wiring.
  - The shortest and straightest route shall be used (e.g., through the wall for a range hood located on an outside wall).
  - Unless manufacturer's specification is greater, sidewall exhaust ducts shall terminate at least:
    - 3' from openable windows, doors, and other openings into the home.
    - 10' from an evaporative cooler inlet.



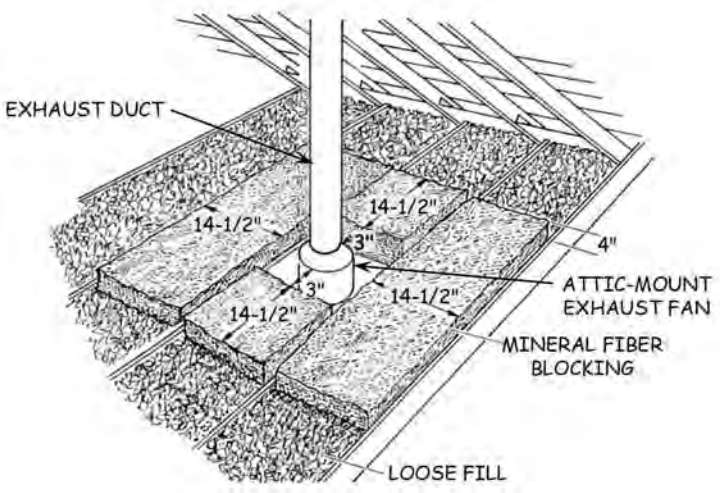
- **Configuration and Joints**
  - Maximum duct length and maximum number of offsets shall be in accordance with manufacturer's instructions.
  - Joints and connections shall be:
    - Secured (e.g., with clamps or short screws), and
    - Sealed (e.g., with elastomeric caulk, or with UL Listed metallic or butyl duct tape, duct mastic, or mesh tape and mastic).

- **Vertical ducts shall:**
  - Extend above the roof approximately 3/4" minimum, and terminate in an approved roof cap with flashing.
  - Be secured to roof sheathing or framing with minimum two #8 sheet metal screws that penetrate solid wood 5/8".
  - Be sealed to the roof surface (e.g., with elastomeric caulk or roofing cement).
- **Sidewall ducts shall:**
  - Extend beyond the wall surface approximately 3/4", and terminate in an approved wall cap.
  - Be secured as needed with #8 sheet metal screws.
  - Be sealed to the wall surface (e.g., with elastomeric caulk).
- **Termination**
  - Exhaust shall discharge outside the home (to outdoors, not underneath the dwelling).
  - Termination shall be flashed and/or caulked around the exterior opening to ensure a weather-tight and waterproof seal.
  - Sidewall terminations shall include a hood (and backdraft damper, if a damper is not inside the kitchen exhaust range hood).
  - Roof terminations shall include flashing and a roof cap.
  - A termination fitting with an integrated collar and a backdraft damper shall be used.
  - Galvanized steel, stainless steel, aluminum or copper shall be used for the termination fitting.



12. DUCTED WALL-MOUNT AND CEILING-MOUNT EXHAUST FANS

- **Ceiling/Wall Penetration**
  - Hole for duct shall be large enough to accommodate the duct, no larger than necessary, and smaller than the mounting plate or fan assembly.
  - Hole for attic-located fan shall be large enough to install the fan, no larger than necessary, and smaller than the grille/trim.
- **Attachment of Exhaust Fan**
  - Fan assembly, or mounting plate when used, shall be securely attached to solid wood or metal with minimum #8 screws.
  - Screws into wood shall penetrate at least 5/8".
- **Interior Wall/Duct Seal**
  - Gap around the duct shall be sealed where the mounting plate meets the wall (e.g., by applying foam weatherstripping tape to the plate or duct, or by using caulk or tape sealant).
- **Attic-Mount Fans**
  - Fans located in the attic above the ceiling shall be protected from loose-fill insulation by permanent blocking, in accordance with CSD WIS Section 20A (Ceiling Insulation for Conventional Homes).



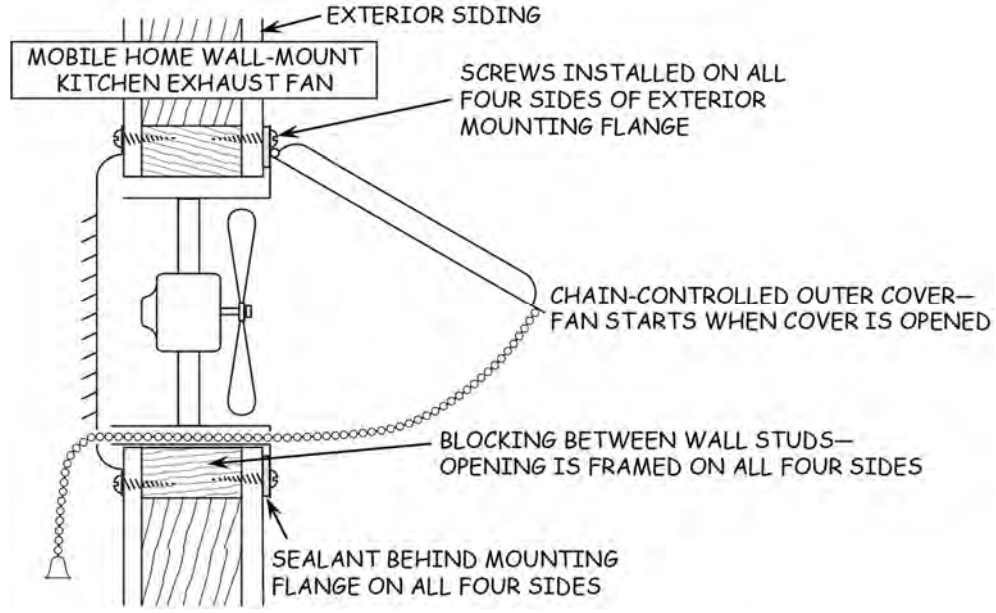
PART 2: MOBILE HOME CRITERIA

13. ALL MOBILE HOME KITCHEN EXHAUST UNITS

- **Minimum CFM Rating**
  - The replacement fan airflow capacity shall be rated at a minimum of 100 CFM.
- **Location in Mobile Homes**
  - Fan inlet shall be installed above, and not *more* than 10' horizontally from, the vertical front of the cooking appliance (range or separate cooktop and oven).

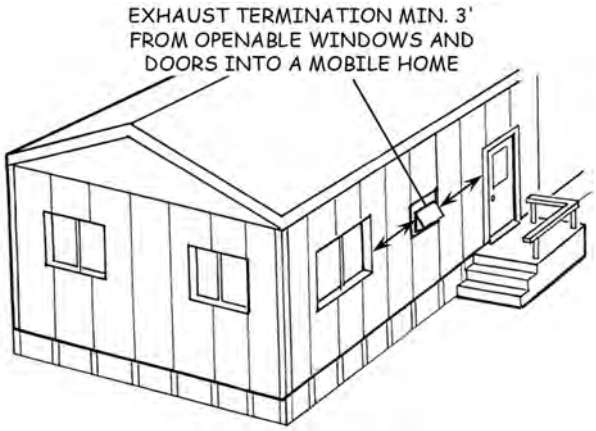
14. WALL-MOUNT AND CEILING-MOUNT MOBILE HOME EXHAUST FANS—REPLACEMENT UNITS

- **Size**
  - Replacement fan shall fit the existing location.
  - If the hole must be enlarged, a maximum of 50% of framing member thickness may be removed.
- **Attachment and Exterior Seal—Wall-Mount**
  - Fan shall be installed per manufacturer's instructions.
  - Exterior cover shall be sealed watertight (e.g., with putty tape) and secured to the wall with screws.
  - Larger/longer screws shall be used if needed for a secure attachment.
- **Attachment and Exterior Seal—Ceiling-Mount**
  - Fan shall be installed and secured in the ceiling per manufacturer's instructions.
  - Roof cap shall be secure and sealed watertight.



15. WALL-MOUNT AND CEILING-MOUNT MOBILE HOME EXHAUST FANS—NEW INSTALLATION

- **Location**
  - Fan inlet shall be installed above and not *more* than 10' horizontally from the vertical front of cooking appliances.
  - Hole for duct shall be located where it will not interfere with structural members, plumbing, or electrical wiring.
  - Sidewall exhaust shall terminate at least 3' from windows, doors, other openings into the home, and Evaporative Cooler inlet.



- **Framing—Wall-Mount**
  - The opening shall be framed on all four sides by lumber equal to or larger than the full-dimensional framing in the wall.
  - Exterior hole shall be cut just large enough to install the fan assembly, leaving adequate exterior wall surface to create a watertight seal.
- **Framing—Ceiling-Mount**
  - Hole shall be cut and fan secured per manufacturer's instructions.
  - Duct shall terminate in an approved roof cap that is flashed and sealed to be watertight.
- **Electrical**
  - An acceptable electrical source shall be available.
  - If power is obtained by splicing into a circuit inside the wall or ceiling, all connections shall be housed in a junction box.
  - If power is obtained from a nearby outlet:
    - The conductors shall be hard-wired into the outlet, and
    - All exposed wiring shall be enclosed in raceway.
- **Attachment and Exterior Seal**
  - Requirements of Item 13 shall be met.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

16. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

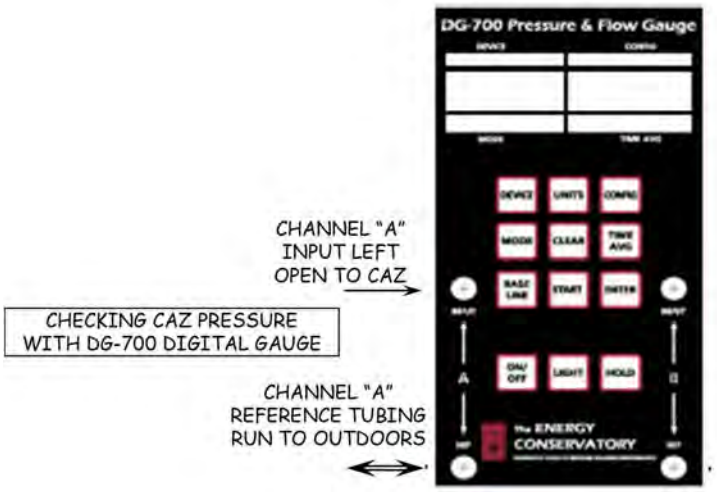
17. COMBUSTION APPLIANCE SAFETY (CAS) TESTING

- **CAS Test required for new and replacement exhaust systems.**
  - Perform a CAS test of all natural draft appliances in any and all locations that can be depressurized by the exhaust system with the fan operating.
  - Perform tests to measure draft and check for spillage shall be performed, as prescribed in the CSD Field Guide Appendix A (CAS Protocol).

18. COMBUSTION APPLIANCE ZONE (CAZ) TESTING

- **Testing Requirement**

- When a kitchen exhaust installation, repair, or replacement is performed, a CAZ test is required to ensure that Natural Draft appliances drawing air from the living space are not negatively impacted. Follow the procedure outlined in the CSD Field Guide, Appendix A.



19. MAKE-UP AIR

- **Kitchen Exhaust Fans**
  - Make-up air shall be provided for kitchen fans exhausting more than 200 CFM.

20. CLIENT EDUCATION

- **Grease Filters**
  - Client shall be instructed to keep grease filters and termination fitting clean.

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NOTES

WATER HEATER—STORAGE GAS

Lead Paint Risk Factor
NONE

TABLE OF CONTENTS

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WATER HEATER—STORAGE GAS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

WATER HEATER REPAIR

1. APPLIANCE REPAIR

- **When assessment and CAS testing indicate operational fail of the water heater:**
  - Applicable repairs shall be made in conformance with the CSD Field Guide and by a qualified technician.
  - Repairs shall be made in conformance with manufacturer's specifications and applicable code requirements.
- **Platform/Enclosure Floor Repair**
  - The flooring under the water heater shall be checked for structural integrity to safety and properly support the water heater. If unsafe, it shall be corrected as a Limited Home Repair before a water heater is repaired or replaced.
- **Water Heater Seismic (Earthquake Straps)**
  - Straps shall be added when a water heater is not strapped, or was not strapped properly, AND at least one of the following applies:
    - The water heater is replaced or repaired.
    - It is required by the local jurisdiction (proof of requirement must be on file with the agency).
    - A water heater blanket is feasible and will be installed.
  - Strap kits must be selected in compliance with WIS Appendix A (Material Specifications) and installed in compliance with manufacturer's instructions.
- **Temperature and Pressure Regulation**
  - When either a temperature and pressure (T&P) relief valve, or an automatic gas shut-off valve plus pressure-relief valve, is not present or is capped off, it shall be repaired in conformance with the CSD Field Guide and Item 11 of this section.
- **Abandonment of Appliance**
  - When repair or replacement of the water heater is beyond the program scope, it shall be offered to the client to abandon the appliance per the CSD Field Guide Appendix A (CAS Protocol).
- **Flexible Gas Connector**
  - Check shall be made for presence of unsafe gas connector, which shall be replaced per the CSD Field Guide Appendix A.
- **Vent Repair/Extension**
  - When appliance vent requires repair or extension, the CSD Field Guide Appendix A policies shall apply. Use of UL-181 tape shall never be allowed as a method to seal appliance vent joints.

WATER HEATER INSTALLATION

2. GENERAL REQUIREMENTS

- **Installation shall be in conformance with:**
  - Product listing, and manufacturer's instructions and specifications
  - Applicable codes, including the current California Electrical Code (CEC), California Plumbing Code (CPC), and local codes.
  - Any existing water leaks shall be repaired before installation begins.

3. APPLIANCE SIZING

- **Replacement Water Heater Capacity, the First Hour Rating**
  - Unit shall comply with the greater of:
    - Manufacturer's sizing recommendations, or
    - Applicable code requirements.
  - Storage unit capacity shall be no *less* than the Uniform Plumbing Code (UPC) minimum "First Hour Rating" guidelines, as shown in Table 42-1.
  - When enclosure size limitations restrict the replacement unit's capacity, sizing for a smaller unit requires a program waiver and proper documentation of the condition in the client file.

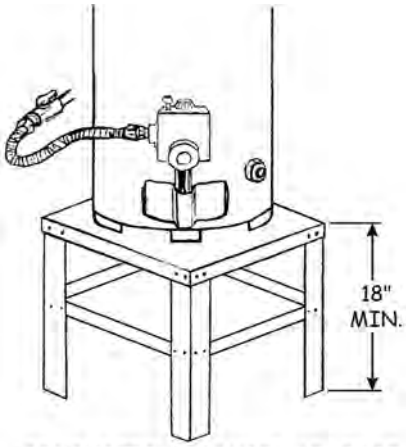
TABLE 42-1: MINIMUM CAPACITY FOR WATER HEATERS (FIRST HOUR RATING)

Number of Bathrooms	**1 to 1.5**			**2 to 2.5**				**3 to 3.5**			
Number of Bedrooms	1	2	3	2	3	4	5	3	4	5	6
First Hour Rating*	42	54	54	54	67	67	80	67	80	80	80

* "First Hour Rating" is water heating capacity expressed in gallons. In other words, it is the amount of hot water the heater can supply per hour (starting with a tank full of hot water). Find the "First Hour Rating" on the yellow EnergyGuide label to determine the size of tank needed.

4. LOCATION

- **All Units**
  - Location shall be structurally sized/constructed to safely support the weight of the tank.
- **Units in Attics**
  - Water heater shall not be installed in attic with whole house or attic exhaust fan, *unless* it has a sealed combustion chamber.
- **Bedrooms and Bathrooms**
  - An open combustion water heater shall not be installed in a bedroom or bathroom, *unless* it is inside a dedicated closet (and no other appliances will be present in the enclosure). The closet shall have a weatherstripped door with self-closing hinges, and all combustion air shall be drawn from outdoors.
- **Units in Garages and Hazardous Locations**
  - When installed in a garage, unit shall be elevated so that the combustion burner is at least 18" above the finished floor, *unless* it is an FVIR unit and elevation is not required by manufacturer's instructions or local code.
  - Units in locations subject to damage (e.g. by an automobile) shall be protected by being elevated, or with barriers or other means prescribed by local code.



COMBUSTION CHAMBER AT LEAST 18" ABOVE GARAGE FLOOR

5. INSTALLATION

- **The tank shall be installed:**
  - Plumb and level in a stable position.
  - With minimum clearance in accordance with manufacturer's instructions.
  - With information labels and controls facing outward.
- **Support**
  - Units supported from the ground shall rest on a level code-compliant base, which extends at least 3" above grade.
- **Orifice Size**
  - Burner orifice shall be verified to be appropriate for type of fuel gas used.

- **Plumbing**
  - Only new parts shall be installed.
  - Threaded fittings shall be sealed with Teflon® tape or non-toxic pipe joint compound.
  - A cold water supply shutoff valve shall be installed if not present.
  - Flexible connectors shall be used to connect the tank to the rigid hot and cold water lines.
  - Dielectric insulators shall be installed on water piping connections to the tank when required by local code.
- **House Line Pressure**
  - House line pressure shall be checked (e.g., with a pressure gauge attached to a hose bib) to be in compliance with the water heater manufacturer's specifications.
  - House line pressure shall be checked when:
    - The area is known to have high water pressure; and
    - Wherever evidence suggests that high line pressure may be present.
  - When water pressure to the home exceeds water heater manufacturer's specifications, a house line pressure regulator shall be installed or replaced to reduce the pressure reaching the water heater below the specified maximum.

6. ACCESS TO UNIT

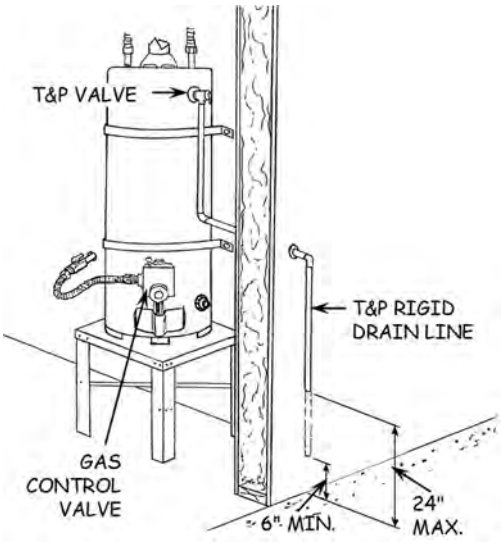
- **Units in Enclosures**
  - Access door shall be at least 24" wide, and high enough to allow removal of the existing appliance.
- **Units in Attics**
  - Access shall have a minimum 22" x 30" opening, with unobstructed passageway, and a minimum 30" x 30" working platform on the front service side of the water heater.[1]

7. CLEARANCES

- **All Units**
  - Clearances shall be in compliance with listing requirements, manufacturer's instructions, the California Plumbing Code (CPC), and local code.
  - Clearances shall be adequate to not interfere with combustion air, T&P relief, or access for maintenance.
- **Clearance from Gas Meter**
  - An open combustion water heater (including FVIR-listed) shall have minimum 3' clearance between its source of combustion and the gas meter.

8. SEISMIC BRACING

- **Requirement**
  - The tank shall be braced (strapped or anchored) to resist horizontal movement during an earthquake only when a replacement water heater is installed.
  - Earthquake straps and braces shall be attached directly to tank (not to the water pipes).
- **Bracing shall be:**
  - Installed per manufacturer's instructions and local code.
  - Securely attached to structural framing or ledger board.
- **Strap Locations**
  - Two straps shall be installed:
    - One within the upper third of the tank, and
    - One within the lower third of the tank.
  - The lower strap shall be at least 4" above the gas control valve.

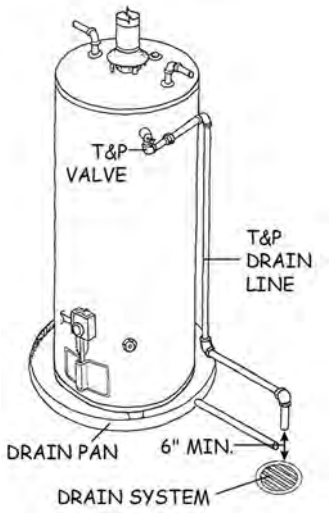


9. PLUMBING

- **All Units**
  - All fittings and valves shall be installed using NEW materials per manufacturer's instructions and local code.
  - PEX tubing shall not be installed within the first 18" of piping connected to a water heater.
  - Threaded fittings shall be sealed with Teflon® tape or non-toxic pipe joint compound.
  - A cold water supply shutoff valve shall be installed if not present.
  - Flexible connectors shall be used to connect the tank to the rigid hot and cold water lines.
  - Dielectric insulators shall be installed on water piping connections to the tank, when required by local code.
  - Backflow prevention shall be installed in accordance with manufacturer specifications and in accordance with the authority having jurisdiction.

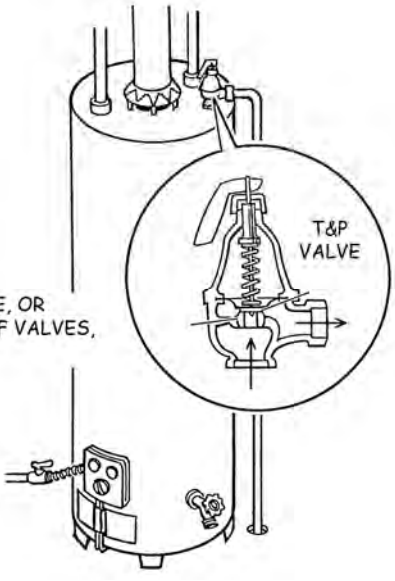
10. DRAIN PAN

- **Storage Units**
  - A watertight pan of corrosion-resistant material shall be installed when the water heater is located in:
    - An attic or on a floor-ceiling assembly, or
    - Other location for which a pan is required by local code.
  - Drain pan shall be 4" in height if leakage is likely to cause damage to the home.
- **Drain**
  - A minimum 3/4" diameter drain line from the pan shall be installed with a continuous downward slope to the exterior, or to a drain system, in accordance with local code.
  - Drain pan shall not inhibit proper combustion air flow.



11. TEMPERATURE AND PRESSURE REGULATION

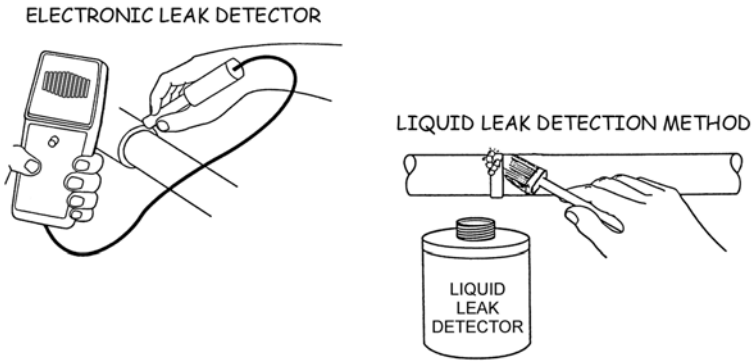
- **Safety Controls**
  - One of the following shall be installed in conformance with the water heater manufacturer's instructions and local code:
    - A temperature and pressure (T&P) relief valve with drain line, or
    - An automatic gas shutoff valve and pressure-relief valve, when T&P valve and drain line are not feasible.
- **The T&P Relief Valve and Automatic Gas Shutoff Valve:**
  - Shall meet the sizing/pressure requirements of the water heater listing and be compliant with the requirements of the local jurisdiction.
- **T&P Relief Valve Drain Line**
  - Line shall be galvanized steel, hard drawn copper, or CVPC.
  - Internal diameter of the line and fittings shall equal or exceed diameter of the relief valve outlet.
  - The line shall drain fully by gravity and shall not be trapped, and it shall not discharge into the drain pan.
  - Drain line shall terminate outside the building, or in an approved drain system, with the terminal end:
    - No *more* than 24", nor *less* than 6", above the surface, and
    - Unthreaded and pointing downward.



- **Expansion Tank**
  - A potable water expansion tank shall be installed on the cold water side.
  - A direct connection with no valves between the storage tank and expansion tank shall be installed in accordance with the authority having jurisdiction, and according to manufacturer specifications.

12. GAS LINES, FITTINGS, AND VALVES

- **All Units**
  - Nonconforming items, such as rigid or flexible copper connector, shall be replaced with code-compliant materials.
  - All gas lines, flexible gas connectors, fittings and valves shall be installed using new materials per manufacturer's instructions and local code.
  - Gas shutoff valve and flexible gas connector shall be new (existing shall not be reused.
  - Manual gas shutoff valve shall be within 3' of the appliance and in the same room where the appliance is located.
  - A flexible gas connector shall be located between the gas control valve and shutoff valve.
  - Readily-accessible sediment trap (drip leg) shall be located just ahead of flexible gas connector, when required by local code.
  - All new and affected gas lines, flexible gas connectors, fittings, and valves shall be checked for gas leaks using a method approved by the local jurisdiction.



GAS LINE FITTINGS, VALVES, AND CONNECTORS CHECKED FOR GAS LEAKS

13. COMBUSTION AIR REQUIREMENTS

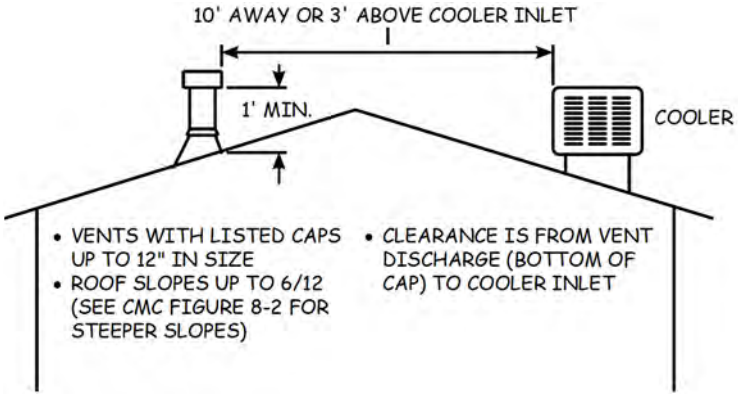
- **All Units**
  - Combustion air shall be supplied in conformance with manufacturer's instructions, local code, and CSD Field Guide Appendix A.
  - Obstructions in existing combustion air vents (e.g., overblown insulation) shall be cleared as needed to provide required NFVA.

14. VENT SYSTEM

- **All Systems**
  - Appliance venting shall be in conformance with manufacturer's instructions and local code.
    - Pipe located outdoors, or exiting through a ceiling or wall, must be type B (double wall).
  - Existing components shall be replaced with new components (as required) to ensure that the entire vent system conforms with the appliance listing and code requirements.
  - Vent dampers shall not be used.
  - Type B vent pipe shall be used outdoors, and the vent cap shall be at least 5' in vertical height above the draft hood.
  - Horizontal vent connectors shall not dip or sag and shall slope upward a minimum of 1/4" per foot of horizontal length.
  - Gas vents shall be supported in accordance with their listings and manufacturer's instructions.

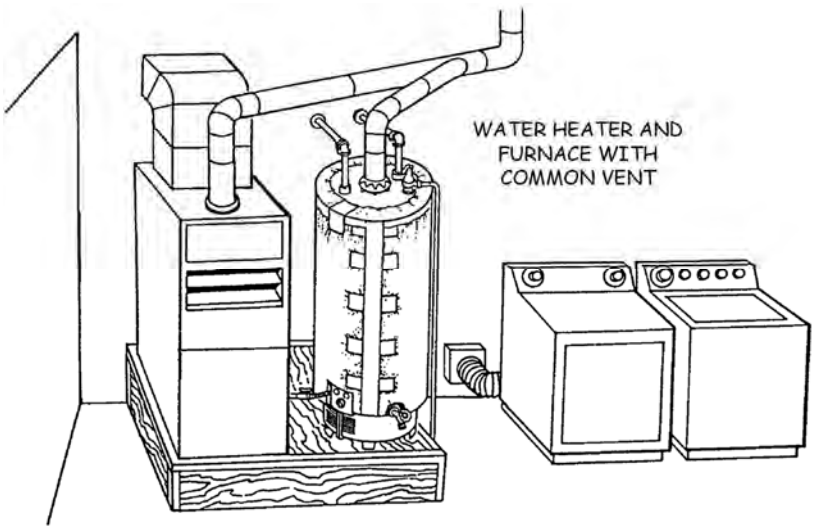
14. VENT SYSTEM (cont.)

- **Type B Gas Vents**
  - Vents with Listed vent caps 12" in size or smaller shall be in compliance with the California Mechanical Code.[2]
    - Existing vents shall terminate minimum 1' above a roof (for slopes up to 6/12), provided the vent is located at least 8' from a vertical wall or similar obstruction.
    - Vents within 8' of a vertical wall or obstruction must terminate:
      - At least 2' above the highest point where they pass through the roof, and
      - At least 2' *higher* than any portion of the building within 10'.
  - Vent terminations located within 10' of outside-air, makeup-air, and forced-air/cooler inlets shall terminate at least 3' above such inlets.
  - A gas vent extending through an exterior wall shall not terminate adjacent to the wall or below the eaves.
  - All gas vents shall extend through the roof flashing, or roof jack, and terminate with a listed cap or listed roof assembly.
  - Vent pipes shall be supported in accordance with their listing and manufacturer's instructions.



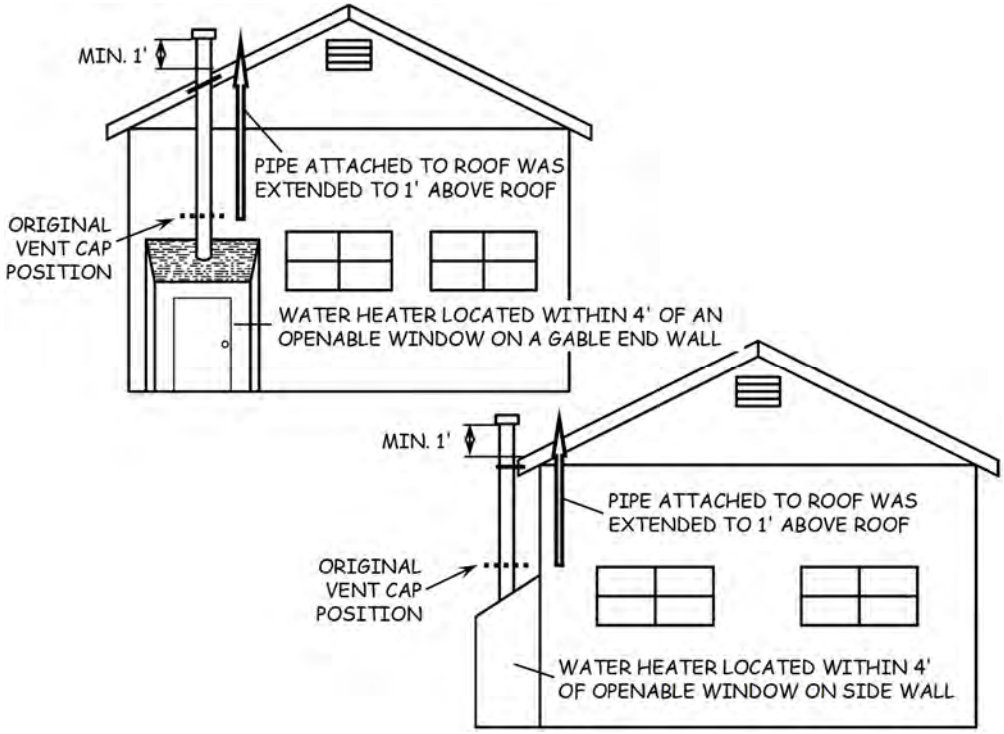
- **Through-Wall Mechanical Draft Vent Terminals**
  - A mechanical draft venting system shall terminate at least 3' above any forced air inlet (e.g., evaporative cooler) located within 10'.
  - A mechanical draft venting system (other than direct vent) shall terminate the following minimum distances from doors, operable windows and gravity inlets into a building:
    - 1' above, or 4' below, or
    - 4' horizontally from the door/window/inlet .

- **Common Vents**
  - A common vent system serving both the water heater and another appliance shall be sized in accordance with local code and the California Mechanical Code.[3]



14. VENT SYSTEM (cont.)

- **Water Heater in Outdoor Enclosure Adjacent to Sidewall**
  - Vent pipe shall be extended as illustrated below, or in accordance with local code, if more stringent when:
    - The horizontal measurement from the center of the vent termination to an adjacent operable door or window is 4-feet or less.
  - The horizontal measurement from the center of the appliance draft hood to an adjacent operable door or window is 4-feet or less.
  - The replacement/extended vent pipe must be Type B, and it must terminate at least 1' above the dwelling roof when:
    - The vent pipe penetrates the roof overhang, or
    - It is located immediately adjacent the roof edge and secured by a clamp to the fascia.
  - If the vent pipe is located further away from the roof edge, it must extend to:
    - At least 2' above the roof edge, and
    - 2' *higher* than any portion of the building within 10'.
  - If offsets are used (e.g., to avoid penetrating the roof overhang), offsets shall not exceed 45°, *except* one 60° offset is allowed.



15. THERMAL EFFICIENCY

- **Hot and Cold Water Pipes**
  - Pipe insulation shall be installed in accordance with CSD WIS Section 18 (Water Heater Pipe Insulation).
  - Heat traps shall be installed on the inlet and outlet piping, where not provided by manufacturer.
- **Tank**
  - Replacement water heaters shall have a minimum internal insulation of at least R-12; therefore, no additional external insulation shall be installed in accordance with CSD WIS Section 16 (Water Heater Insulation).
  - Because California regulations for internal tank insulation exceed the federal regulations, an external insulation blanket shall not be installed on a replacement water heater.

PART 2: MOBILE HOME CRITERIA

16. INSTALLATION

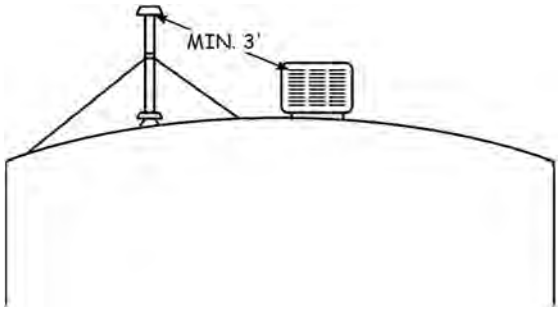
- **Water heater shall be:**
  - In compliance with requirements of the California Department of Housing and Community Development (HCD).
  - Have maximum standby loss of 7% (25 to 35 gallons) or 6% (over 35 gallons).[4]
  - Water heater is not required to be listed/labeled for installation in a mobile home, unless required be HCD.
- **Access requirements and unit installation shall be in conformance with:**
  - Manufacturer's instructions, and
  - HCD requirements, and
  - Installation guidelines in this section.

17. DRIP PAN

- **Drip Pan and Lower CVA Vent**
  - A drip pan shall be installed and drained per HCD regulations.
  - If the drip pan covers existing CVA venting in the floor, a new lower CVA vent shall be installed within 12" of the compartment floor.

18. MOBILE HOME GAS VENT TERMINAL

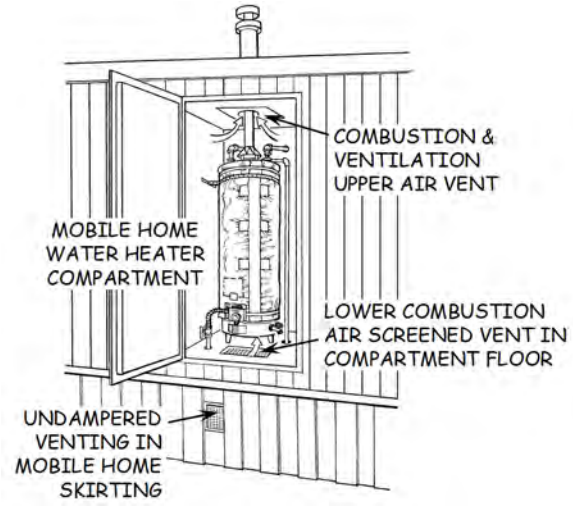
- **Vent pipes shall not terminate under the mobile home.**
- **Water Heater Vent Terminals**
  - A water heater vent pipe located near an evaporative cooler shall terminate at least 3' from the cooler intake.
  - If this requirement is not met, infiltration-reduction measures shall not be installed.



- ***Exception* for Inoperable Cooler**
  - When an Evaporative Cooler is inoperable, or the property owner wants it abandoned, vent terminal clearances do not apply if the Cooler is removed and the roof opening is sealed.

19. COMBUSTION AIR REQUIREMENTS (MOBILE HOMES)

- **Open Combustion Water Heater Combustion Air Venting**
  - An upper combustion air vent shall be present, such as:
    - A double concentric vent pipe in the ceiling:
      - Appliance vent pipe surrounded by air space and a larger-diameter outer pipe.
      - NFVA is the cross-sectional area of the larger pipe minus the cross-sectional area of the smaller pipe.
    - An undampered vent (screen or grille) installed in the enclosure ceiling, or in the door or outer wall and located to begin within 12" of the enclosure ceiling.

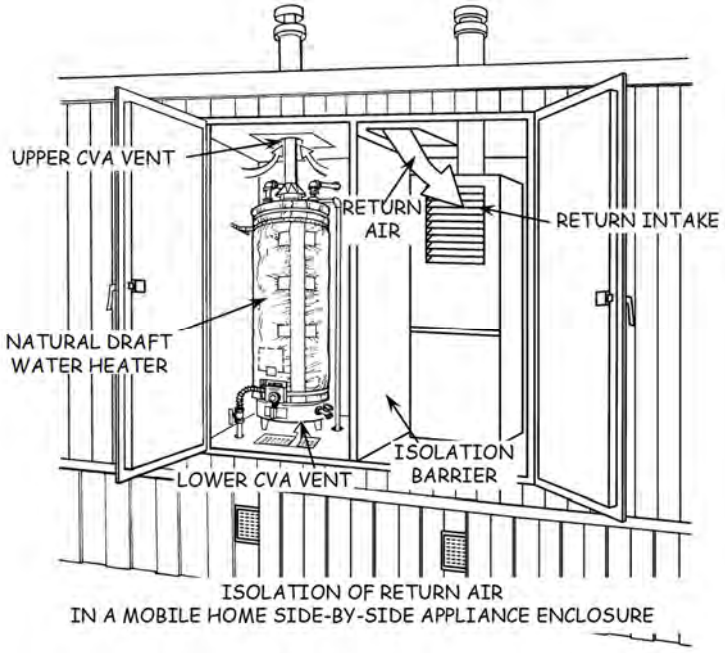


19. COMBUSTION AIR REQUIREMENTS (MOBILE HOMES) (cont.)

- **Open Combustion Water Heater Combustion Air Venting (cont.)**
  - A lower combustion air vent (undampered screen or grille to outdoors) shall be present, located in:
    - The enclosure floor, or
    - The door or wall located to begin within 12" above the floor.
  - A continuous duct extending from the enclosure to the outdoors may be used to supply upper or lower combustion air venting.
  - CVA vent NFVA shall be in accordance with the CSD Field Guide Appendix A.

20. ISOLATION OF RETURN AIR

- **The return air system shall not have leaks which:**
  - Depressurize any open combustion appliance enclosure.
  - Draw in combustion air or combustion gases from any open combustion appliance (e.g., from furnace itself or nearby water heater).
  - Depressurize or draw air from a space where hazardous chemicals are stored or toxic fumes may be present.



ISOLATION OF RETURN AIR
IN A MOBILE HOME SIDE-BY-SIDE APPLIANCE ENCLOSURE

- **The following conditions are not allowed:**
  - An open combustion FAU drawing non-ducted return air through a grille in the furnace housing.
  - A closed combustion FAU located in an appliance enclosure adjacent to an open combustion water heater when:
    - The furnace enclosure is part of the return system and
    - The two appliances are not separated by an airtight barrier.
- **Required Corrections**
  - Any condition allowing pollutants from the water heater to be drawn into the FAU return shall be corrected by constructing an isolation barrier between the two appliances.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

21. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

22. APPLIANCE REMOVAL AND DISPOSAL

- **Requirements of the local jurisdiction shall be followed to:**
  - Remove old water heater and associated components.
  - Seal any unused chimney openings and penetrations.
  - Remove unused oil tank, lines, valves, and associated equipment.
  - All work shall be completed by a licensed plumbing (C-36) professional where required by the authority having jurisdiction and installed to industry-accepted standards.
- **Shell or Structural Damage**
  - Any penetrations to the exterior of the home created by the installation of the replacement water heater shall be sealed.

23. OPERATIONAL CHECKS

- **Water Heater Operation/Commissioning**
  - The water heater shall be tested in compliance with manufacturer specifications and relevant industry standards and shall perform properly and safely.
- **Thermostat Temperature**
  - Thermostats shall be set at 120°F, *unless* higher temperature is requested by the client or is required for medical reasons, or as prescribed by local code.
- **Combustion Appliance Safety Testing**
  - Post-CAS Appliance Repair and Replacement testing shall be conducted in accordance with the CSD Field Guide Appendix A.
  - The appliance shall pass CAS Testing.
- **Other Appliances**
  - Appliances turned off during the installation of the water heater shall be returned to standard operating condition (i.e., pilot lights shall be re-lit, if necessary).

24. CLIENT EDUCATION

- **Safety**
  - Client will be provided information regarding the health effects and risk of high carbon monoxide concentrations, as well as a list of monitors that provide more detail regarding CO levels.
- **Operations and Maintenance**
  - Clients shall be educated on the safe and efficient operation and maintenance of the system, including:
    - Adjustment of water temperature and target temperature in accordance with local code.
    - Periodic drain and flush.
    - Expansion tank and backflow preventer (no occupant maintenance required).
    - Periodic inspection, maintenance, or replacement.

REFERENCED STANDARDS

[1] CPC §509.4

[2] CMC §802.6

[3] CMC §803.0

[4] ANSI Z21.10.1 and addendums 1a-1991 and 1b-1992

WATER HEATER—
STORAGE ELECTRIC

Lead Paint Risk Factor
NONE

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WATER HEATER—STORAGE ELECTRIC

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

WATER HEATER REPAIRS

1. APPLIANCE REPAIR

- **When assessment indicates operational/electrical fail of the water heater:**
  - Applicable repairs shall be made in conformance with the CSD Field Guide and by a qualified technician.
  - Repairs shall be made in conformance with manufacturer's specifications and applicable code requirements.
- **Water Heater Seismic (Earthquake Straps)**
  - Straps shall be added when a water heater is not strapped, or was not strapped properly, AND at least one of the following applies:
    - The water heater is replaced or repaired.
    - It is required by the local jurisdiction (proof of requirement shall be on file with the agency).
    - A water heater blanket is feasible and will be installed.
  - Strap kits shall be selected in conformance with WIS Appendix A (Material Specifications) and installed in compliance with manufacturer's instructions.
- **Platform/Enclosure Floor Repair**
  - The flooring under the water heater shall be checked for structural integrity to safely and properly support the water heater. If unsafe, it shall be corrected as a Limited Home Repair before a water heater is repaired or replaced.
- **Temperature and Pressure Regulation**
  - When either a Temperature and Pressure (T&P) relief valve, or an automatic gas shut-off valve plus pressure-relief valve, is not present or is capped off, it shall be repaired in conformance with the CSD Field Guide and Item 10 of this section.
- **Vent Repair/Extension**
  - When appliance vent requires repair or extension, use of UL-181 tape shall never be allowed as a method to seal appliance vent joints.
- **Abandonment of Appliance**
  - When repair or replacement of the water heater is beyond the program scope, it shall be offered to the client to abandon the appliance in conformance with CSD program policy.

WATER HEATER INSTALLATION

2. GENERAL REQUIREMENTS

- **Installation shall be in conformance with:**
  - Product listing and manufacturer's instructions and specifications.
  - Applicable codes, including the current California Electrical Code (CEC), California Plumbing Code (CPC), and local codes.
  - Any existing water leaks shall be repaired before installation begins.

3. APPLIANCE SIZING

- **Replacement Water Heater Capacity, the First Hour Rating**
  - Unit shall comply with the greater of:
    - Manufacturer's sizing recommendations, or
    - Applicable code requirements.
  - Storage unit capacity shall be not *less* than the Uniform Plumbing Code (UPC) minimum "First Hour Rating" guidelines, as shown in Table 43-1.

- When enclosure size limitations restrict the replacement unit's capacity, sizing for a smaller unit requires a program waiver and proper documentation of the condition in the client file.

TABLE 43-1: MINIMUM CAPACITY FOR WATER HEATERS (FIRST HOUR RATING)

Number of Bathrooms	1 to 1.5			2 to 2.5				3 to 3.5			
Number of Bedrooms	1	2	3	2	3	4	5	3	4	5	6
First Hour Rating*	42	54	54	54	67	67	80	67	80	80	80

*"First Hour Rating" is water heating capacity expressed in gallons. In other words, it is the amount of hot water the heater can supply per hour (starting with a tank full of hot water). Find the "First Hour Rating" on the yellow EnergyGuide label to determine the size of tank needed.

4. LOCATION

- **All Units**
  - Clearances shall be in compliance with listing requirements, manufacturer's instructions, the CPC, and local code.
  - Location shall be structurally sized/constructed to safely support the weight of the tank.
- **Units in Enclosures**
  - Access door shall be at least 24" wide, and high enough to accommodate removal of the appliance.

5. INSTALLATION

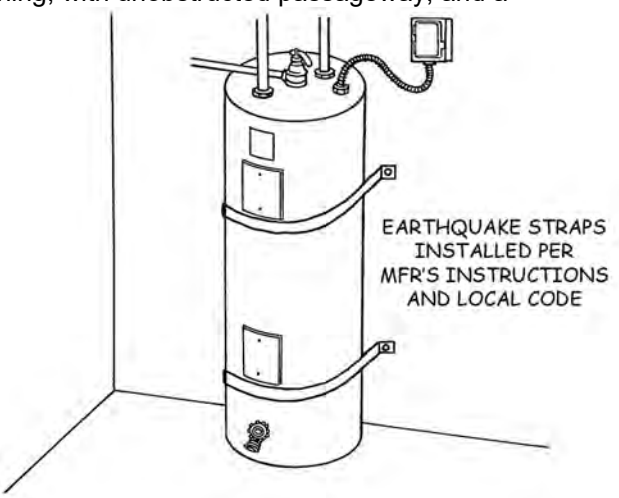
- **The tank shall be installed:**
  - Plumb and level in a stable position.
  - With a minimum clearance per manufacturer's instructions.
  - With information labels and access panels facing outward.
  - The volume and pressure of the water supplied to the appliance will be in accordance with manufacturer specifications.
- **Support**
  - Units supported from the ground shall rest on a level code-compliant base which extends at least 3" above the ground.

6. ACCESS TO UNIT

- **Units in Enclosures**
  - Access door shall be at least 24" wide, and high enough to allow removal of the existing appliance.
- **Units in Attics**
  - Access shall have a minimum 22" x 30" opening, with unobstructed passageway, and a minimum 30" x 30" working platform on the front service side of the water heater.

7. SEISMIC BRACING

- **All Tanks**
  - Unit shall be braced (strapped or anchored) to resist horizontal movement during an earthquake only when a replacement water heater is installed.
- **Bracing shall be:**
  - Installed per manufacturer's instructions and local code.
  - Securely attached to structural framing or ledger board.



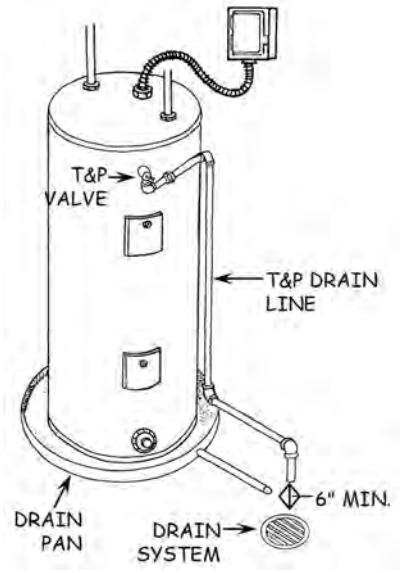
- **Strap Locations**
  - Two straps shall be installed: one within the upper third of the tank, and one within the lower third of the tank.
  - Strap shall not hinder removal of thermostat access covers.

8. PLUMBING

- **All Units**
  - All fittings and valves shall be installed using NEW materials per manufacturer's instructions and local code.
  - PEX tubing shall not be installed within the first 18" of piping connected to a water heater.
  - Threaded fittings shall be sealed with Teflon® tape or non-toxic pipe joint compound.
  - A cold water supply shutoff valve shall be installed if not present.
  - Flexible connectors shall be used to connect the tank to the rigid hot and cold water lines.
  - Dielectric insulators shall be installed on water piping connections to the tank, when required by local code.
  - Backflow prevention shall be installed in accordance with manufacturer specifications and in accordance with the authority having jurisdiction.

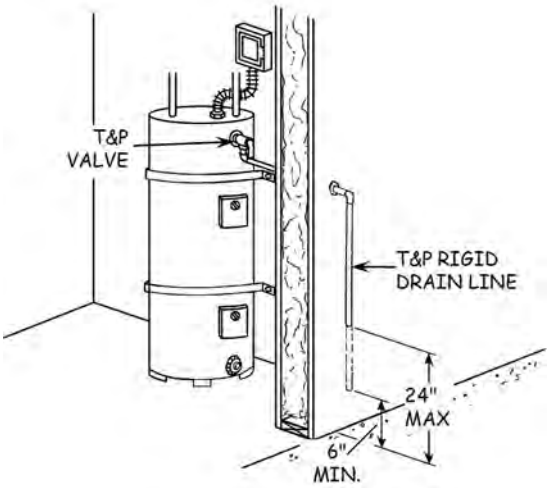
9. DRAIN PAN

- **Pan**
  - Drain pan shall be 4" in height if leakage is likely to cause damage to the home.
  - A watertight pan of corrosion-resistant material shall be installed when the water heater is located in:
    - An attic or on a floor-ceiling assembly, or
    - Other location for which a pan is required by local code.
- **Drain**
  - A minimum 3/4" diameter drain line from the pan shall be installed.
  - Line shall have a continuous downward slope to the exterior, or to a drain system, in accordance with local code.



10. TEMPERATURE AND PRESSURE REGULATION

- **Safety Controls**
  - One of the following shall be installed in conformance with the water heater manufacturer's instructions and local code:
    - A Temperature and Pressure (T&P) Relief Valve with drain line, or
    - An automatic gas shutoff valve and pressure-relief valve, when T&P valve and drain line are not feasible.
- **The T&P Relief Valve and Automatic Gas Shutoff Valve:**
  - Shall meet the sizing/pressure requirements of the water heater listing and be compliant with the requirements of the local jurisdiction.
- **T&P Relief Valve Drain Line**
  - Line shall be galvanized steel, hard drawn copper, or CPVC.
  - Internal diameter of the line and fittings shall equal or exceed diameter of the relief valve outlet.



- The line shall drain fully by gravity and shall not be trapped.
- Drain line shall terminate outside the building, or in an approved drain system, with the terminal end:
  - No *more* than 24", nor *less* than 6", above the surface, and
  - Unthreaded, and pointing downward.

- **House Line Pressure**
  - House line pressure shall be verified to be in compliance with Water Heater manufacturer's specifications.
  - A House Line Pressure Regulator shall be installed or replaced, when needed to limit water pressure to the tank at the specified maximum.
- **Expansion Tank**
  - A potable water expansion tank will be installed on the cold water side.
  - A direct connection with no valves between the storage tank and expansion tank will be installed in accordance with the authority having jurisdiction and according to manufacturer specifications.

11. ELECTRICAL SUPPLY

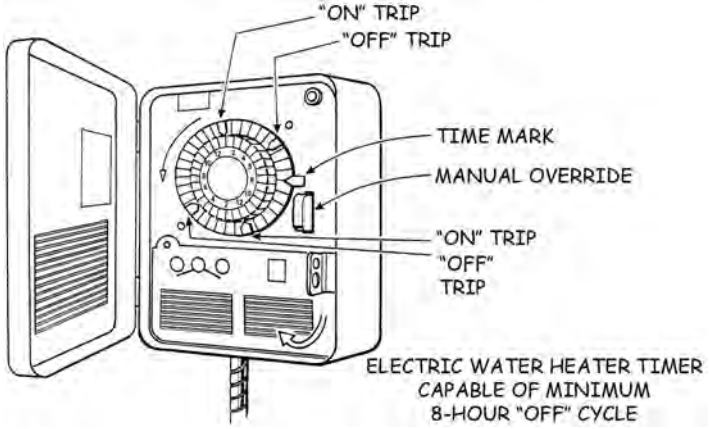
- **Electrical service shall be checked to ensure that a safe circuit with proper conductors and capacity is present or will be provided.**
- **All electrical wiring, disconnects, and overcurrent protection shall be in conformance with:**
  - Manufacturer's instructions, and
  - The California Electrical Code (CEC), and local code.
- **The branch circuit supplying power to the unit shall have:**
  - Capacity of at least 125% of the nameplate rating of the water heater.
  - Properly sized conductors for the overcurrent protection used.
- **The Water Heater shall be:**
  - Protected by a fuse or circuit breaker of the proper amperage rating.
  - Properly grounded to the electrical service.

12. THERMAL EFFICIENCY

- **Hot and Cold Water Pipes**
  - Pipe insulation shall be installed in accordance with CSD WIS Section 18 (Water Heater Pipe Insulation).
  - Heat traps shall be installed on the inlet and outlet piping where not provided by manufacturer.
- **Tank**
  - Replacement water heater shall have a minimum internal insulation of at least R-16; therefore, no external insulation shall be installed in accordance with CSD WIS Section 16 (Water Heater Insulation).
  - Because California regulations for internal tank insulation exceed the federal regulations, an external insulation blanket shall not be installed on a replacement water heater.

13. WATER HEATER TIMER

- **A Water Heater timer shall be installed:**
  - When prescribed by program policy. (See CSD Field Guide measure-specific policy for "Water Heater Timer—Electric.")
  - In compliance with CSD WIS Section 44 (Electric Water Heater Timers).



PART 2: MOBILE HOME CRITERIA

14. INSTALLATION

- **Water heater shall be:**
  - In compliance with requirements of the California Department of Housing and Community Development (HCD).
  - Water heater is not required to be listed/labeled for installation in a mobile home, unless required be HCD.
- **Access requirements and unit installation shall be in conformance with:**
  - Manufacturer's instructions, and
  - HCD requirements, and
  - Installation guidelines in this section.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

15. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

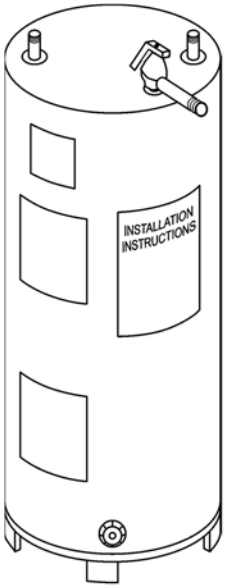
PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

16. APPLIANCE REMOVAL AND DISPOSAL

- **Requirements of the local jurisdiction shall be followed to:**
  - Remove old water heater and associated components.
  - Seal any unused chimney openings and penetrations.
  - Remove unused oil tank, lines, valves, and associated equipment.
  - All work shall be completed by a licensed plumbing professional where required by the authority having jurisdiction and installed to industry-accepted standards.
- **Shell or Structural Damage**
  - Any penetrations to the exterior of the home created by the installation of the replacement water heater shall be sealed.

17. OPERATIONAL CHECKS

- **Water Heater Operation/Commissioning**
  - The water heater shall be tested in compliance with manufacturer specifications and relevant industry standards and shall perform properly and safely.
- **Thermostat Temperature**
  - Thermostats shall be set at 120°F, *unless* higher temperature is requested by the client or is required for medical reasons, or as prescribed by local code.
- **Other Appliances**
  - Appliances turned off during the installation of the water heater shall be returned to standard operating condition.



MANUFACTURER'S INSTRUCTIONS AND WARRANTY BOOKLET PLACED IN MFR's PLASTIC JACKET AND ATTACHED TO TANK

18. CLIENT EDUCATION

- **Crew Responsibilities**
  - Completed work will be reviewed with the client.
  - Clients shall be educated on the safe and efficient operation and maintenance of the system, including:
    - Adjustment of water temperature and target temperature in accordance with local code.
    - Periodic drain and flush.
    - Expansion tank and backflow preventer (no client maintenance required).
    - Periodic inspection, maintenance, or replacement.

ELECTRIC WATER HEATER TIMERS

Lead Paint Risk Factor
NONE

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ELECTRIC WATER HEATER TIMERS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

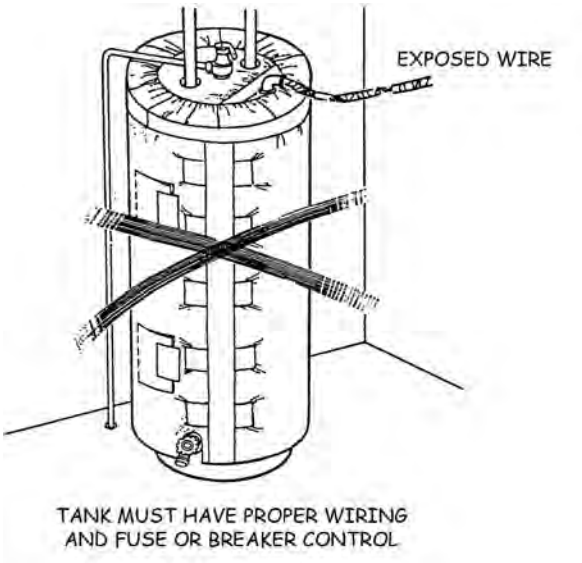
TIMER REPAIR

Not applicable to this measure.

TIMER INSTALLATION

1. WATER HEATER

- **Existing Water Heater Shall Have:**
  - Electric resistance heating coils.
  - Properly installed temperature and pressure (T&P) valve.



2. ELECTRICAL WIRING

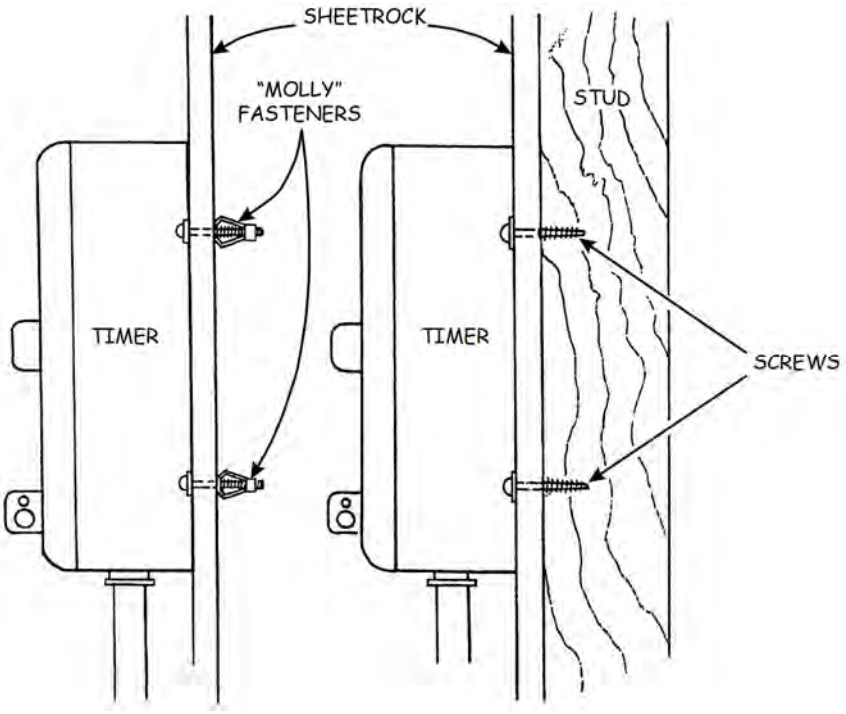
- **All Units**
  - Wiring shall be properly sized for the electrical load.
  - Wiring shall conform to local code (HCD requirements for Mobile Homes).
  - Heater shall be connected to fuse box or electric service breaker with proper overcurrent protection.
  - Exposed wiring shall be enclosed in conduit/raceway.
  - Conduit and timer housing/box in locations exposed to the elements shall be rated for outdoor installation.

3. LOCATION

- **Exposure**
  - Timer and water heater shall be located in protected area (not exposed to weather):
    - Indoors, or
    - Inside an outdoor enclosure, or
    - In an outdoor covered area in which the roof or overhang extends away a minimum of 4' on all exposed sides.
- **Weather Protection for Timer**
  - Outdoor installation of the timer is allowed only when access to the water heater would otherwise be difficult for occupants (e.g., tank located under the house, with restricted crawlspace access).
  - Timer shall be protected from the weather.
  - Timer and housing shall be rated for installation in the type of location in which it is mounted (damp or wet location).
  - Electrical wiring shall be protected from the weather (e.g., with waterproof conduit and fittings) and properly secured.
- **Support**
  - Tanks supported from the ground shall rest on a code-compliant base that extends 3” above the ground. See CSD WIS Section 43 (Water Heater—Storage Electric).

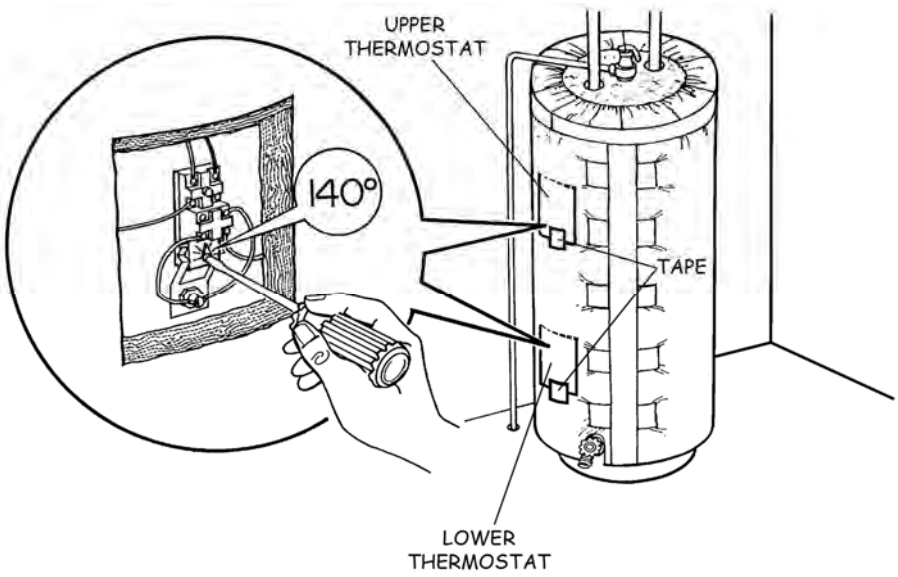
4. MOUNTING TIMER

- **Timer shall be securely mounted to:**
  - Framing members or solid wood sheathing with screws, or
  - Gypsum with anchoring devices (e.g., drive anchors, “molly bolts” or other expansion anchors).
- **Mounting of timer on Water Heater**
  - Acceptable only when allowed by manufacturer's instructions.



5. SETTINGS

- **Temperature Setting**
  - Water heater thermostats shall be set to a maximum of 140°F, *unless* specified otherwise by health and safety code.
- **Timer Settings**
  - Timer setback period shall be 8 hours minimum.



PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Mobile Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

6. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.
- **All Multi-Family Water Heaters**
  - Installation of water heater timers shall be determined by Energy Audit only, in compliance with the CSD Field Guide Energy Audit Policies.

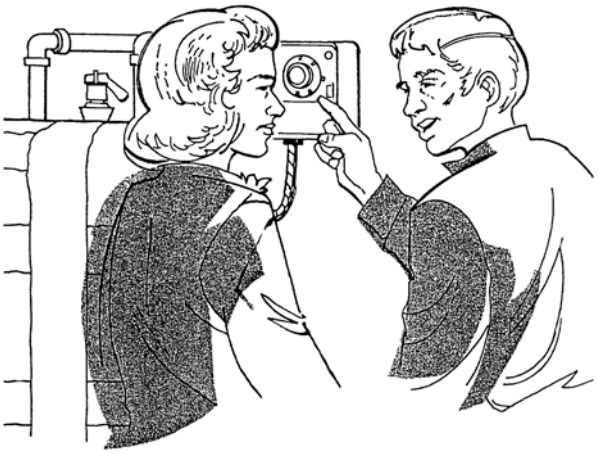
PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

7. OPERATIONAL CHECKS

- **All Units**
  - Timer shall be checked to ensure proper operation.
  - Timer shall be set to accommodate client's hot water requirements (minimum two setback cycles per day).

8. CLIENT EDUCATION

- **Clients shall be educated on proper use of thermostat including:**
  - Proper use of water heater timer (as applicable).
  - Installers shall allow for client comfort in programming the timer.



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NOTES

SHOWERHEADS AND FAUCET AERATORS

Lead Paint Risk Factor
NONE

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SHOWERHEADS AND FAUCET AERATORS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

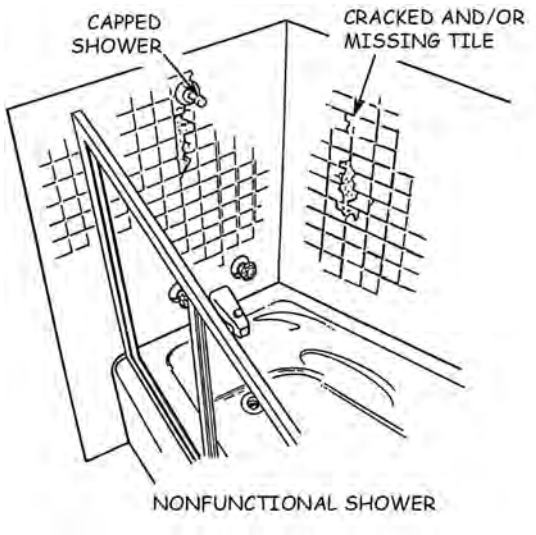
SHOWERHEAD AND AERATOR REPAIR

Not applicable to this measure.

SHOWERHEAD INSTALLATION

1. INSTALLATION LIMITATIONS

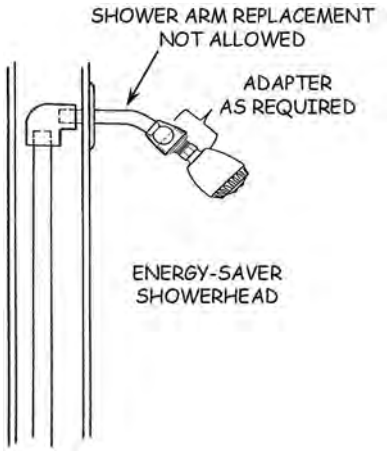
- **Functional Showers**
  - Energy-saver showerheads shall be installed on all functional showers that have showerheads with flow rates exceeding 2.0 GPM.
  - House line pressure shall be within manufacturer's specification for minimum and maximum water pressures to achieve listed flow rate.
  - Installer pre-work assessment shall be conducted to determine if plumbing needs correction before installing high-efficiency shower head or faucet.
    - Corrections must be within the Weatherization Program scope.
- **Non-functional Showers**
  - Energy-saver showerheads shall not be installed on showers which are not functional or not acceptable due to:
    - Plumbing defects (e.g., capped pipe or missing shower arm), or
    - Physical defects that are likely to result in water leaks (i.e., broken or missing tiles, hole in the wall/surround, etc.).
    - Piping shall not be in such poor condition that showerhead installation could cause plumbing problems.
    - Shower arms shall not be made of plastic, nor require removal or replacement.



2. GENERAL INSTALLATION

- **General Requirements**
  - Equipment shall be installed in accordance with manufacturer specifications and meet all applicable local codes.
  - Repair or replace shower diverter, if needed.
  - When a thermostatic shower valve (TSV) is installed in conjunction with an energy-saver showerhead, installation of the TSV (and adapter if used) shall be in compliance with CSD WIS Section 51.
- **Replacement Showerheads**
  - Features shall be selected that meet any special needs of the occupant (e.g., shut-off, swivel, handheld showers).
  - If multiple heads are provided in a single shower, the total flow rate for all showerheads in that shower shall not exceed 2.5 GPM.

- **All Showerheads**
  - Remove existing showerhead.
  - Evaluate debris that might clog showerhead.
  - Clean threads on the shower pipe.
  - Threaded fitting shall be sealed with Teflon® tape.
  - Thread the new showerhead onto the shower pipe.
- **Shower Arms**
  - Shower arms shall not be removed or replaced.
- **Shower Arm Adapters**
  - Adapters shall be installed when required for installation of energy-saver showerheads.



3. HAND-HELD SHOWERHEADS

- **Installation**
  - Showerhead shall attach to the shower arm, not the wall.
  - Acceptable to install when:
    - Required due to client's physical limitations, or
    - Pre-existing showerhead is hand-held and is defective.
  - House line pressure shall not exceed manufacturer's specified maximum.

FAUCET AERATOR INSTALLATION

4. GENERAL INSTALLATION

- **Shall be installed only on faucets that provide hot water intended for human consumption.**
  - Close the sink drain to prevent loss of parts.
  - Unscrew the nozzle beneath the spout in a counterclockwise direction.
    - Prevent damage to faucet finish (if using pliers).
  - Follow manufacturer's instructions for installation of washers and new aerator.
    - Threaded fitting shall be sealed with one layer of Teflon® tape, when feasible.
    - Thread the new aerator with nozzle onto spout and hand tighten. Avoid cross-threading.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Standards for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

5. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

6. OPERATIONAL CHECKS

- **Performance**
  - Installed showerheads, shower arm adapters, and faucet aerators shall function properly and satisfy the client.
  - Client's acceptance of the showerhead and/or aerator shall be documented.
  - Threaded connections shall not leak.
    - If leak is present, tighten in small increments until leaking stops. Do not over-tighten.

7. POST-INSTALLATION

- **Repairs**
  - Any penetrations to the exterior of the home created by the installation of the equipment shall be sealed.
  - Any damage done to the dwelling during installation shall be repaired.
- **Decommissioning**
  - Replaced shower heads and faucet aerators will be recycled or disposed of properly.
  - Replaced showerheads shall not be left in the dwelling.
- **Client Education**
  - Client shall be supplied with both verbal and written instructions for proper operation and maintenance for all measures installed.
  - Clients shall be given written documentation that describes components of the system, maintenance requirements, safety considerations, and warranty, at a minimum.

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NOTES

SHADE SCREENS

Lead Paint Risk Factor
NONE

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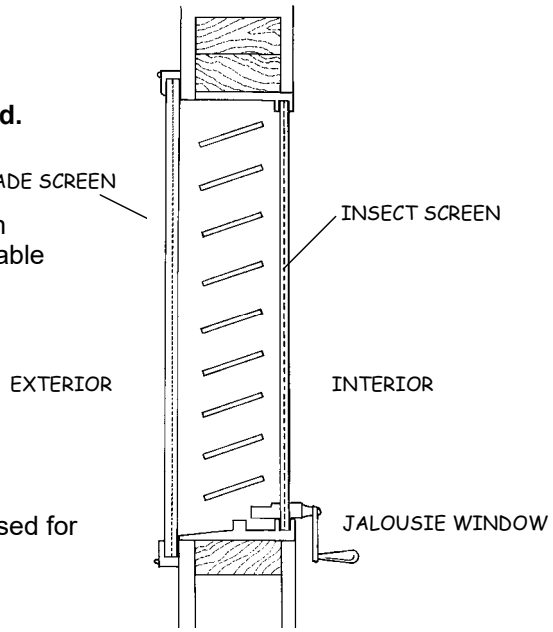
SHADE SCREENS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

SHADE SCREEN REPAIR



1. REPLACEMENT OF EXISTING SCREENS

- **Patching of an existing screen shall not be allowed.**
- **Bent or damaged frames shall not be re-used.**
- **Single and Double Hung Windows**
  - Replacement of existing exterior screen material in existing frames with shade screen fabric is acceptable when:
    - Existing screen serves the entire window.
    - Existing frame meets material requirements in CSD WIS Appendix A (Material Specifications), and is not otherwise bent or damaged.
- **Jalousie, Casement, or Awning Windows**
  - Existing interior insect screen frame shall not be used for shade screen.

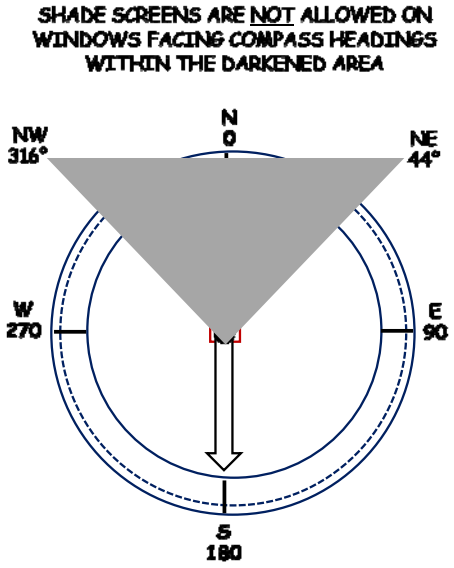
SHADE SCREEN INSTALLATION

2. ALL WINDOWS

- **Prime Windows**
  - Existing unit's frame, sashes, and panes shall be structurally sound.
  - Water penetration points shall be sealed.
  - Limited dry rot damage to the window frame shall be repaired before the shade screen installation in accordance with the Limited Home Repair measure-specific policy.

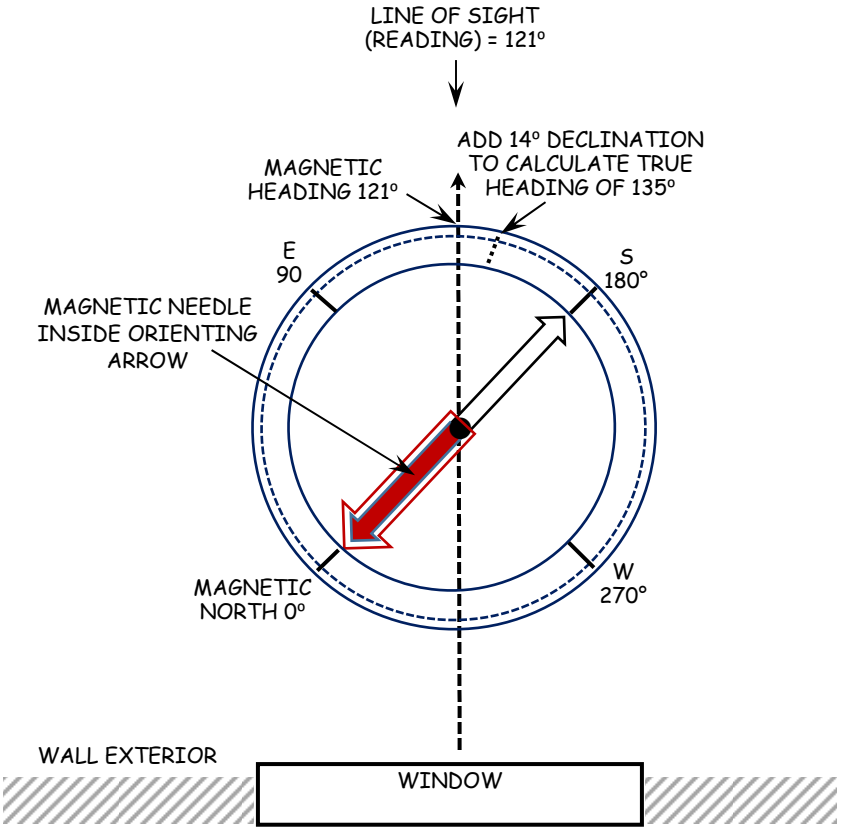
3. INSTALLATION LIMITATIONS

- **All Shade Screens**
  - Shade screens shall be installed only on windows that
    - Face within 135° of true south:
      - Toward the east, 45° through 180°, and
      - Toward the west, 180° through 315°.
    - Are shaded no more than 50% (e.g., from overhang, side fins, trees, vegetation, etc.).



4. DETERMINING WINDOW ORIENTATION

- **Cell Phone Compass Application Procedure**
  - When using a cell phone compass application, first set phone to read true north before taking a reading, using the procedure described below.
- **Procedure for All Compass Types**
  - Follow compass manufacturer's instructions.
    1. Stand with your back to the window being oriented.
    2. Hold compass/cell phone level by its base.
    3. Rotate the compass/cell phone until the red magnetic needle lines up inside the orienting arrow outline within the compass housing.
    4. When using a cell phone application, record the degree number sighted directly across the compass face (final reading); **OR**
    5. When using a magnetic compass, record the degree number sighted directly across the compass face, and then add the appropriate declination factor (final reading).
    6. When window orientation final reading is between 0° and 44° **OR** between 316° and 360°, windows in that wall do not qualify for a shade screen.
  - Note: All windows in a given wall have the same orientation, and therefore, do not require separate readings.



- **Declination Adjustment for a Magnetic Compass**
  - When using a magnetic compass, take a reading and then add the compass declination (correction factor) value from Table 46-1 to determine feasibility.
    - Select the geographic region from Table 46-1 that is closest to the dwelling location.
    - Add the corresponding number for that region to the compass reading.
    - Use the adjusted reading to determine measure feasibility.

- When using a declination-adjustable compass, it is acceptable to turn the compass housing with the orienting arrow to automatically account for the declination factor in accordance with Table 46-1 and manufacturer's instructions.

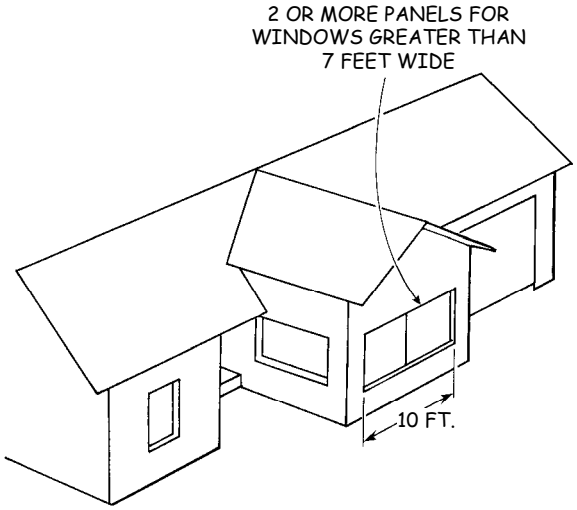
TABLE 46-1: DECLINATION* ADJUSTMENT BY REGION

Geographic Region for the Home Being Evaluated	Compass Declination* for that Region
Redding	+15º
Sacramento	+14º
Bakersfield	+13º
San Diego	+12º

* Declination is a "correction factor" that is added to a magnetic compass reading to indicate true north.

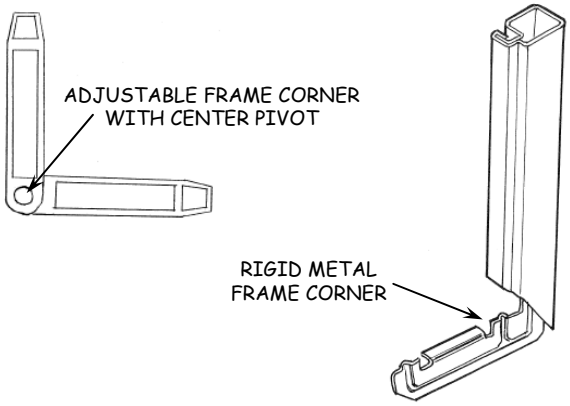
5. CONSTRUCTION AND INSTALLATION

- **All Shade Screens**
  - Shade screens shall be mounted on the exterior only.
  - A minimum of 1/2" space required between shade screen and glass.
  - The panes and window frame being treated shall be completely covered.
  - Bowing and warping not allowed.
  - Windows over 7' wide shall be covered with screening constructed of two or more panels.
  - Tension-mounted shade screens not allowed.



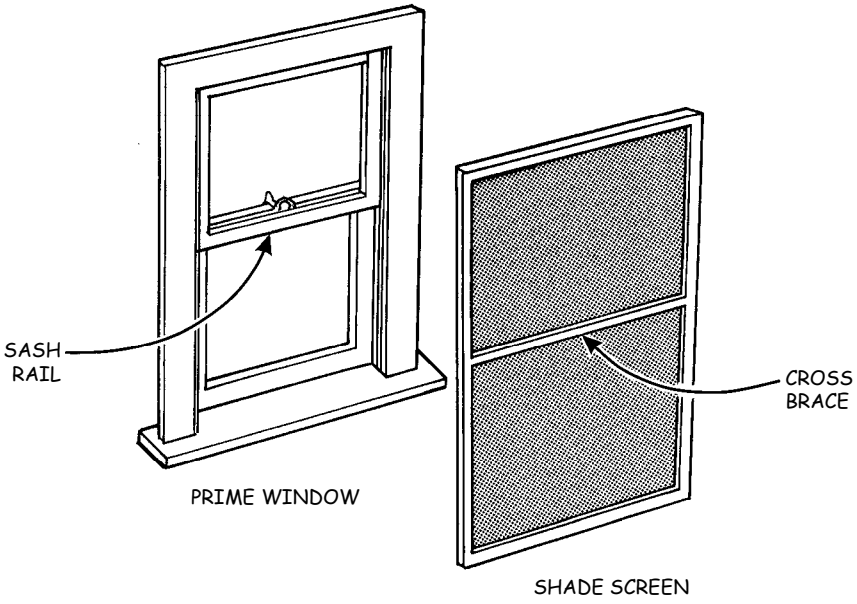
6. FRAME CORNERS

- **Frame corners shall be firmly and securely joined.**
  - Corners on rectangular frames shall be square.
  - Corners on rake windows shall be adjusted to match the lines of the window frame.
- **Square Corners**
  - Rigid metal internal frame corners shall be used; adjustable and plastic corners not allowed.
- **Angled Corners (Rake Windows)**
  - Adjustable internal frame corners are allowed.
    - May be durable, solid plastic (two legs riveted in the center), when adjustable metal frame corners are not available.
  - Angled corners may also be made without internal frame corners by:
    - Notching the frames so one piece of frame lays over the other, and
    - Securing them together with a pop-rivet.
  - Angled corners shall be adjusted for proper frame shape before the screen fabric is installed and the unit is secured to the window.



7. INTERNAL BRACING

- **All Shade Screens**
  - Bracing required in windows over 25 sq. ft.
  - Bracing shall align with meeting rails and mullions when present.



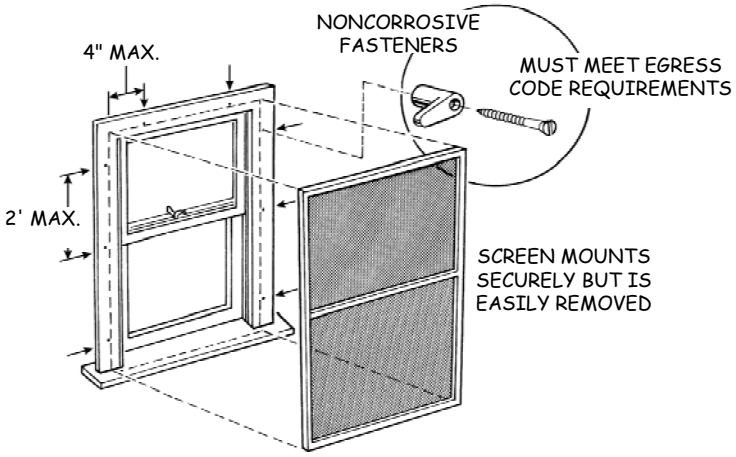
8. SCREEN FABRIC ATTACHMENT

- **All Shade Screens**
  - Screening shall be fastened to the frame in a manner to permit replacement of screen and spline.

9. FRAME ATTACHMENT

- **Attachment with Screws**
  - Required for installations on surfaces into which screws can be installed (e.g., wood trim and traditional thick cement stucco).
  - Screws shall not be installed in:
    - Vinyl windows, or
    - Exterior Insulation and Finish Systems (EIFS)—thin synthetic stucco over foam board.
  - Fasteners (rotating clips) and screws shall be made of corrosion-resistant metal materials; plastic fasteners not allowed.
  - Fasteners shall be compatible with screen frame and existing window hardware.
  - Barrel of rotating clip shall rest on mounting surface.
  - A minimum of four fasteners per screen required:
    - Within 4" of each corner on each side.
    - Spaced at intervals of no greater than 2'.

- **Attachment to Vinyl Windows**
  - U-channel brackets attached to window frame: Not allowed.
  - Hook-and-loop (e.g., Velcro®) attachment: Not allowed.
- **Shade Screens for Bedroom Windows**
  - Local code egress requirements, if any, shall be met (including code-approved attachments, if required).



PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

10. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

11. WORKMANSHIP REQUIREMENTS

- **All Shade Screens**
  - Screens shall be:
    - Square, plumb, and in alignment with existing window.
    - Securely mounted, but easily removable.
  - Screen fabric shall be straight and tight within the frame.
  - If heavier lines are present in the fabric, they shall be positioned vertically.

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NOTES

WINDOW FILM

Lead Paint Risk Factor
NONE

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WINDOW FILM

PART 1: PRE-INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

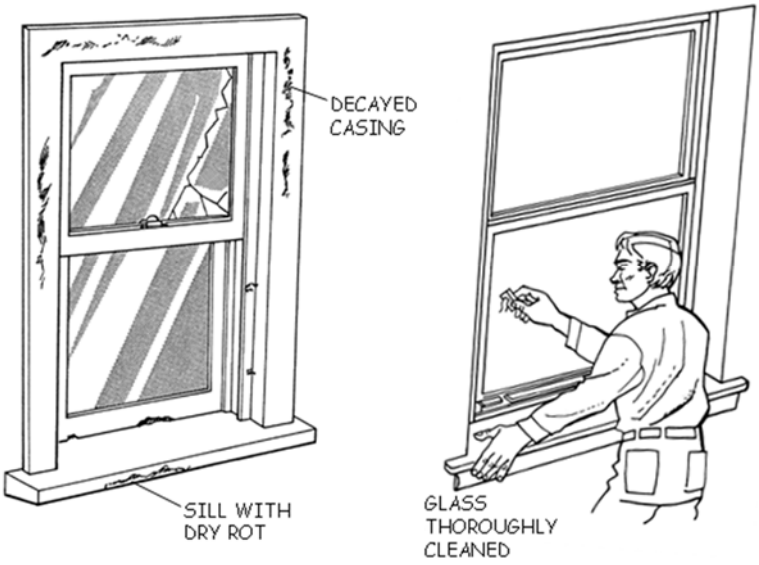
WINDOW FILM REPAIR

Not allowed for this measure.

WINDOW FILM INSTALLATION

1. PRE-INSTALLATION REQUIREMENTS

- **All Windows**
  - Existing panes, sashes, and frame shall be structurally sound.
  - Glass surface shall be:
    - Free of cracks, holes, and blemishes.
    - Scraped to remove all paint spots, etc.
    - Cleaned thoroughly to remove all grease and dirt.
      - Window film manufacturer's instructions shall be followed.
      - Cleaners containing ammonia or vinegar shall not be used, unless specifically allowed by film manufacturer.

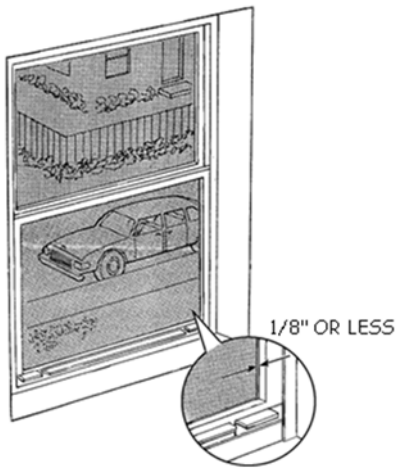


2. INSTALLATION LIMITATIONS

- **All Windows**
  - Film shall be installed only on windows which:
    - Face within 135 degrees of true south (determine window orientation in conformance with CSD WIS Section 46, Shade Screens).
    - Are shaded no more than 50% (e.g., from overhang, side fins, trees, vegetation, etc.).
  - Film shall be installed only on the interior surface of single-pane windows.

3. FRAME CLEARANCE

- **All Windows**
  - Maximum distance between window frame and film shall be less than 1/8".
  - Film must not touch window frame material (i.e., wood, metal, plastic mullions or sash).



4. SEAMS

- **All Windows**
  - A single sheet shall be applied to all windows less than 60" in width or height.
  - All splices shall be installed to manufacturer's specifications.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

5. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

6. APPEARANCE CHECK

- **Proper Installation**
  - Installed film shall have uniform appearance without streaks, wrinkles, pinholes, spots or discoloration.

MECHANICAL VENTILATION (WHOLE-HOUSE)

Lead Paint Risk Factor
LOW

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MECHANICAL VENTILATION (WHOLE-HOUSE)

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

MECHANICAL VENTILATION REPAIR

Not applicable to this measure.

TASK 1: CALCULATION OF WHOLE-HOUSE MECHANICAL VENTILATION AIR REQUIREMENT

1. GENERAL REQUIREMENTS

- **Qualifying Homes**
  - The mechanical ventilation system (fan, duct, wiring, and controls) shall be installed in accordance with the manufacturer's instructions and local code.
  - Structural integrity of the home shall be maintained (e.g., roof trusses, walls, floor joists).
  - All existing local exhaust fans and clothes dryers (gas or electric) within the living space shall be ducted to the outdoors.
  - Leakage to the house from other spaces shall be prevented (particularly from the garage, as well as unconditioned attic and crawlspace, etc.).
  - The door between the garage and living space shall be weatherstripped.
- **Fan Airflow (CFM) Measurement**
  - Airflow measurements for whole house and local ventilators (new and existing) shall be conducted using an appropriate airflow measuring device, as prescribed in CSD WIS Appendix A (Material Specifications).
  - The measuring device must be appropriate for the airflow (cfm) and air pressure (Pa) being measured, and for appropriate airflow (exhaust, supply, or balanced).
  - Manufacturer's instructions shall be followed regarding:
    - Capability and limitations of the airflow measuring device, and
    - Proper operating procedure.

2. WHOLE-HOUSE FINAL MECHANICAL VENTILATION AIR REQUIREMENT

- **Calculation Overview**
  - The whole-house ventilation airflow (CFM) requirement is determined by using Equation 49-1:

Equation 49-1:	Whole-house Final Ventilation Air Requirement CFM = [(Initial Ventilation Air Requirement) + (Local Exhaust Adjustment)] – (Infiltration Credit)

3. INITIAL WHOLE-HOUSE VENTILATION AIR REQUIREMENT

- **Initial Whole-House Continuous "Ventilation Air Requirement" in CFM**
  - The required CFM shall be determined by using Equation 49-2 or Table 49-1.
  - The Equation and Table assume two persons in the first bedroom (or studio apartment), and one person per additional bedroom. When higher occupancy density is known, 7.5 CFM is added for each additional person.

Equation 49-2:	Initial Ventilation Air Requirement CFM = (0.03 x Sq. Ft.) + [7.5 x (# BR + 1)]

Sq. Ft.	=	Sq. ft. of living space, from interior room measurements, or exterior wall measurements
# BR	=	Number of bedrooms in the home
Use (# BR + 1) or actual number of occupants, if higher (e.g., use "4" if a 2-BR house has four occupants).		

TABLE 49-1: INITIAL VENTILATION AIR REQUIREMENT

Floor Area Sq. Ft.	Number of Bedrooms				
	0–1	2	3	4	5
<500	30 CFM	38 CFM	45 CFM	53 CFM	60 CFM
501 – 1000	45 CFM	53 CFM	60 CFM	68 CFM	75 CFM
1001 – 1500	60 CFM	68 CFM	75 CFM	83 CFM	90 CFM
1501 – 2000	75 CFM	83 CFM	90 CFM	98 CFM	105 CFM
2001 – 2500	90 CFM	98 CFM	105 CFM	113 CFM	120 CFM
2501 – 3000	105 CFM	113 CFM	120 CFM	128 CFM	135 CFM
3001 – 3500	120 CFM	128 CFM	135 CFM	143 CFM	150 CFM
3501 – 4000	135 CFM	143 CFM	150 CFM	158 CFM	165 CFM
4001 – 4500	150 CFM	158 CFM	165 CFM	173 CFM	180 CFM
4501 – 5000	165 CFM	173 CFM	180 CFM	188 CFM	195 CFM

TASK 2: LOCAL EXHAUST ADJUSTMENT

4. KITCHEN AND BATHROOM FANS

- **All Homes**
  - Evaluations shall be made of the kitchen, and for each full bathroom (with a bathtub or shower).
  - Calculations shall be made to account for "CFM deficits" of exhaust fans (actual CFM that is less than the CFM prescribed in Items 5 and 6).
  - Credit of 20 CFM is allowed for each openable window in the kitchen or full bathrooms.
  - Repair and Installation of Exhaust Duct and Termination
    - All exhaust fans and clothes dryers shall be correctly ducted to the outdoors with a proper termination.
    - Fan CFM measurement (to calculate CFM Adjustment) shall occur after duct repair or installation work is complete.

5. KITCHEN CFM ADJUSTMENT

- **Procedure**
  - Measure the CFM of existing exhaust fan (kitchen exhaust/range hood). That is the "Measured CFM."
  - Determine if there is an openable window in the kitchen.
  - "Kitchen CFM Adjustment" is calculated using Equation 49-3 (answer may be negative).
    - If "Measured CFM" exceeds 100, use 100. (Any CFM above 100 is disregarded.)
    - If there is no operable exhaust fan present, "Measured CFM" = zero.

- When one or more openable windows are present in the kitchen area, the "window credit" is 20 CFM. When there is no window, the credit = zero CFM.

Equation 49-3:	Kitchen CFM Adjustment = 0.25 x [(100 CFM) (Measured CFM + Window Credit)]

6. BATHROOM CFM ADJUSTMENT

- **Procedure**
  - Measure CFM of existing exhaust fan in each full bathroom (ignore half-bathrooms where no bathtub or shower is present). That is the "Measured CFM."
  - For each full bathroom, the "Bathroom CFM Adjustment" is calculated using Equation 49-4.
    - If "Measured CFM" exceeds 50, use 50 (any CFM above 50 is disregarded).
  - If there is no operable exhaust fan present—or if CFM cannot be determined—"Measured CFM" = zero CFM.
  - When one or more operable windows are present in the bathroom, the "window credit" is 20 CFM. When there is no window, the credit = zero CFM.
- **"Total Bathroom CFM Adjustment"**
  - Equation 49-4 is applied to each *full* bathroom in the home.
  - The sum of the answers is the "Total Bathroom CFM Adjustment."

Equation 49-4	Bathroom CFM Adjustment = 0.25 x [(50 CFM) – (Measured CFM + Window Credit)]

7. TOTAL LOCAL EXHAUST CFM ADJUSTMENT

- **Procedure**
  - The Total Local CFM Adjustment is calculated using Equation 49-5.
  - The value must be zero or a positive number; if the answer is negative, the value = zero CFM.

Equation 49-5:	Total Local CFM Adjustment = (Kitchen CFM Adjustment) + (Total Bathroom CFM Adjustment)

TASK 3: OPTIONAL SHELL LEAKAGE EVALUATION FOR INFILTRATION CREDIT

8. INFILTRATION CREDIT

- **Feasibility**
  - The Infiltration Credit is an alternative compliance path under ASHRAE 62.2 (2016) for horizontally attached multi-family units and detached single-family dwellings only.
  - Calculation of the Infiltration Credit is Optional within CSD's weatherization programs.
  - The Infiltration Credit shall be calculated using the CSD 540C (Mechanical Ventilation Calculator) only, which requires the form to be operated with Microsoft Excel due to the complexity of the required ASHRAE 62.2 calculations.
- Procedure
  - The Infiltration Credit is a 7-Step Procedure that is outlined below:
- Step-1: Feasibility
  - Identify dwelling unit type (i.e., single-family (detached) or multi-family (horizontally attached). If unit is not one of these, the Infiltration Credit is not feasible.
    - Confirm that any attached walls to another unit are only attached horizontally (via walls). Vertically stacked units do not qualify for the Infiltration Credit.
- Step-2: Effective Leakage Area
  - Perform a RESNET 800 single-point Blower Door® test (CSD Field Guide Appendix C) final Blower Door test *after* shell tightening measures have been installed.

- Measure the CFM leakage at 50 Pa of house pressure and record the reading on the CSD 540C Infiltration Credit Calculator.
- Calculate the Effective Leakage Area with the Equation 49-6 below:

Equation 49-6:	Effective Leakage Area = (0.000381) x (RESNET 800 Blower Door Reading in CFM50.)

- Step-3: Normalized Leakage
  - Calculate the Normalized Leakage with the Equation 49-7 below:

Equation 49-7:	Normalized Leakage = 1000 x (Effective Leakage Area/Dwelling Unit Floor Area) x (Dwelling Height ÷ 8.2)$^{0.4}$

  - Where:
    - Dwelling Unit Floor Area (ft.^{2}) = All above-grade and below-grade finished areas, only if they are living space and finished in a manner similar to the rest of the dwelling.
    - Dwelling Unit Height (ft.) = Total vertical distance between the lowest point and highest point, above-grade, within the pressure boundary. Exclude unconditioned attic spaces.
- Step-4: Weather & Shielding Factor
  - Select the Weather Station Factor (WSF) from Table 49-3 that is geographically closest to the dwelling's location.

TABLE 49-3: WEATHER & SHIELDING FACTOR (WSF)

Nearby City	Weather Station	CEC Climate Zone	Zip Code	WSF
IDENTIFY CLOSEST CITY TO DWELLING				
Alturas	Alturas	**16**	96101	0.59
Arcata/Eureka	Arcata Airport	**1**	95519	0.56
Bakersfield	Bakersfield Meadows Field	**13**	93308	0.43
Bishop	Bishop Airport	**16**	93514	0.55
Blythe	Blythe Riverside County Airport	**15**	92225	0.48
Burbank	Burbank–Glendale–Pasadena Airport	**9**	91505	0.39
Camarillo	Camarillo	**6**	93010	0.43
Camp Pendleton	Camp Pendleton	**10**	92055	0.4
Carlsbad	Carlsbad/Palomar	**7**	92011	0.38
China Lake	China Lake National Air Field	**14**	93555	0.52
Chino	Chino Airport	**10**	91710	0.45
Chula Vista	Chula Vista Brown Field NAAS	**7**	91910	0.4
Concord	Concord–Buchanan Field	**12**	94520	0.53
Crescent City	Crescent City Airport	**1**	95531	0.6
Daggett	Daggett Barstow–Daggett Airport	**14**	92327	0.58
Edwards	Edwards Airforce Base	**14**	93516	0.59
Emigrant Gap-Blue Canyon	Blue Canyon-Nyack Airport	**16**	95715	0.44
Emigrant Gap-Truckee-Tahoe Arpt	Truckee–Tahoe Airport	**16**	96161	0.66

Fairfield-Travis AFB	Travis Field Air Force Base	**12**	94535	0.67
Fresno	Fresno Yosemite International Airport	**13**	93727	0.45
Fullerton	Fullerton Municipal Airport	**8**	92833	0.34
Hawthorne	Jack Northrop Field	**8**	90250	0.38
Hayward	Hayward Air Terminal	**3**	94545	0.47
Imperial	Imperial	**15**	92251	0.46
Lancaster	Lancaster General William Fox Field	**14**	93536	0.62
Lemoore	Lemoore Reeves National Air Field	**13**	93246	0.5
Livermore	Livermore Municipal Airport	**12**	94550	0.53
Long Beach	Long Beach Daugherty Field	**6**	90712	0.38
Los Angeles-LAX	Los Angeles International Airport	**8**	90045	0.42
Marysville	Beale Airforce Base	**11**	95901	0.45
Merced	Merced/Macready Fld	**12**	95340	0.46
Modesto	Modesto City–County Airport	**12**	95354	0.47
Montague	Montague Siskiyou County Airport	**16**	96064	0.55
Monterey	Monterey National Air Field	**3**	93940	0.49
Mountain View	Mountain View Moffett Field	**4**	94043	0.45
Napa	Napa County Airport	**2**	94558	0.55
Needles	Needles Airport	**15**	92363	0.51
Oakland	Oakland Metropolitan Airport	**3**	94502	0.54
Oxnard	Oxnard Airport	**6**	93030	0.45
Palm Springs-Intl Arpt	Palm Springs International Airport	**15**	92262	0.45
Palm Springs-Thermal Arpt	Palm Springs Thermal Airport	**15**	92274	0.46
Palm Springs-Twentynine Palms	Twentynine Palms	**15**	92262	0.5
Palmdale	Palmdale Airport	**14**	93550	0.57
Paso Robles	Paso Robles Municipal Airport	**4**	93446	0.53
Point Mugu	Point Mugu National Air Field	**6**	93041	0.45
Red Bluff	Red Bluff Municipal Airport	**11**	96080	0.5
Redding	Redding Municipal Airport	**11**	96002	0.47
Riverside-March AFB	March Air Force Base	**10**	92503	0.43
Riverside-Municipal Arpt	Riverside Municipal Airport	**10**	92503	0.42
Sacramento-Executive Arpt	Sacramento Executive Airport	**12**	95822	0.51
Sacramento-Metropolitan Arpt	Sacramento Metropolitan Airport	**12**	95837	0.51
Salinas	Salinas Municipal Airport	**3**	93905	0.54
San Diego-Lindbergh	San Diego Lindbergh Field	**7**	92101	0.38
San Diego-Miramar	San Diego Miramar Natl Air Field	**7**	92145	0.39
San Diego-North Island	San Diego North Island Natl Air Field	**7**	92118	0.39
San Diego-Montgomery	San Diego/Montgomery	**7**	92123	0.39

San Francisco-San Francisco Arpt	San Francisco International Airport	**3**	94128	0.6
San Jose	San Jose International Airport	**4**	95110	0.48
San Luis Obispo	San Luis County Regional Airport	**5**	93401	0.51
Sandberg	Sandberg	**16**	93532	0.68
Santa Ana	Santa Ana John Wayne Airport	**8**	92707	0.36
Santa Barbara	Santa Barbara Municipal Airport	**6**	93117	0.44
Santa Maria-Lompoc	Lompoc	**5**	93455	0.55
Santa Maria-Public Arpt	Santa Maria Public Airport	**5**	93455	0.52
Santa Monica	Santa Monica Municipal Airport	**6**	90405	0.39
Santa Rosa	Santa Rosa	**2**	95403	0.49
South Lake Tahoe	South Lake Tahoe	**16**	96150	0.64
Stockton	Stockton Metropolitan Airport	**12**	95206	0.5
Ukiah	Ukiah Municipal Airport	**2**	95482	0.47
Van Nuys	Van Nuys Airport	**9**	91406	0.39
Visalia-Porterville	Porterville (AWOS)	**13**	93277	0.42
Visalia-Municipal Arpt	Visalia Municipal Airport	**13**	93277	0.43
Yuba City	Yuba County	**11**	95991, 93	0.5

- Step-5: Effective Annual Average Leakage Rate
  - Using values from the steps 2–4 above, calculate the Effective Annual Average Leakage Rate.

Equation 49-8:	Effective Annual Average Leakage Rate = Normalized Leakage x WSF x Dwelling Unit Floor Area / 7.3[4]

- Step-6: Measure and Calculate Exterior Dwelling Surface Areas to Obtain the Exterior Envelope Surface Area Reduction Factor
  - For single-family (detached) dwellings, the value of the Exterior Envelope Surface Area Reduction Factor shall default to 1.0
  - For multi-family (horizontally attached) dwellings:
    - Draw a sketch of the dwelling that identifies each wall, if helpful.
    - Measure each unattached exterior wall of the dwelling to obtain the dimensions.
    - Measurements for each wall should be provided in whole numbers (feet) and decimals (round to the whole inch).
    - Multiply (Length x Width) of each unattached wall to obtain the surface area and note on the CSD 540C “Total Surface Area” worksheet.
    - Add together the surface areas of all unattached walls.
    - Repeat the measurement and calculation process to determine the surface area of all horizontally attached walls. Add together the surface areas of all horizontally attached walls.
    - Repeat the measurement and calculation process to determine the surface area of the walls where a garage is attached. Add together these surface areas (if there is more than one wall attached to the unit’s garage).

- Total all attached and detached wall surface areas. This is equal to the "Total Surface Area."
- Using values from the steps above, calculate the Exterior Envelope Surface Area Reduction Factor.

Equation 49-9:	Exterior Envelope Surface Area Reduction Factor = $\frac{\text{Total Surface Area} - (\text{S. Area of Attached Walls} + \text{S. Area of Attached Garage Walls})}{\text{Total Surface Area}}$

- Step-7: Infiltration Credit
  - Using values from the steps 5 and 6 above, calculate the Infiltration Credit using the equation 49-10.
  - Round the value to the tenths place (for example: 25.873 would be represented as 25.9).

Equation 49-10:	Infiltration Credit = Effective Annual Average Leakage Rate x Exterior Envelope Surface Area Reduction Factor[4]

9. WHOLE-HOUSE FINAL VENTILATION AIR REQUIREMENT

- **Calculation**
  - In accordance with Equation 49-1 above, subtract the Infiltration Credit from the Initial Ventilation Air Requirement added to the Local Exhaust Adjustment.

    Whole-house Final Ventilation Air Requirement CFM =
    [(Initial Ventilation Air Requirement) + (Local Exhaust Adjustment)] – (Infiltration Credit)

  - This final calculation will provide the Whole House Final Ventilation Air Requirement, which will be the minimum fan size for the whole-house mechanical ventilation system.

TASK 4: WHOLE-HOUSE VENTILATION RUN-TIME—CONTINUOUS OR INTERMITTENT

10. RUN-TIME AND CFM CONSIDERATIONS

- **Unit Selection**
  - Intermittent run-time requires an increase in the fan airflow CFM.
  - Intermittent run-time (instead of continuous operation) shall be:
    - Based on client preference.
    - Selected after continuous and intermittent operation has been explained to the occupant.
- **CFM in Bathroom Location**
  - If the whole-house ventilation fan is installed in a bathroom:
    - It shall operate at a minimum of 50 CFM when the bathroom is occupied.
    - When the whole-house ventilation requirement is less than 50 CFM, a two-speed fan with motion sensor/switch shall be installed, so that airflow automatically elevates to at least 50 CFM when the bathroom is occupied.

11. CONTINUOUS CFM

- **Continuous Airflow**
  - Continuous airflow meets whole-house ventilation requirement with the lowest CFM.
  - The (Adjusted) Final Ventilation Air Requirement CFM is the required minimum continuous CFM for the whole-house mechanical ventilation system, calculated using Equation 49-11.
  - If the (Adjusted) Final Ventilation Air Requirement is 15 CFM or less, a whole-house mechanical ventilation fan is not required, per CSD policy.

Equation 49-11:	Final Ventilation Air Requirement CFM = [Initial Fan CFM (Eq. 49-1 or Table 49-1)] + [Total Local CFM Adjustment (Eq. 49-5)] (Eq. 49-10)]

12. INTERMITTENT CFM—MINUTES-PER-HOUR (M-P-H)

- **Intermittent Airflow**
  - Intermittent fan programming requires increased fan size/capacity (in CFM).
  - Intermittent M-P-H Fan CFM is based on the "Final Ventilation Air Requirement CFM," and the resulting increased CFM is determined using Table 49-4.
- **Minutes-per-Hour Runtime ("M-P-H Runtime")**
  - Fan shall operate once every hour for the M-P-H Runtime (in minutes) from Table 49-4.
  - The higher the CFM, the shorter the runtime.

TABLE 49-4: MINUTES-PER-HOUR (M-P-H) RUNTIME

Continuous Fan CFM	Intermittent Fan CFM and M-P-H Runtime*													
	30 CFM	40 CFM	50 CFM	60 CFM	70 CFM	80 CFM	90 CFM	100 CFM	110 CFM	120 CFM	130 CFM	140 CFM	150 CFM	160 CFM
30 CFM	60	45	36	30	26	23	20	18	16	15	14	13	12	11
35 CFM	NA	53	42	35	30	26	23	21	19	18	16	15	14	13
40 CFM	NA	60	48	40	34	30	27	24	22	20	18	17	16	15
45 CFM	NA	NA	54	45	39	34	30	27	25	23	21	19	18	17
50 CFM	NA	NA	60	50	43	38	33	30	27	25	23	21	20	19
55 CFM	NA	NA	NA	55	47	41	37	33	30	28	25	24	22	21
60 CFM	NA	NA	NA	60	51	45	40	36	33	30	28	26	24	23
65 CFM	NA	NA	NA	NA	56	49	43	39	35	33	30	28	26	24
70 CFM	NA	NA	NA	NA	60	53	47	42	38	35	32	30	28	26
75 CFM	NA	NA	NA	NA	NA	56	50	45	41	38	35	32	30	28
80 CFM	NA	NA	NA	NA	NA	60	53	48	44	40	37	34	32	30
85 CFM	NA	NA	NA	NA	NA	NA	57	51	46	43	39	36	34	32
90 CFM	NA	NA	NA	NA	NA	NA	60	54	49	45	42	39	36	34
95 CFM	NA	NA	NA	NA	NA	NA	NA	57	52	48	44	41	38	36
100 CFM	NA	NA	NA	NA	NA	NA	NA	60	55	50	46	43	40	38

* Fan must operate once every hour for the number of minutes shown in the body of the table. NA = Not allowed.

13. INTERMITTENT CFM—HOURS-PER-DAY (H-P-D)

- **Intermittent Airflow (CFM)**
  - Intermittent fan programming requires increased fan size/capacity (in CFM).
  - Intermittent H-P-D Fan CFM is increased, and is determined using Table 49-5.
- **Hours-Per-Day Runtime ("H-P-D" Runtime)**
  - Fan shall cycle on at least *1 hour every 3 hours*, and operate a minimum of *8 hours per day*.
  - Hours-per-day of fan operation are determined using Table 49-5.

TABLE 49-5: HOURS-PER-DAY (H-P-D) RUNTIME

Continuous Fan CFM	Intermittent Fan CFM and H-P-D Runtime*												
	40 CFM	50 CFM	60 CFM	70 CFM	80 CFM	90 CFM	100 CFM	110 CFM	120 CFM	130 CFM	140 CFM	150 CFM	160 CFM
30 CFM	18	14	12	10	9	8	8	8	8	8	8	8	8
35 CFM	21	17	14	12	11	9	8	8	8	8	8	8	8
40 CFM	24	19	16	14	12	11	10	9	8	8	8	8	8
45 CFM	NA	22	18	15	14	12	11	10	9	8	8	8	8
50 CFM	NA	24	20	17	15	13	12	11	10	9	9	8	8
55 CFM	NA	NA	22	19	17	15	13	12	11	10	9	9	8
60 CFM	NA	NA	24	21	18	16	14	13	12	11	10	10	9
65 CFM	NA	NA	NA	22	20	17	16	14	13	12	11	10	10
70 CFM	NA	NA	NA	24	21	19	17	15	14	13	12	11	11
75 CFM	NA	NA	NA	NA	23	20	18	16	15	14	13	12	11
80 CFM	NA	NA	NA	NA	24	21	19	17	16	15	14	13	12
85 CFM	NA	NA	NA	NA	NA	23	20	19	17	16	15	14	13
90 CFM	NA	NA	NA	NA	NA	14	22	20	18	17	15	14	14
95 CFM	NA	NA	NA	NA	NA	NA	23	21	19	18	16	15	14
100 CFM	NA	NA	NA	NA	NA	NA	24	22	20	18	17	16	15

*Fan must operate at least 1 hour every 3 hours, and the daily total shall equal the number of hours shown in the body of the table (minimum 8 hours per day). NA = Not allowed.

TASK 5: INSTALLATION REQUIREMENTS

14. EXISTING FAN

- **Whole-House Ventilation**
  - An existing fan may be used as a whole-house ventilator *only when* it conforms to the material specification criteria, per CSD WIS Appendix A (Material Specifications).
- **Local (Spot) Ventilation**
  - Measured CFM of an existing exhaust fan shall be used for the Local Ventilation Adjustment *only when* the fan is: (a) operable, and (b) ducted outdoors.
  - There is no requirement to replace substandard local exhaust fans or install local exhaust fans when they don't exist.
    - *Exception:* Kitchen Exhaust fans are installed, when qualifying by feasibility criteria.

15. FAN INSTALLATION

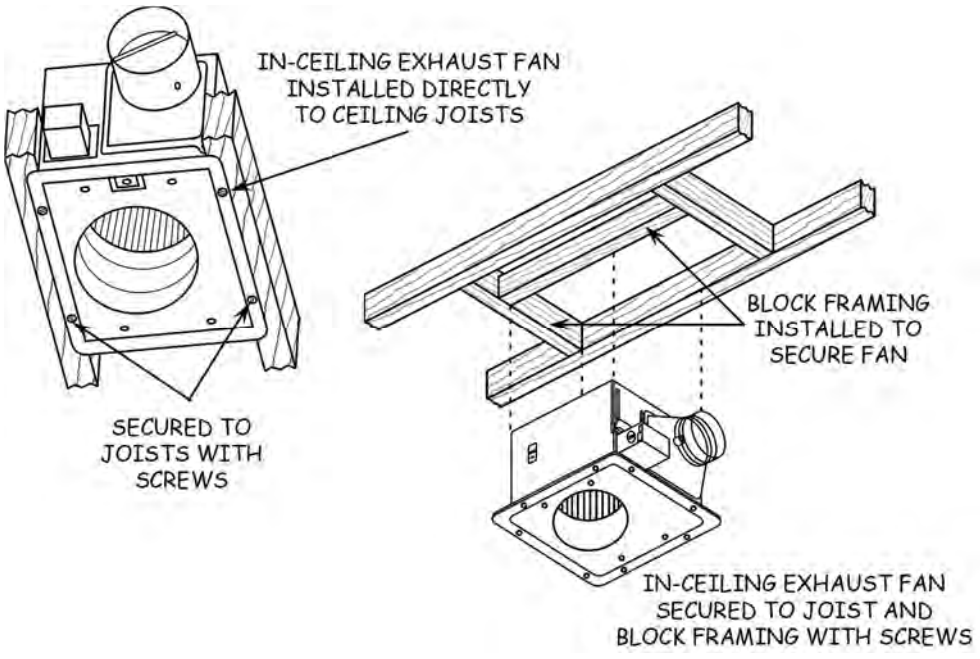
- **General Requirements**
  - Installation locations near moisture source (e.g., kitchen or bathroom) shall not violate manufacturer's recommendation (e.g., for HRV, ERV, or exhaust system).
  - Manufacturer-supplied hardware shall be used in accordance with manufacturer's instructions, unless otherwise specified or allowed by the fan manufacturer.
  - An existing fan location may be utilized for a new fan, if the old fan is completely removed, and proper ducting for the new fan can be installed.
  - The installation location must allow easy access for filter change and cleaning by the client, when required by the fan manufacturer.
- **Fan Selection**
  - Manufacturer's required clearance for the size of the fan selected shall be followed.
  - The mechanical ventilation system shall not cause excessive depressurization (see Item 28).
    - When depressurization is an issue, pressure relief shall be supplied by passive inlet venting, relief shall be supplied by door undercut, or a supply ventilator shall be installed instead of an exhaust ventilator.
  - When ACM are present:
    - Mechanical Ventilation shall be evaluated; and when feasible, installed in accordance with the CSD Asbestos Policy.
    - When ACM insulation (i.e., vermiculite) is in an attic, it is acceptable to install a *supply* or *balanced* ventilator as long as no ACM will be disturbed (exhaust ventilators shall not be installed).
    - In order to not deny a potentially feasible measure, it is strongly suggested that vermiculite material be tested for the presence of ACM.
- **Sound (Sone) Level**
  - Sound level for a continuously operating whole-house mechanical ventilation system shall not exceed 1.0 sone in accordance with ASHRAE 62.2.
    - Sone level certification shall be provided by fan manufacturer (e.g., listed on the ID label).
    - *Exceptions:*
      - A 1.2 sone in wall-mount supply fan is allowed, when a 1.0 sone product is not available.
      - The 1.0 sone limit does not apply to an in-line or remote fan with at least 4' of ducting between the fan unit and the indoor termination/grille.

14. FAN INSTALLATION (cont.)

- **Intake**
  - Supply fan intake grille shall be installed in a central location within the main body of the house.
  - Exhaust fan intake grille shall be installed in spaces where odor, moisture vapor, or other contaminants may be generated.
  - When multiple fans or intakes/supplies are installed, they shall be separated to draw/supply air in different parts of the living space.
- **Power Source**
  - Consideration shall be given to power source location, conductor size, current capacity, grounding, and overcurrent protection.
  - Prior to working with electrical components (fan, controller, etc.), power shall be turned off at it source (breaker or fuse).
  - Existing wiring shall be confirmed to be safe, and new wiring shall be properly installed and safe, as specified in Item 26.
- **Sealants**
  - Sealants shall be compatible with their intended surfaces (selected and installed in accordance with manufacturer's instructions and CSD WIS Appendix A).
  - Exterior gaps between terminal device and mounting surface (roof or wall) shall be sealed watertight, using weather-resistant materials (e.g., elastomeric caulk).
  - Interior gaps between register/grille and interior surface shall be sealed airtight.
  - Sealants shall be continuous and shall meet fire barrier specifications required by local code.
  - Gypsum edge shall be wetted before applying water-based sealant.
- **Mounting Screws for Fan Installation**
  - The unit shall be properly secured in accordance with manufacturer's instructions.
    - When attached to solid wood, screws shall minimum #8 and penetrate solid wood at least 5/8", or per manufacturer's instructions (if different).
    - When not attached to solid wood, compatible and appropriate fasteners shall be used (drywall anchor, molly bolt, toggle bolt, etc.).

16. IN-CEILING FAN INSTALLATION

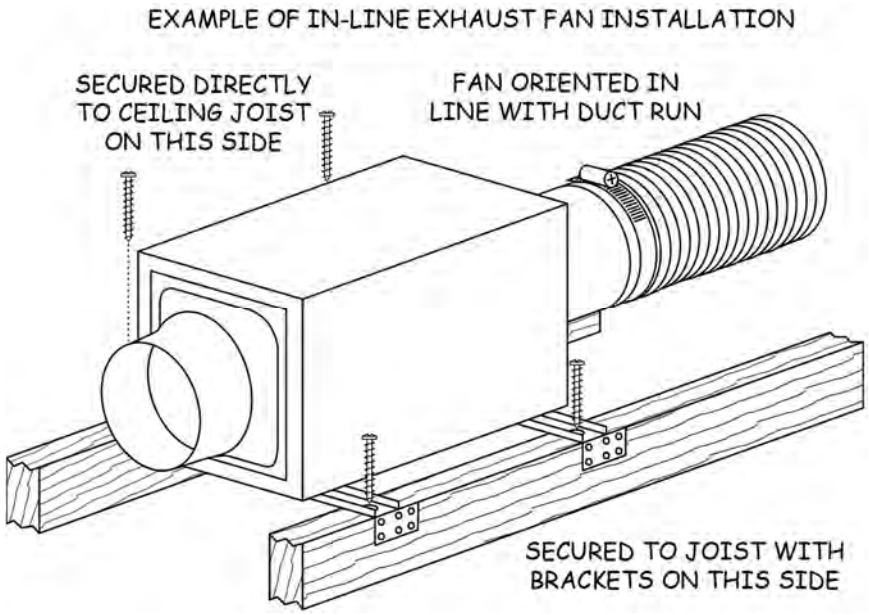
- **Backdraft Damper**
  - Shall be present and may be integral damper (part of the fan unit), or included in the termination (wall or roof cap assembly).
- **Flange Mount**
  - Fan shall be mounted:
    - Directly to ceiling joists, when spacing is appropriate and allowed by manufacturer, or
    - To block framing installed to accommodate fan dimensions.



- **Bracket Mount**
  - Unit shall be mounted and secured to ceiling joists using supplied mounting brackets, rough-in adapter, etc.
  - Fan mounted directly against joist:
    - Spacers shall be used when required to ensure that the fan assembly is mounted parallel to the joist.

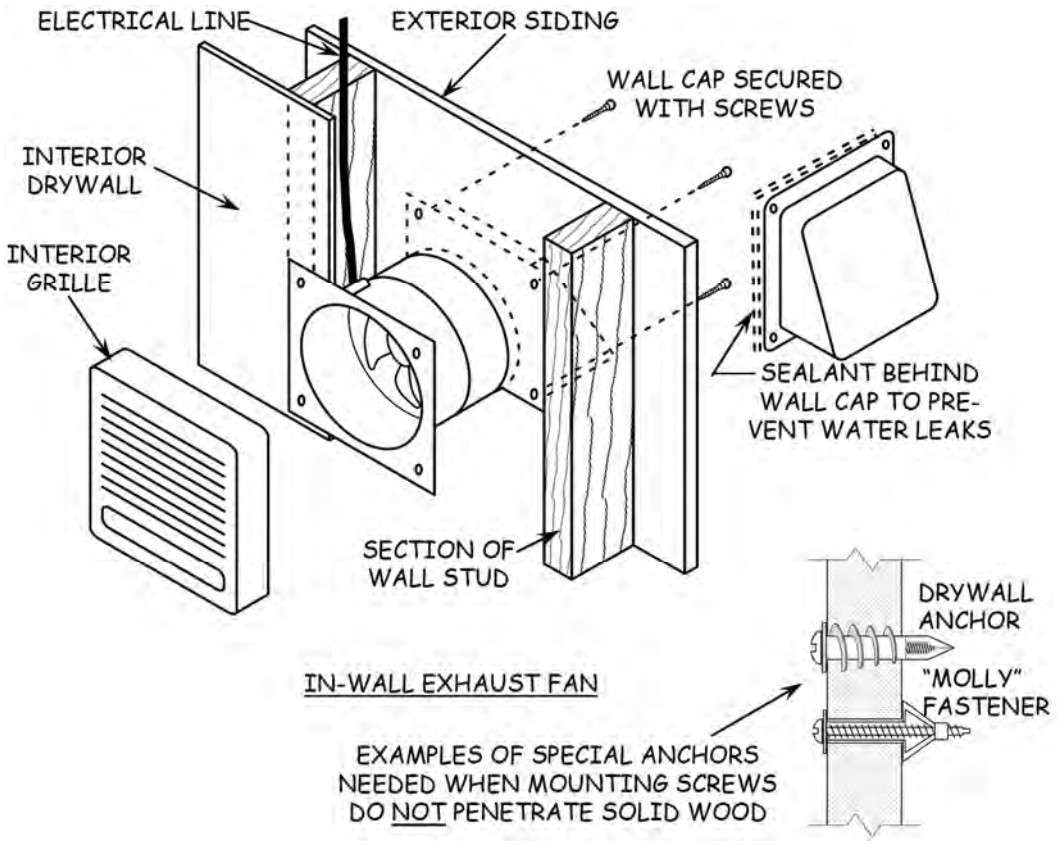
17. IN-LINE FAN INSTALLATION

- **Backdraft Damper**
  - For Exhaust systems, the damper shall be:
    - Located at the exterior wall or roof cap assembly.
    - Gravity controlled, so it blows open when the fan is operating, but it falls closed to keep out wind when the fan is off.
  - For Supply systems, a spring-loaded butterfly damper shall be installed that fits into the duct on the inlet side of the fan, so it pulls open when the fan is operating.
  - Damper shall be installed to open in the direction of the desired flow.
- **In-Line Fan Mount and Orientation**
  - Fan unit shall be mounted to framing members directly and/or with mounting brackets, spring-equipped hangers, or other devices recommended by the fan manufacturer.
  - Fan shall be oriented with duct run as short as possible, and must be accessible to client for service.
  - Fan shall be oriented with inlet toward the fan intake fitting.
  - Fan shall be isolated from the building framing, unless designed to be directly attached.
  - Fan will be installed remotely, with ducting that separates it from supply/exhaust register or grille.
- **Filter**
  - An accessible filter in compliance with Item 19 shall be installed.
- **Boot/Can to Interior Surface**
  - All gaps between boot/can and interior surface shall be air sealed.



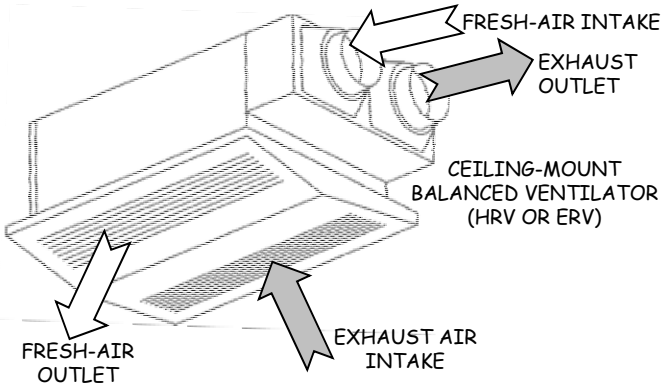
18. IN-WALL FAN INSTALLATION

- **Backdraft Damper**
  - Damper shall be present for exhaust systems within the fan or in the wall cap assembly.
- **Wall opening shall be:**
  - Adjacent to one stud to facilitate securing one edge of the housing to solid wood, as illustrated on the following page (or as instructed by manufacturer, if different).
  - Free of obstructions (wiring, pipes, etc.).
  - No larger than 1/4" greater than the duct diameter or fitting to properly install the fan housing and duct in accordance with manufacturer's instructions.
- **Wall Grille and Terminal**
  - Fan outlet shall be oriented toward the final termination location and to minimize the length of the duct run.
  - Location: Clearance from sources of contamination per Item 24.
  - Gaps: Interior and exterior grille/terminal shall be sealed per Item 14.
- **Attachment**
  - Where attached to solid wood, screws shall penetrate the wood at least 5/8″, or per manufacturer's instructions if different.
  - Where not attached to solid wood, appropriate fasteners shall be used (drywall drive anchor, molly bolt, toggle bolt, etc.



19. BALANCED VENTILATORS (HRVS AND ERVS)[1]

- **Installation/Location**
  - Units shall not be installed in the kitchen, bathroom, or other source of moisture, unless allowed by the manufacturer.
  - Fans, service switch, filters, drain, and drain pan shall be accessible for maintenance in accordance with authority having jurisdiction.
    - Additionally, an HRV typically requires a condensate drain, which shall be installed per manufacturer's instructions.
  - Attic-mount units:
    - Allowed only when they can be located next to the attic access opening in a manner that allows easy access for required maintenance.
    - When there are multiple intakes/outlets, terminals shall be installed in separate areas of the living space.
  - Separate outlet/inlet terminals shall be 3' apart, or per manufacturer's instructions if different.
  - Combination outlet/inlet terminal shall be in conformance with manufacturer's specifications.
  - In-ceiling units shall be:
    - Placed in a central location (e.g., hallway) or living area (e.g., living room).
    - Installed per guidelines in Item 15.
  - Wall-mount units shall be
    - Placed in a living area (e.g., living room).
    - Installed per guidelines in Item 17.



- **Fan Mounting**
  - Fan shall be securely mounted in accordance with manufacturer specifications.
  - Fan shall be oriented so the equivalent length of the duct run is as short as possible; calculate "equivalent length" in accordance with guidelines in Item 22 and Table 49-6.
  - Fan shall be isolated from the building framing unless specifically designed to be directly attached.
- **Backdraft Dampers**
  - Outdoor air intakes and exhausts shall be equipped with automatic or gravity dampers that close when the ventilation system is not operating.
- **Duct Connections**
  - Ducts shall be properly connected and secured to applicable registers or grilles, collector box, HRV or ERV, intake fitting, and termination fitting.
  - Fittings shall be appropriate for regional weather conditions and installation location on house, so as not to be rendered inoperable.
  - Ducts shall be installed and sealed per Items 20–23.

[1] HRV = Heat Recovery Ventilator; ERV = Energy Recovery Ventilator.

- **Duct Layout when Connected to FAU**
  - Air to be exhausted to the outdoors shall not be taken directly from the forced air system.
  - Supply ducts attached to the return side of forced air systems shall be:
    - Attached using a mechanically fastened start collar.
    - Attached as close to the HVAC system's fan as possible while remaining in compliance with manufacturer specifications.
    - Set up to provide filtration of outdoor ventilation air before reaching the HVAC system with minimum MERV 6 filter (see Item 19).
    - Connected to the intake fitting/terminal.
    - Connected and sealed in accordance with Item 20.
- **Insulation**
  - Ducts installed outside of the thermal envelope shall be insulated in accordance with local code and CSD WIS Appendix A (Material Specifications).
- **Balance and Flow**
  - Airflow shall be measured and adjusted to match to the system's intent.

20. AIR FILTERS

- **Balanced or Supply-type Mechanical Ventilation Ventilators**
  - Mechanical ventilation systems that supply outdoor air to the living space through ductwork more than 10 ft. in length, and through a thermal conditioning component (except evaporative coolers), shall have an air filter with a minimum efficiency of MERV 6 (when tested in accordance with ANSI/ASHRAE Standard 52.2).
  - The filter shall be located and installed in a manner that facilitates easy access and regular service by the occupant, when required by the manufacturer.
  - For in-line or remote supply fans, a filter grille or similar device shall be installed at the outlet (e.g., in the ceiling).
  - Filter or air cleaning system that intentionally produces ozone is not allowed.
- **Passive Inlet Vents**
  - A factory-installed filter shall be present and in conformance with Item 28.

21. ALL DUCTS

- **Duct Installation and Support**
  - Consideration shall be given to:
    - Vent termination location, amount of space for duct run, and duct insulation.
    - Roof condition and type (e.g., metal, shingle, bow string, flat).
  - Ducts shall be as straight as possible, fully extended, and have the shortest run possible, per manufacturer specifications (see Items 20–23).
  - All joints, seams, and duct connections shall be installed, attached, mechanically secured, and supported—and joints and seams shall be sealed—in accordance with manufacturer's instructions and local code.
    - When unavailable, guidelines in CSD WIS Section 6 (Duct Repair and Sealing) shall apply.
- **Supports**
  - Support materials shall be applied in a way that does not crimp ductwork or cause the interior dimensions of the ductwork to be less than specified.
  - Horizontal runs will be supported in accordance with duct manufacturer specifications and local code.
  - At a minimum, metal ducts shall be supported by 1/2" or wider 18-gauge strapping, or 12-gauge or thicker galvanized wire no more than 10' apart.
  - Follow additional support installation and spacing guidelines in CSD WIS Section 6.

- **Transitions**
  - Ventilation ducts shall not be smaller than the connections to which they are attached. When duct (exhaust fan outlet) and collar diameters do not match in size, a properly sized rigid metal transition (reducer or increaser) shall be used to join the two components.

22. EXISTING DUCTS

- **Duct used for whole-house mechanical ventilation shall be:**
  - Replaced or repaired if damaged, and replaced if undersized.
  - Repaired and sealed as needed.
  - In conformance with Item 20.
- **Duct Dimensions and Length**
  - Diameter (or rectangular cross-sectional area), number of elbows, and maximum length shall be as specified by in Table 49-6, or the fan manufacturer's specifications, if more stringent.
  - Length shall not exceed the maximum allowed.

TABLE 49-6: MAXIMUM DUCT LENGTH (FT.) WITH NO ELBOWS[1,3,4,5]

		FLEX Metal Duct								SMOOTH Metal and PVC Duct							
	Fan CFM* @ 0.25 iwc ➔	50	80	100	125	150	200	250	300	50	80	100	125	150	200	250	300
MINIMUM DUCT DIAMETER[2]	3"	NA	NA	NA	NA	NA	NA	NA	NA	5'	NA	NA	NA	NA	NA	NA	NA
	4"	56'	4'	NA	NA	NA	NA	NA	NA	114'	31'	10'	NA	NA	NA	NA	NA
	5"	No Limit	81'	42'	16'	2'	NA	NA	NA	No Limit	152	91	51	28	4	NA	NA
	6"	No Limit	No Limit	158'	91'	55'	18'	1'	NA	No Limit	No Limit	No Limit	168	112'	53'	25'	9'
	7"	No Limit	No Limit	No Limit	No Limit	161'	78'	40'	19'	No Limit	No Limit	No Limit	No Limit	No Limit	148	88'	54'
	8" and above	No Limit	No Limit	No Limit	No Limit	No Limit	189'	111'	69'	No Limit	No Limit	No Limit	No Limit	No Limit	No Limit	198'	133'

KEY

[1]The table assumes no elbows. Make the following deductions:
- Subtract 15 feet for each 90° elbow.
- Subtract 7.5 feet for each 45° offset.

[2]For non-circular ducts, calculate the diameter as four times the cross-sectional area divided by the perimeter.

[3]For these components, use manufacturer's specifications. If not available, use these guidelines:
- Subtract 30 feet for a wall cap with bird screen and damper.
- Subtract 35 feet for a low-profile soffit vent with bird screen and damper.
- Subtract 60 feet for a low-profile roof cap for round duct with bird screen and damper.

[4]NA = Not Allowed

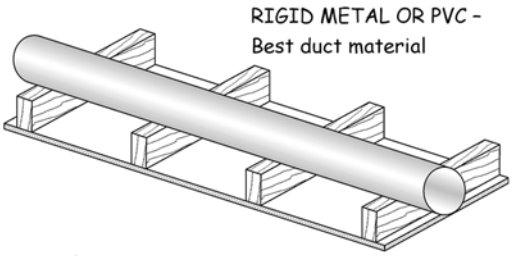
[5]No Limit = At this duct diameter, there is no limit on the maximum duct length.

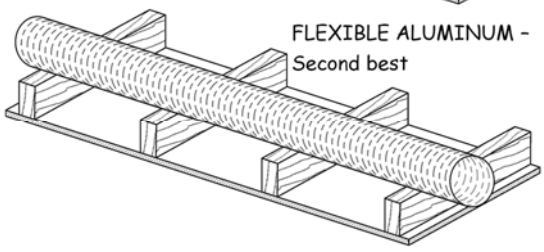
[6]For airflow values not listed, use the next higher value (e.g., for 60 CFM, use rows for 80 CFM, etc.)

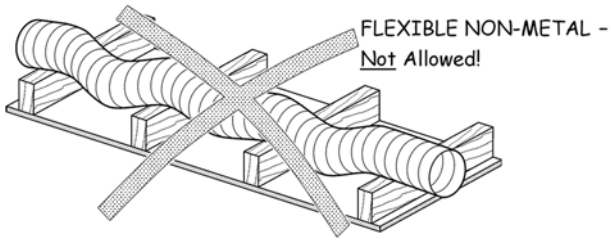
*

23. NEW DUCTS

- **All ducts shall:**
  - Be installed, attached, secured, sealed and supported in accordance with Item 20.
  - Be in conformance with requirements of Table 49-6 for diameter, number of elbows, and maximum length.
  - Terminate outside the building in an approved wall or roof cap termination.
  - Have clearances from sources of contamination as prescribed in Item 24.
  - When applicable, be sloped to remove condensation to outdoors.
- **New Duct Materials**
  - Duct materials shall be in conformance with the CSD WIS Appendix A.
  - Airflow Characteristics
    - Rigid metal or PVC ducts have the best airflow characteristics.
    - Flexible metal ducts have the next-best airflow.
  - Insulation
    - Ducting located outside of the thermal envelope shall be insulated in accordance with CSD WIS Appendix A and CSD WIS Section 19 (Duct Insulation).



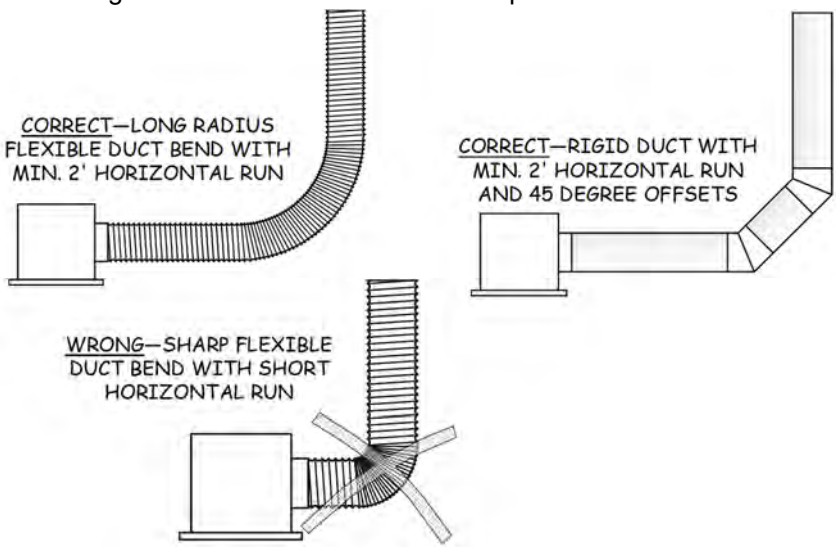




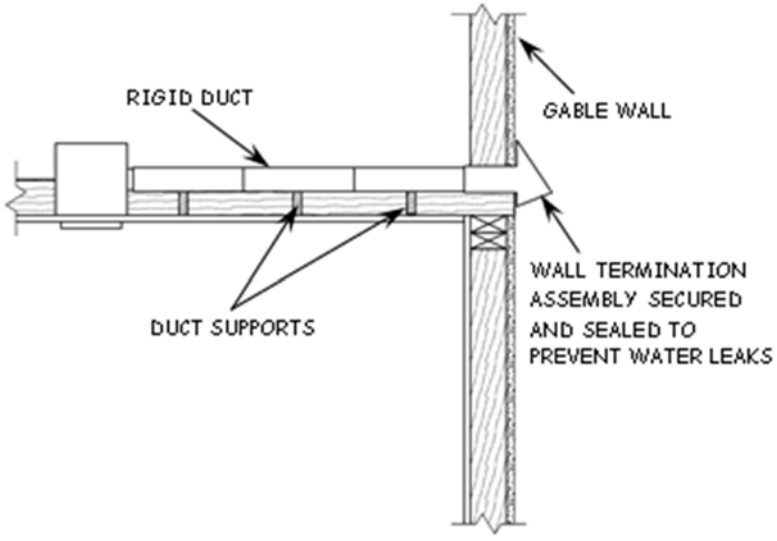
- **Bends and 90º Elbows**
  - Duct shall be installed with the shortest possible length and fewest possible bends and elbows.
  - Straight duct shall extend 2' to 3' from the fan before the first bend or elbow.
  - Turns will be made so the radius at the centerline is no less than one duct diameter.
- **Duct elbows shall:**
  - Have a 90-degree maximum bend, but be avoided where possible.
  - Be limited to 3 elbows for duct diameters 4" or larger.
  - Not be used in 3" diameter duct.

22. NEW DUCTS (cont.)

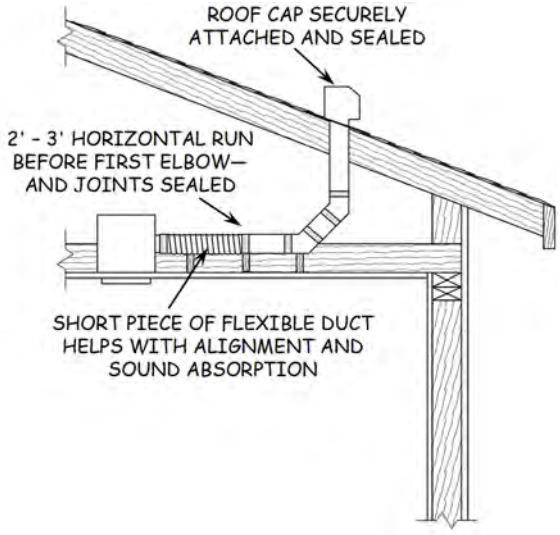
- **Duct Supports**
  - Ducts shall be supported in accordance with Item 20 and CSD WIS Section 6 (Duct Repair and Sealing).
- **Long-Radius Bends**
  - Bends and 45º offsets shall be used instead of 90º elbows, when possible, to create long-radius bends.
  - Short, sharp bends are not allowed.
  - When determining diameter and length requirements:
    - Bends of 45º or less constitute the equivalent of half a 90º elbow (two of them count as one elbow).
    - Each bend greater than 45º constitutes the equivalent of one 90º elbow.



- **Horizontal Ducts**
  - Duct shall terminate outside the building in a wall termination assembly.
  - When feasible, slope duct downward toward the exterior, to remove condensation to outdoors.
- **Vertical Ducts**
  - Duct shall terminate outside the building in a roof cap assembly.



- **Multi-Branch Duct Systems**
  - When the fan is intermittent, each branch shall be equipped with a backdraft damper to prevent movement of air from one room to another when the fan is not operating.
  - It is acceptable for the damper to be located in the branch duct, or in the inlet/outlet location.



24. WALL OR ROOF CAP ASSEMBLY (TERMINATION)

- **Termination Requirements**
  - Exterior terminals shall have clearances from sources of contamination and other terminals (if applicable), per Item 24.
  - The terminal shall be screened with mesh having a weave of 1/4″ minimum and 1/2″ maximum.
  - Termination shall be secured and sealed to prevent water leaks.
  - Installation fasteners and screening shall not inhibit damper operation.
  - Exterior termination fitting will be flashed or weather-sealed to direct water away from penetrations.
  - Termination shall be compatible with fan manufacturer's recommendations and local code.
    - Collar shall be at least the same diameter as the exhaust fan outlet.
    - If collar is larger, a rigid metal transition (increaser/reducer) shall be used.
  - Termination shall be appropriate for regional weather conditions and located so that it is not obstructed by snow, vegetation, or other material.

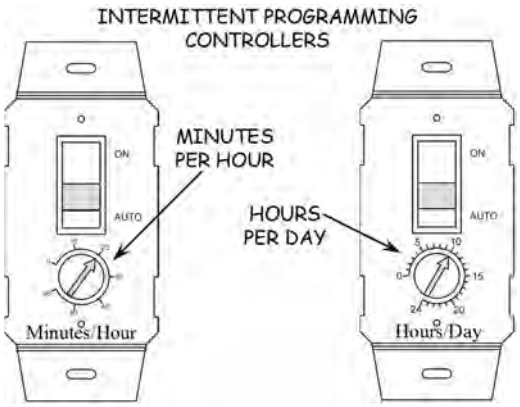
25. CLEARANCES FOR ROOF AND WALL CAP TERMINATIONS

- **All Terminations**
  - Termination shall be located in accordance with manufacturer's instructions and local code.
  - Consideration will be given for adequate head clearance.
  - Outdoor air intake shall be installed in accordance with the following:
    - A minimum of 6" from grade.
    - Above local snow or flood line.
    - A minimum of 18" above an asphalt based roof.
    - Never on a flat roof.
  - The following Roof and Wall Termination guidelines apply, unless superseded by manufacturer or local code.

Inlet for Mechanical System shall be at least:	
10' from or 3' below	Gas vent pipe, solid-fuel chimney
10' from	Bathroom or kitchen exhaust, plumbing vent, clothes dryer exhaust, vehicle exhaust source, or other source of toxic contamination
3' from	Attic vent, gas meter set assembly.
Outlet for Mechanical System shall be at least:	
3' from	Bathroom or kitchen exhaust, plumbing vent, or attic vent
3' from	Evaporative cooler or mechanical air inlet, or operable door or window into the building, or property line

26. FAN CONTROLLERS

- **Controller Installation Guidelines**
  - With power turned off at the source, circuit shall be checked for proper capacity, conductors, grounding, and overcurrent protection.
  - Fan controller shall be installed as prescribed by the manufacturer, if not built into the fan.
  - Wiring shall be properly installed and safe, per Items 14 and 26.



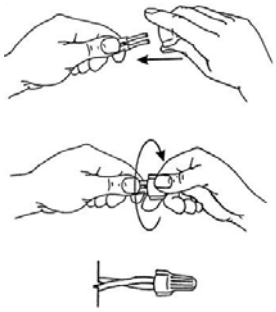
- **Programming**
  - Controller shall be set to the speed required to achieve proper CFM airflow.
  - Timer shall be programmed per manufacturer's instructions.
  - If programmed for intermittent use:
    - Minimum minutes-per-hour (M-P-H runtime) of operation shall be set per Item 11; or
    - Minimum hours-per-day (H-P-D runtime) of operation shall be determined per Item 12.
- **Manual Override Control**
  - Each installation shall have a readily accessible override control for the occupants, which can be any of the following:
    - A labeled wall switch (as illustrated to the right).
    - A control on the fan unit that can easily be accessed by removal of a cover plate or grille, without the use of tools.
    - A labeled breaker dedicated to operation of the ventilator.
  - Accessible controls shall have a durable label informing occupants that the fan should be turned "On" whenever the home is occupied, using wording such as:
    - "Ventilation Control: Keep On When Home Is Occupied." or
    - "Ventilation Control: Keep On When Anyone Is Home."

MECHANICAL VENTILATION OVERRIDE CONTROL LABEL

- **Control/Switch in Bathroom**
  - Fan controls and switches shall not be reachable from a tub or shower.
- **Testing**
  - Following installation, the controller shall be programmed and fan shall be tested for proper operation, in conformance with manufacturer's guidelines.

27. ELECTRICAL WIRING

- **Wiring**
  - Wiring shall be in conformance with manufacturer's instructions and local code.
  - Conductors shall be copper, or as specified by fan manufacturer.
  - Wires shall not be damaged (no nicks, cuts, slices, etc.)
- **Splices shall be:**
  - Secured with a pressure splicing connector (e.g., wire nut®), firmly twisted to lock wires together in the connector.
  - Contained within a fixture or junction box.



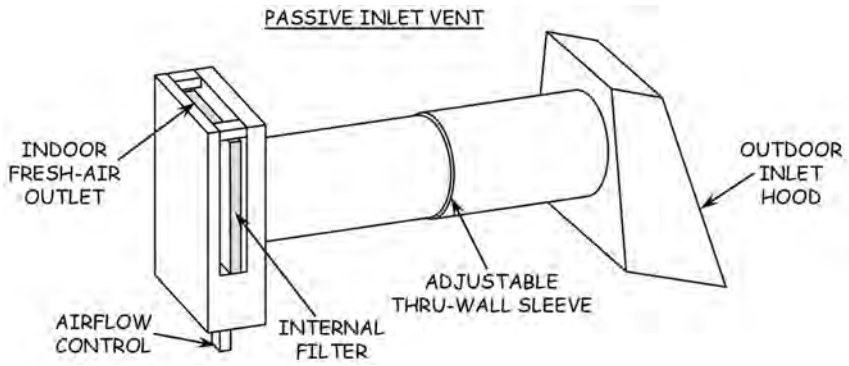
- **Grounding**
  - Circuits shall be properly grounded, or provided with GFCI protection in lieu of grounding, in accordance with manufacturer's instructions and local code.
- **GFCI Protection**
  - Fan power circuit shall be GFCI-protected, if specified by fan manufacturer or required by local code.

28. PRESSURE BALANCING

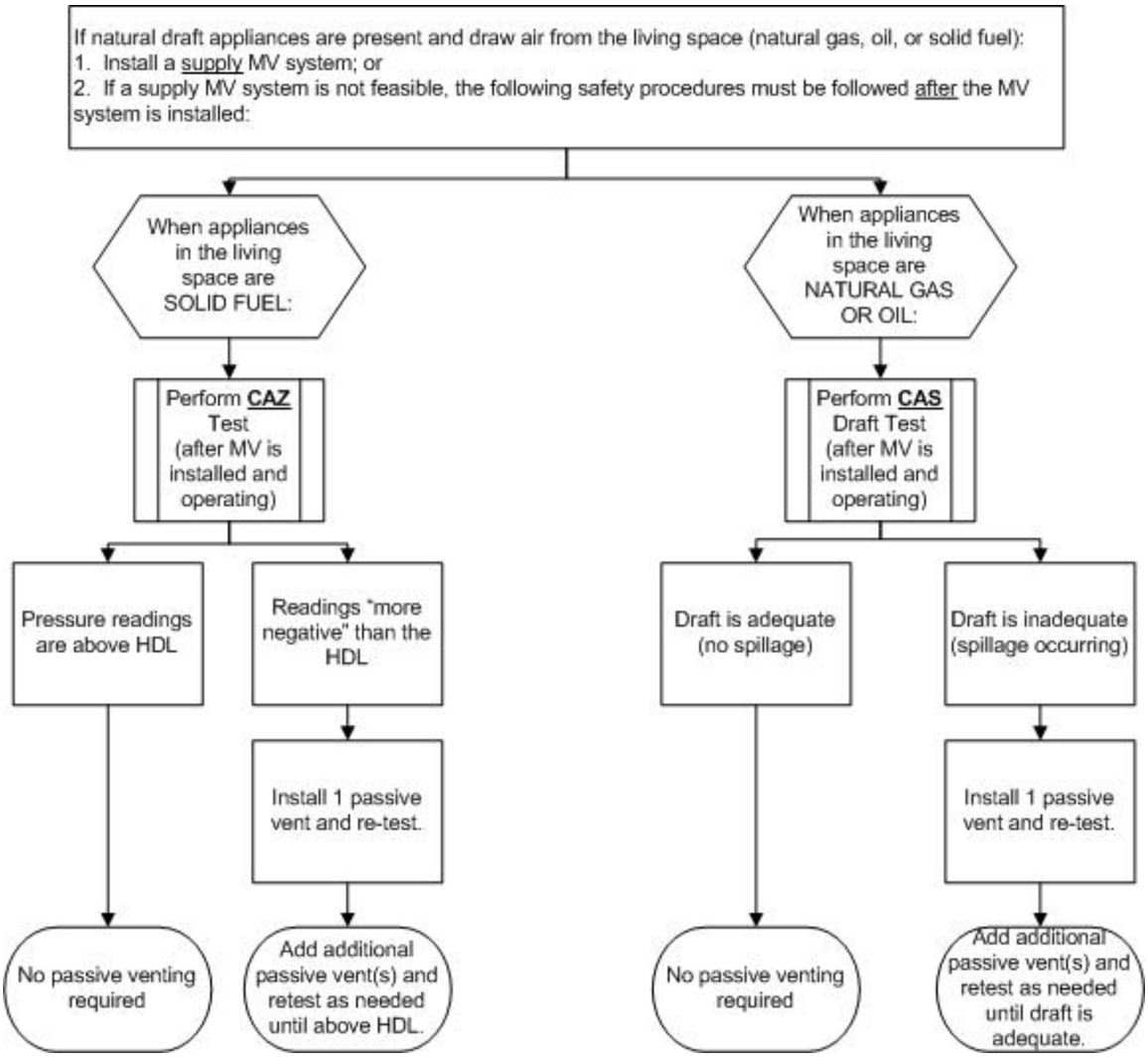
- **Required Pressure Balancing Test**
  - When a mechanical ventilation system is installed, testing shall be performed using this procedure:
    - Exterior doors and windows shall be closed.
    - Interior doors shall be closed.
    - Turn on Mechanical Ventilation system. All other exhaust fans and devices shall be on.
    - Using a digital gauge, tubing from the Reference tap shall be extended outdoors.
    - Tubing from the Input tap shall be extended under each interior door in the dwelling individually to measure room pressure with reference to outdoors.
  - No room shall exceed ±3 Pa with reference to the outdoors.
  - When necessary, an appropriate means of pressure balancing shall be installed (e.g., passive inlet vents, transfer grilles, door undercuts, jump ducts, individual room returns, etc.).

29. PASSIVE INLET VENTS (MAKE-UP AIR)

- **Passive Vent CFM**
  - A passive vent is used to provide makeup air from outdoors, to minimize or prevent house depressurization.
    - Passive inlet vents are not applicable to meet code requirements for CVA vents; however, by relieving house depressurization, they help to resolve backdrafting problems of natural draft appliances. To use this option, CVA must be calculated using the CSD Field Guide Appendix A (Combustion Appliance Safety Protocol).
  - CFM_{NAT} airflow of the passive vent is the airflow passing through the vent at *natural* pressure.



- **Installation/Location**
  - Unit shall be installed on an outside wall in a location that shall not produce a draft causing occupant discomfort, such as:
    - High on a wall and away from seating areas, or
    - Inside a closet or enclosure that is vented to the living space.
  - Passive inlet vent shall be located and installed:
    - In accordance with manufacturer's instructions and local code,
    - With a maximum 1/4" insect/rodent screen at the air inlet to prevent pest intrusion, and
    - With clearances from sources of contamination as prescribed in Item 24.
  - Outdoor inlet shall be sealed against the wall to prevent water leakage.
- **Combustion Appliance Safety/Combustion Appliance Zone Protocol**
  - After installing a mechanical ventilation system, the CAS/CAZ protocol outlined below shall be followed to determine if passive venting will be required to ensure safe operation of all combustion appliances in the living space.
  - Pressure in any CAZ shall not more negative than the House Depressurization Limit (HDL), per guidelines in CSD Field Guide Appendix A.
  - Mechanical ventilation shall not cause any vented open combustion appliance in the living space to draft improperly or spill.



30. TRANSFER GRILLES, JUMP DUCTS, AND DOOR UNDERCUTS

- **Room with a Solid Door**
  - When the mechanical ventilation fan will be in a bathroom (or other room with solid door), an air path into the main body of the home shall be present that provides airflow at least equal to the fan CFM.
  - A transfer grille or jump duct may be installed, or the door may be undercut.
  - When a transfer grille is installed, its NFVA shall equal or exceed:
    - NFVA of the required door undercut (see Table 49-7), or
    - Net opening sq. in. of the transfer grille (e.g., louvered metal vent) shall equal or exceed the net opening sq. in. of the mechanical ventilation fan's intake grille.
  - When a jump duct is installed:
    - Interior cross-sectional area of the duct shall equal or exceed NFVA of the required door undercut (from Table 49-7), and
    - NFVA of the jump duct inlet and outlet registers shall equal or exceed NFVA of the required door undercut.
  - When door undercut is used to provide the required air path:
    - Guidelines in Table 49-7 shall be followed.
    - The client shall be made aware that, if thicker floor covering (e.g., carpet) is installed, the gap must be maintained, which may require enlargement of the undercut.

TABLE 49-7: DOOR UNDERCUT GUIDELINES

Fan Airflow	Up to 80 CFM	>80 to 100 CFM	>100 to 120 CFM	>120 to 140 CFM	>140 to 180 CFM
Gap Size	3/8"	1/2"	5/8"	3/4"	7/8"
NFVA sq. in.	[door opening width (in.)] x [undercut height (in.)]				

PART 2: MOBILE HOME CRITERIA

31. APPLICATION OF ASHRAE 62.2 TO WEATHERIZED MOBILE HOME DWELLINGS

- **Limitations**
  - See Part 1: Installation Requirements for Conventional Homes *except* for the Items below.
  - Mechanical ventilation system manufacturer's limitations for use in a mobile home shall be researched and applied.
- **Pressure Balancing**
  - No resistance greater than 3 Pa shall exist between the fan intake location, with reference to the main body of the house (common area).
  - When excessive imbalance is present, an appropriate means of pressure balancing shall be employed (e.g., passive inlet vents, transfer grilles, jump ducts, door undercuts, etc.) in accordance with Items 28 and 29 of this section.
- **CAZ Requirement**
  - When an open combustion appliance (liquid or solid fuel) draws combustion air from the living space:
    - CAZ testing shall be performed following mechanical ventilation installation to determine that the negative pressure is not brought beyond the House Depressurization Limit (HDL).
    - Follow CAZ Testing guidelines in CSD Field Guide Appendix A.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

32. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.
- **Application of 62.2 to Weatherized Multi-Family Dwellings**
  - Limitations
    - Whole house mechanical ventilation requirements in multi-family (horizontally attached) or detached type multi-family buildings shall be calculated as in accordance with Part 1 of this standard.
  - Pressure Balancing
    - Pressure balancing requirements shall be in accordance with the Conventional Home requirements described in Items 27-29 of this section.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

33. DECOMMISSIONING EXISTING EXHAUST OR SUPPLY VENTILATION SYSTEMS

- **Power Supply/Electrical Wiring**
  - Power supply/conductors shall be disconnected and properly terminated in a visible junction box.
- **Removal**
  - Fan components (housing, fan, and ducting) that cannot be reused shall be removed and disposed of lawfully.
  - Existing duct, if abandoned, may be removed and the hole closed off and insulated to preserve the thermal and pressure boundary.
  - All shell and duct leakage bypasses created by the installation of Mechanical Ventilation shall be air sealed.
- **Repair**
  - If necessary, the void from the duct work removal shall be insulated.
  - Fan opening shall be sealed and insulated.
  - Fan termination shall be sealed against water leaks.

34. OPERATIONAL CHECK

- **System Programming**
  - Final testing of the system shall be performed by field personnel to ensure proper operation and performance of all functions, including acceptable system airflow CFM (in accordance with ASHRAE 62.2).
    - Airflow shall be checked on all installed whole house mechanical ventilation systems (and new/replacement kitchen exhaust systems).
    - Flow rate shall be measured using an approved device (see CSD WIS Appendix A).
- **Correction Work Order**
  - When a nonconforming condition (improper installation or operation, inadequate CFM flow rate, etc.) is found during visual inspection or operational checks:
    - a work order for corrections shall be developed, and
    - all nonconforming conditions shall be corrected.

35. VISUAL INSPECTION

- **All Units**
  - Visual inspection shall be performed and documented for:
    - Electrical connections
    - Name plate (rated sone and flow)
    - Damper operation (internal and external)
    - Motor cleanliness
  - Ducts shall be inspected for:
    - Support
    - Sizing
    - Connections (proper materials, mechanically connected, and properly sealed)
    - Insulation, where required
  - Termination shall be checked for:
    - Proper clearances, per Item 24.
    - Proper installation, attachment, and water sealing.
  - Air Leakage
    - Air leakage to the house from other spaces shall be prevented (e.g., from garages, unconditioned crawlspaces, unconditioned attics).
      - When shell leakage testing is not performed, prescriptive sealing shall be performed in accordance with the CSD 704 Shell Leakage Data Sheet.

36. CLIENT EDUCATION

- **Crew Responsibilities**
  - Crew shall educate the client on:
    - Proper operation and use of controls.
    - Manual override.
    - For an HRV or ERV, emphasize regular cleaning of filter and core per manufacturer's instructions to maintain required airflow.
- **Operation Guide**
  - A system operation guide designed for occupants (non-professionals) shall be provided to the client to explain how and why to operate the mechanical ventilation system.
  - The system operation guide or a label indicating the presence and purpose of the mechanical ventilation system shall be permanently posted:
    - at the indoor electrical panel (or subpanel), when present, or
    - in full sight elsewhere indoors, in a location approved by client, when there is no indoor electrical panel.
  - See required Label template on the next page, and sample completed Label.

37. REFERENCED STANDARDS

- **Standards and best practices for mechanical ventilation are available from the following sources:**
  - ASHRAE standard 62.2-2016 (Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings), for sale online at http://www.techstreet.com/products/1855284 and
  - Title 24 2016 Residential Compliance Manual (Subsection 4.6). Download Chapter 4 (or the entire manual) free at: http://www.energy.ca.gov/title24/2016standards/residential_manual.html

38. MANDATORY OPERATION GUIDE/LABEL FORMAT

The Operation Guide/Label format shown below shall be utilized.

Information about Your Whole-House Mechanical Ventilation System and Maintenance Requirements			
Installer	Contractor	Phone	Address
System Type	❑ Supply Ventilator ❑ Exhaust Ventilator ❑ Exhaust with Passive Inlet ❑ Heat Recovery Ventilator (HRV) ❑ Energy Recovery Ventilator (ERV)		
System Purpose	• The purpose of mechanical ventilation is to provide adequate fresh air inside the home. • System size (airflow) is based on the size of your home and the number of occupants. • There is a manual override switch; however, it should be switched <u>on</u> whenever anyone is at home. Too little ventilation can cause moisture and health problems.		

Ventilator Unit (Fan)	Brand	Model #	Required Airflow (cfm)	Total Installed Airflow (cfm)	
				Normal	Bathroom Boost
			cfm	cfm	cfm

Controller ❑ Built into Fan	Brand	Model #	Function (Constant Speed, Multi-speed, Intermittent)

System Function and Operation	

Required Maintenance	

For reference purposes, a sample of a completed Operation Guide/Label is provided below:

Information about Your Whole-House Mechanical Ventilation System and Maintenance Requirements			
Installer	Contractor Best CSD Agency	Phone 916-916-9169	Address 123 Good St., Goodtown 91919
System Type	❑ Supply Ventilator ❑ Exhaust Ventilator ❑ Exhaust with Passive Inlet ❑ Heat Recovery Ventilator (HRV) ❑ Energy Recovery Ventilator (ERV)		
Purpose	• The purpose of mechanical ventilation is to provide adequate fresh air inside the home. • System size (airflow) is based on the size of your home and the number of occupants. • There is a manual override switch; however, it should be switched <u>on</u> whenever anyone is at home. Too little ventilation can cause moisture and health problems.		

Ventilator Unit (Fan)	Brand	Model #	Required Airflow (cfm)	Total Installed Airflow (cfm)	
				Normal	Bathroom Boost
	Acme FanCo	AV-1234567	40 **cfm**	45 **cfm**	50 **cfm**

Controller ❑ Built into Fan	Brand	Model #	Function (Constant Speed, Multi-speed, Intermittent)
	Acme Controls (If separate)	AC-1234567 (If separate)	40 cfm constant, with 60 cfm boost

System Function and Operation	Low-speed continuous operation at 45 cfm, increases to 50 when bathroom is occupied

Required Maintenance	Vacuum fan intake monthly.

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NOTES

VACANCY SENSOR SWITCHES

Lead Paint Risk Factor
LOW

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VACANCY SENSOR SWITCHES

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

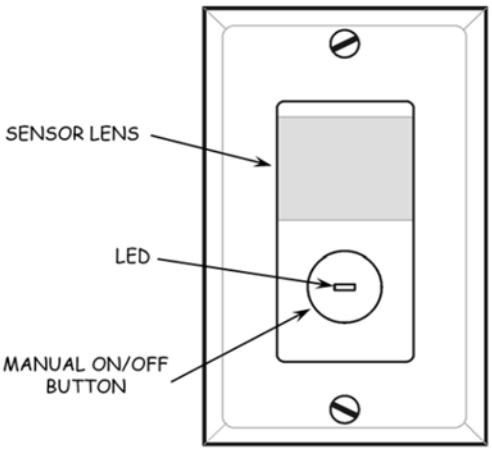
VACANCY SENSOR SWITCH REPAIR

Not allowed for this measure.

VACANCY SENSOR SWITCH INSTALLATION

1. PRE-INSTALLATION REQUIREMENTS

- **Prior to installing a vacancy sensor switch:**
  - The circuit to be controlled shall be checked and determined to be:
    - Operational and properly grounded (when grounding is required).
    - Bearing an electrical load that is within acceptable limits for the vacancy sensor switch (VSS).
  - Before replacing an existing switch with a VSS, power to the switch box shall be turned off.



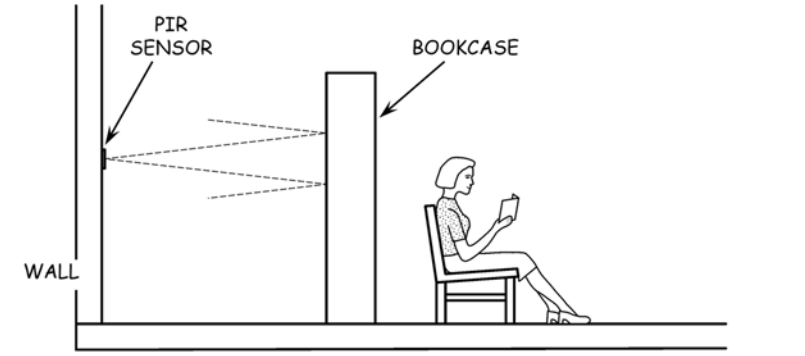
EXAMPLE OF SWITCH-BOX VACANCY SENSOR

2. INSTALLATION REQUIREMENTS

- **Instructions**
  - Installation shall be in compliance with this section, manufacturer's instructions, and local code.
  - When a conflict occurs, the more restrictive provision shall be followed.
- **All Installations**
  - All vacancy sensor switches shall replace existing wall-mount light switches.
  - The cover plate shall match the color of the vacancy sensor switch.
- **Special Use Vacancy Sensor Switches**
  - For controlling a bathroom exhaust fan and light with one sensor, a dual load vacancy sensor switch rated to handle the fan load shall be installed.
  - For three-way and four-way lighting circuits, vacancy sensor switch shall be a multi-way unit designed for use in such circuits.
  - For dimmable lighting circuits, vacancy sensor switch shall be a dimmable unit designed for use in such circuits.
- **Two-Wire Switch Circuits**
  - Vacancy Sensors installed in light switch boxes without a neutral conductor and/or equipment ground may require a minimum circuit wattage to operate.
  - Those 2-wire sensors shall not be installed in a lighting circuit that currently has, or can be retrofitted with, incandescent or halogen lamps/bulbs using a total wattage less than the minimum required to operate the sensor."

3. LOCATION

- **Vacancy sensor switch shall be located:**
  - In an energy-saving location, per the CSD Field Guide measure-specific policy.
  - In compliance with manufacturer's specifications, including:
    - Obstacles and hard surfaces in the room.
    - Acceptable range and coverage area of the sensor.
    - Type of occupant use (walking, reading, computer use, etc.).
    - Magnitude of motion:
      - Minor motion (reading, writing, and hand movements), or
      - Major motion (full-body and walking).
      - Where it can sense all occupants, to avoid turning off lights ("false off") while the room is still occupied.
      - Where it does not monitor the area outside the door (which can cause nuisance switching).
- **Room Characteristics**
  - Passive Infrared (PIR) vacancy sensor switches shall be installed only in locations with an unobstructed line-of-sight of the entire room.
  - Ultra Sound (US) vacancy sensor switches are allowed in rooms that may have obstructions and hard surfaces.
  - Dual Technology (Combination PIR/US) vacancy sensor switches are allowed in any location conforming to installation criteria, primarily room size.
- **Inappropriate Circuits**
  - Units shall not be installed on circuits of existing emergency lighting fixtures and any type of circuit not approved by the manufacturer.

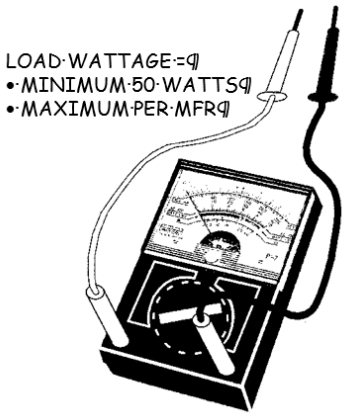


PIR SENSORS ARE LINE-OF-SIGHT, NOT USED WHEN OBSTACLES ARE PRESENT

4. ELECTRICAL REQUIREMENTS

- **Circuit and Grounding**
  - Must be a 110–120 volt circuit located in a wall switch box.
  - Vacancy sensor switch grounding lead shall be properly connected to the system grounding conductor, when present.
  - When a grounding conductor is not present in the electrical box, the vacancy sensor switch shall be rated for use without an equipment ground.
    - When a neutral conductor is not present in the switch box, the VSS shall be rated for use without a neutral conductor.
- **Wiring for Multi-Way Systems:**
  - Switch installation and electrical wiring shall be in conformance with manufacturer's instructions and local code.

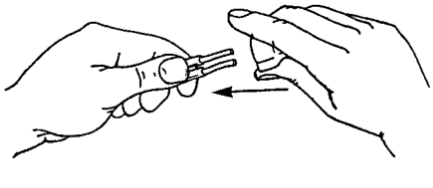
- **Electrical Load**
  - The total switched wattage shall:
    - Be at least 50 watts.
    - Not exceed manufacturer's load rating.

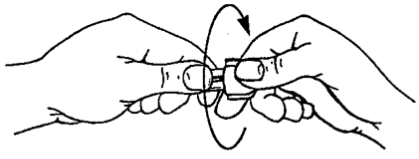


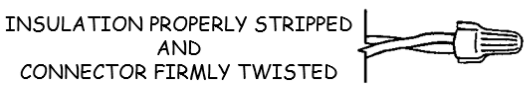
- **Lighting**
  - Vacancy sensor switches shall be:
    - Rated for use with the incandescent or halogen lighting.
    - Rated for the fan load, when installed on a single circuit that controls both a bathroom light and exhaust fan.

5. FIXTURE WIRING

- **All Units**
  - Vacancy sensor switch shall be mechanically secured to an electrical box with at least two fasteners.
  - Splices shall be contained within the box, and conductors shall not be damaged (e.g., no slices, cuts, nicks, etc.).
  - All Connectors
    - Connector shall be UL listed, new, properly sized (type and number of conductors).
    - Wires shall be stripped to the specified length, and connectors shall be installed per manufacturer and local code requirements.
  - Twist-on Wire Connectors (e.g., Wire Nuts)
    - Connectors shall be firmly twisted to hold them securely in place.
    - Wires are pre-twisted, when specified by manufacturer or code.
    - Electrical tape may be used as a supplement to the connector, but not to secure the conductors.
  - "Poke-in" and "stab-in" type connectors may be used in lieu of twist-on, in accordance with fixture manufacturer and local code.
  - Screw-terminal wire attachments shall be securely tightened, with conductor wrapped around the screw no more than 360 degrees.
  - Aluminum and copper wires shall not be spliced together, except in accordance with manufacturer's instructions and code, utilizing AL/CU wire connectors (and anti-oxidant paste when required).

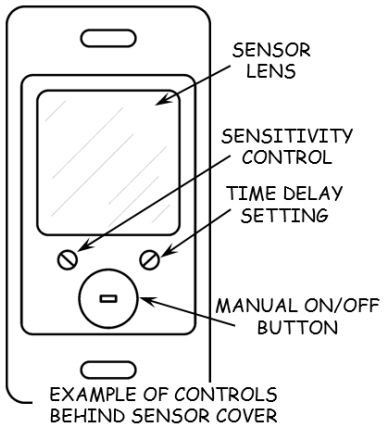






6. SENSOR SETUP

- **Testing and Troubleshooting**
  - Each vacancy sensor will be set up and tested by the installer.
  - If it does not perform as designed, corrections shall be made in accordance with manufacturer's troubleshooting instructions.
- **Time Delay and Sensitivity**
  - Time delay shall be set based on conditions at residence.
  - Default delays:
    - 15 minutes for standard light controls.
    - 30 minutes for dual relay for a bathroom exhaust fan.
  - When the vacancy sensor switch has a sensitivity setting, it shall be adjusted to optimal sensitivity based on household conditions.



PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

7. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

8. CLIENT EDUCATION AND WARRANTY

- **Customer shall be provided with:**
  - Instruction for operation of the vacancy sensor switches.
  - Manufacturer's written instructions, when available.
  - Written warranty documents.

9. CLEAN UP

- **All Units**
  - All replaced switches, cover plates, dust, scraps, and other debris resulting from vacancy sensor switch installation shall be cleaned up and removed from the premises—utilizing lead-safe practices when applicable.
  - Furniture and other household items moved for installation work shall be returned to their original positions.

THERMOSTATIC SHOWER VALVES AND SHOWERHEADS

Lead Paint Risk Factor
NONE

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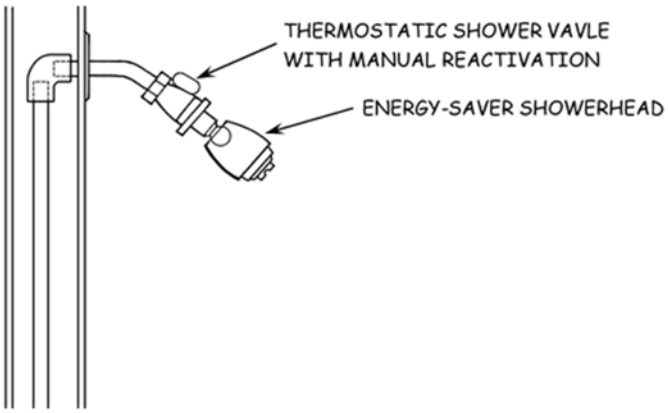
THERMOSTATIC SHOWER VALVES AND SHOWERHEADS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

TSV AND SHOWERHEAD REPAIR

Not allowed for this measure.

TSV AND SHOWERHEAD INSTALLATION



1. INSTALLATION REQUIREMENTS

- **Thermostatic Shower Valves and Showerheads**
  - Shall be installed only on functional showers—not on showers which are not functional due to plumbing or physical defects.
- **Shower Arm Adapters**
  - A shower arm adapter shall be installed when required for installation of the thermostatic shower valve (TSV) or valve and energy-saver showerhead.
  - When a TSV is installed in conjunction with an energy-saver showerhead, the showerhead (and adapter if used) shall be in compliance with CSD WIS Section 45 (Showerheads and Faucet Aerators).
- **Instructions**
  - Installation shall be in compliance with this section, manufacturer's instructions, and local code.
  - When a conflict occurs, the more restrictive provision shall be followed.
- **Threaded Connections**
  - Threads shall be sealed as needed (e.g., with Teflon® tape).
  - Connections shall be checked for leaks (i.e., at the thermostatic shower saver, shower arm, showerhead, and adapter).
- **Temperature Actuation**
  - The shower saver shall automatically reduce flow to a trickle in response to incoming water temperatures exceeding a preset actuation temperature.
  - Water flow shall be easily reactivated with a manual control.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

2. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

3. OPERATIONAL CHECKS

- **Performance**
  - Installed thermostatic shower valves, showerheads, and shower arm adapters shall function properly and satisfy the client.
  - Client's acceptance of the thermostatic shower valve, or valve and showerhead combination, shall be documented.
  - Threaded connections shall not leak.
    - If leak is present, tightening in small increments to stop leaking is allowed. Over-tightening shall be avoided.

4. POST-INSTALLATION

- **Repairs**
  - Any penetrations to the exterior of the home created by the installation of the equipment shall be sealed.
  - Any damage done to the dwelling during installation shall be repaired.
- **Decommissioning**
  - Replaced showerheads and faucet aerators will be recycled or disposed of properly.
  - Replaced showerheads shall not be left in the dwelling.
- **Client Education**
  - Client shall be supplied with both verbal and written instructions for proper operation and maintenance for all measures installed.
  - Clients shall be given written documentation that describes components of the system, maintenance requirements, safety considerations, and warranty, at a minimum.

TIER 2 AUDIO-VISUAL ADVANCED POWER STRIPS (T2 AV APS)

Lead Paint Risk Factor
NONE

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TIER 2 AUDIO-VISUAL ADVANCED POWER STRIPS (T2 AV APS)

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

T2 AV APS REPAIR

Not allowed for this measure.

T2 AV APS INSTALLATION

1. PRE-INSTALLATION

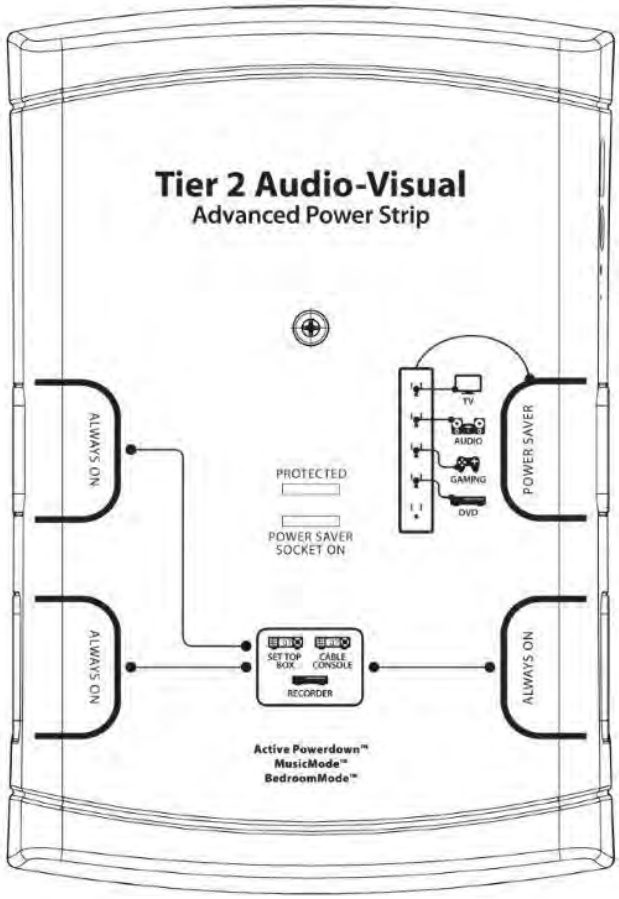
- **All Tier 2 Audio-Visual Advanced Power Strips ("T2 AV APS" or "APS")**
  - Existing home entertainment equipment to be connected to the T2 AV APS shall be:
    - Checked to ensure it is working properly, and
    - Turned off before being unplugged from its present power source.

2. STANDARDS AND INSTRUCTIONS

- **Applicable Standards**
  - Installation shall be in compliance with this section, manufacturer's instructions, and local code.
  - When requirements vary, the more restrictive provision shall be followed.
- **Manufacturer's Instructions**
  - Tier 2 Audio-Visual Advanced Power Strips ("T2 AV APS" or "APS") shall be installed in accordance with the manufacturer's instructions, including:
    - Location and power source of, and installation for, the T2 AV APS,
    - Selection of equipment (television and peripheral devices) to be plugged into the switched (power-saving) and the unswitched (always-on) outlets.
    - Placement of the infrared (IR) remote sensor, and
    - Selection of peripheral devices to be plugged into the switched and unswitched (always-on) outlets.

3. LOCATION

- **The T2 AV APS shall be:**
  - Installed in a location that has good air circulation and is free of moisture sources.
  - Plugged directly into an acceptable receptacle—not into an extension cord, standard power strip, or surge protector.



Graphic Credit: Embertec

4. INSTALLATION

- **Devices that must be connected to the T2 AV APS:**
  - All T2 AV APS:
    - A TV must be present as the primary energy-consuming device, and plugged into the APS per manufacturer's instructions.
  - Corded Power-Strip Type:
    - A surge protector, power strip, extension cord, or another T2 AV APS shall not be plugged into it ("daisy-chained").
  - Direct Wall Plug-In Type:
    - Extension cords or a corded T2 AV APS shall not be plugged into it.
    - One existing or new power strip may be plugged into the T2 AV APS, in accordance with manufacturer's instructions.

5. POWER CORDS

- **All T2 AV APS Power Cords**
  - Power cords shall not be:
    - Run through a wall.
    - Secured in place with staples, tacks, tape, etc.
  - Any excess length shall be safely secured out of the way (e.g., with cable ties).

6. RECEPTACLE USED FOR POWER

- **Quantity Limit**
  - Only one T2 AV APS shall be plugged into a duplex receptacle.
- **The receptacle must be:**
  - Secure and in good, safe working condition.
  - 3-prong and grounded—an adapter is not allowed.

7. PLUG-IN DEVICE LIMITATIONS

- **Permitted Devices**
  - Only electronic equipment recommended by the T2 AV APS manufacturer shall be plugged into its outlets.
  - Small appliances (e.g., heaters, lamps. toaster, coffee maker, etc.) shall not be plugged in.
  - Computers, cable boxes, and DVR systems shall not be plugged into a T2 AV APS, to prevent unnecessary re-booting and potential failure of these systems.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

8. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

9. OPERATIONAL CHECKS

- **All Units**
  - The T2 AV APS shall be checked to confirm proper operation with the client present to observe the procedure.
    - Following APS installation instructions, use the TV IR remote control to turn on the switched outlets
    - Turn on all peripheral devices plugged into the switched outlets and the always-on outlets of the APS.
    - With TV and peripheral devices turned on, press power button on the TV IR remote control to turn off the TV.
      - All switched devices should automatically turn off within 5 minutes.
      - All always-on devices should remain on.
  - If the T2 AV APS does not perform as designed, corrections shall be made in accordance with manufacturer's troubleshooting instructions.

10. CLIENT EDUCATION

- **Instructions and Warranties**
  - Client shall be instructed on how to operate the T2 AV APS.
  - Client shall be provided with manufacturer's written instructions and warranty documents.

11. CLEAN UP

- **All Units**
  - All packaging materials and other debris shall be cleaned up and removed from the premises.
  - Furniture and other household items moved for installation work shall be returned to their original positions.
  - Replaced standard power strips shall be disposed of in accordance with local recycling and disposal guidelines.

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NOTES

LED BULBS

Lead Paint Risk Factor
NONE

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LED BULBS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

LED BULB REPAIR

Not applicable to this measure.

LED BULB INSTALLATION

1. EXISTING FIXTURE AND CIRCUIT

- **Prior to LED Installation**
  - Check the existing fixture for compliance with requirements of this section and the CSD Field Guide, including:
    - Hazardous electrical condition.
    - Maximum wattage allowed.
    - Control by a dimmer switch or other special controller, per Item 4.
    - Rating for “damp” or “wet” locations, when applicable, for outdoor installations.

2. INSTALLATION

- **All Types**
  - All lamps, without exception, shall be installed by the contractor.
  - Only incandescent and halogen lamps shall be replaced.
  - Installation shall be in compliance with this section, CSD WIS Appendix A (Material Specifications), manufacturer’s instructions and recommendations, and local code.
    - When a conflict occurs, the more restrictive provision shall be followed.

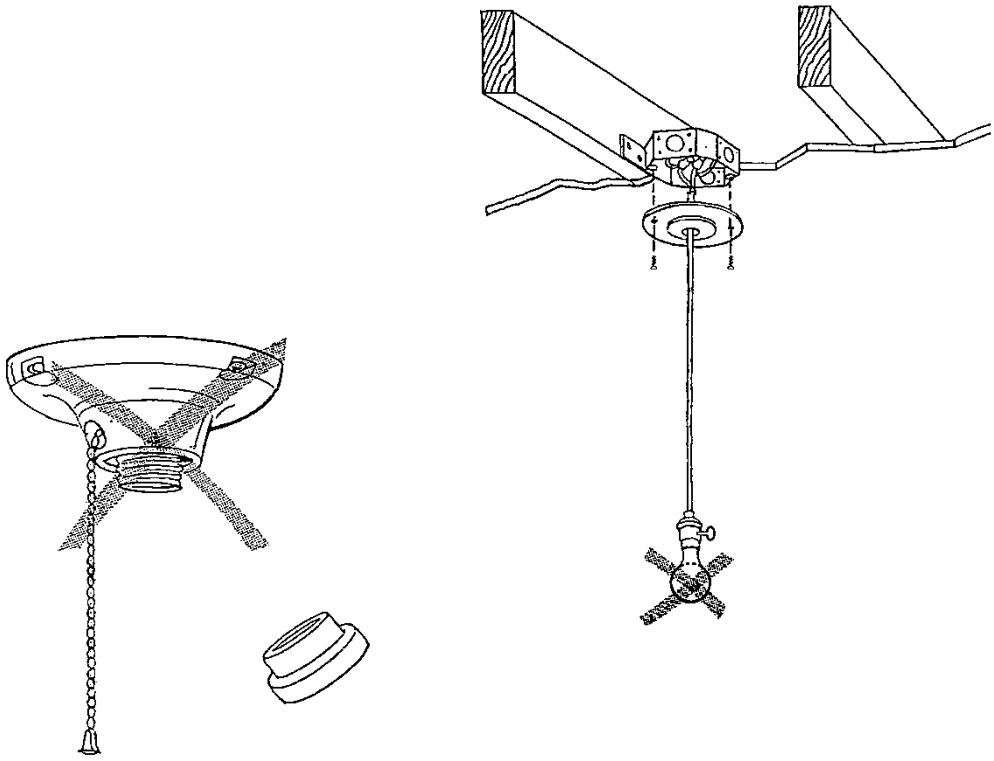
3. LUMENS

- **Installed LED**
  - Incandescent or Halogen Wattage Equivalencies: LED Bulbs must provide light output (lumens) levels sufficient to maintain pre-existing levels, and in accordance with the specifications below unless prohibited by the fixture manufacturer.

Incandescent and Halogen Fixtures (Fixture Wattage)	ENERGY STAR Brightness (Minimum Lumens)
40 watts	450
60 watts	800
75 watts	1,100
100 watts	1,600
150 watts	2,600

4. GENERAL LOCATIONS FOR LED BULBS

- **Globes**
  - LED bulbs shall not be installed in an enclosed globe or enclosed fixture, if prohibited by the LED manufacturer.
- **Fan Lighting**
  - All Fixtures
    - LED bulbs shall not be installed in fan lighting fixtures, if prohibited by the ceiling fan or LED manufacturer.
    - Armed light fixtures (cluster lighting) shall remain level after installation of LED bulbs.
    - Only LED bulbs identified by the manufacturer for use in a ceiling fan shall be installed in a fan to prevent premature failure of the LED.
- **Dimmers, Photosensors, and Vacancy or Occupancy Sensors**
  - All Fixtures
    - Only LED bulbs rated for use with dimmers, photosensors, and occupancy sensors shall be installed in fixtures controlled by such devices.
- **Timers**
  - Mechanical or Solid State
    - LED bulbs are acceptable to install in fixtures equipped with mechanical or solid state timers, when allowed by the LED manufacturer.
- **Lamp Cord Supported**
  - All Types
    - LED bulbs shall not be installed in fixtures supported only by a lamp cord.
- **Missing Caps**
  - Porcelain Bases
    - LED bulbs shall not be installed in lamp bases with missing caps.

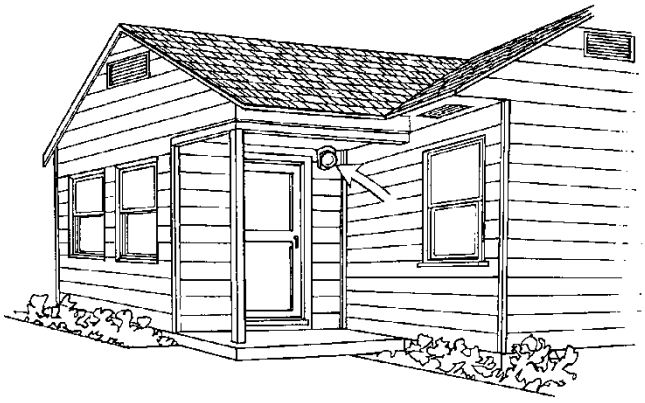


5. OUTDOOR LOCATIONS FOR LED BULBS

- **Installed LED Bulbs**
  - When LED bulbs are installed in outdoor locations:
    - The LED bulb shall be protected from the weather per manufacturer's instructions, and
    - The fixture shall be rated for damp or wet locations.

PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.



PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

6. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.
- **All LED Locations**
  - Replacing incandescent lamps with LEDs shall be determined by Energy Audit only.

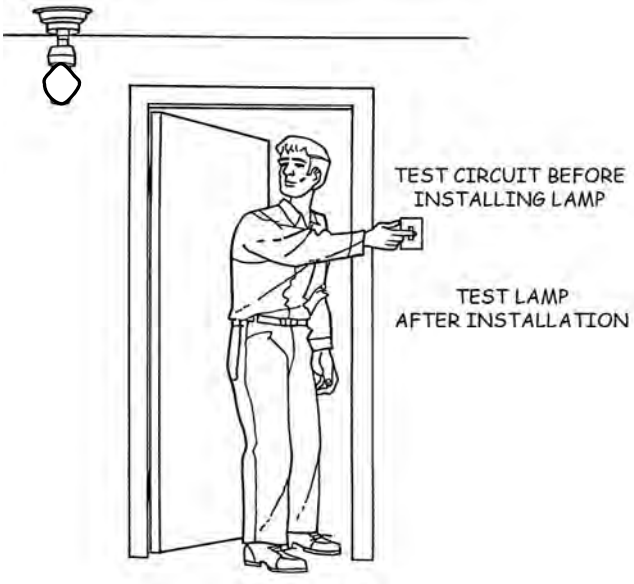
PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

7. OPERATIONAL CHECKS

- **All Fixtures**
  - The installer and QC inspector shall:
    - Test all installed LED bulbs before leaving.
    - Confirm that the lighting level is adequate for the client.

8. DISPOSAL REQUIREMENTS

- **All Removed Bulbs**
  - Existing bulbs shall not be left with the client or in the client's home.
  - All replaced bulbs and fixtures shall be de-manufactured, and disposed of in accordance with the requirements of the local jurisdiction.



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NOTES

LED NIGHT-LIGHTS

Lead Paint Risk Factor
NONE

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LED NIGHT-LIGHTS

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

LED NIGHT-LIGHT REPAIR

Not allowed for this measure.

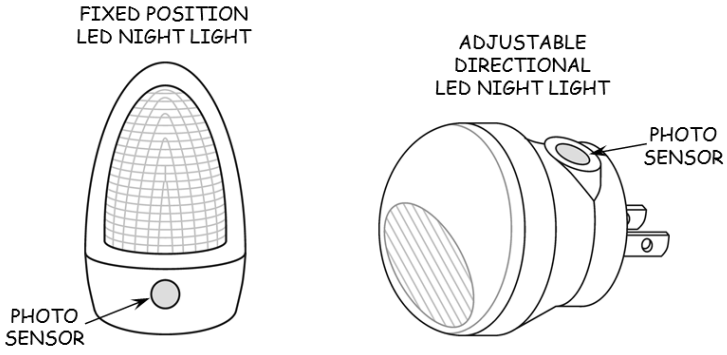
LED NIGHT-LIGHT INSTALLATION

1. INSTALLATION REQUIREMENTS

- **Instructions**
  - Installation shall be in compliance with this section, manufacturer's instructions, and local code.
  - When a conflict occurs, the more restrictive provision shall be followed.

2. INSTALLATION

- **All Units**
  - Manufacturer's installation recommendations shall be followed.
  - All night-lights must be installed by the weatherization installers.
  - If receptacle is switched, the switch shall function properly.
  - Devices unplugged for night-light installation shall be plugged in again in an alternative location.
- **The receptacle shall be:**
  - Securely installed in an electrical box.
  - In good condition (wiring, receptacle, and cover plate).
    - Night-lights shall not be installed in a receptacle that is not properly secured or has an electrical hazard present.
- **Cover Plates**
  - Missing or damaged cover plates shall be replaced for the receptacle used to power the night-light.
- **Extension Cords**
  - The night-light shall be plugged directly into a secure receptacle, not into an extension cord.



PART 2: MOBILE HOME CRITERIA

See Part 1: Installation Requirements for Conventional Homes.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

3. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

4. OPERATIONAL CHECKS

- **All Units**
  - All installed LED night-lights shall be tested for proper operation.
  - When light level is too high to activate the unit for the operational check, the photo sensor shall be covered to simulate darkness.

5. CLIENT INSTRUCTIONS AND WARRANTY

- **All Units**
  - Client shall receive manufacturer's instructions and written warranty, when available.

6. DISPOSAL REQUIREMENTS

- **All Units**
  - Installation/packaging materials shall be removed from the premises.

HIGH-EFFICIENCY TOILETS (HET)

Lead Paint Risk Factor
LOW

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HIGH-EFFICIENCY TOILETS (HET)

PART 1: INSTALLATION REQUIREMENTS FOR CONVENTIONAL HOMES

HET REPAIR

Not allowed for this measure.

HET INSTALLATION

1. PRE-INSTALLATION

- **Qualified Installer**
  - All installations shall be made by, or under the supervision of, a licensed contractor.
- **Toilet Removal and Preparation**
  - Toilet flange shall be:
    - Cleaned (all old wax and debris removed)
    - Checked for damage/deterioration that requires repair/replacement
  - Floor area where the new toilet will rest (footprint) shall be clean (free of wax and debris).
  - Existing anchor bolts shall be removed from toilet flange, along with all remaining debris.
  - Toilet flange shall be examined to determine if it is in good condition and can properly secure the toilet.
  - If toilet flange is too low (per toilet manufacturer's specification), it shall be determined whether:
    - A proper-size flange extension must be installed, or
    - Addition of a second wax ring is appropriate and will provide a long-term seal.
- **Floor Repair**
  - When the floor under the toilet is unstable due to damaged/degraded wood flooring (e.g., from water damage), repairs must be made before a new toilet may be installed.
  - Damaged wood flooring material and weakened framing members shall be removed.
  - New solid wood framing shall be installed as needed to provide rigid support for replacement wood flooring material (e.g., plywood).
  - Upper surface of replacement material shall match existing floor level.
  - All wooden materials shall be secured with corrosion-resistant anchors (e.g., zinc-plated or corrosion-resistant coated deck screws).
  - Floor covering (e.g., vinyl) shall be installed as needed to facilitate installation of a new toilet.

2. INSTALLATION REQUIREMENTS

- **Instructions**
  - When the local jurisdiction requires a permit for toilet replacement, one shall be obtained.
  - Installation shall comply with this section, manufacturer's instructions, and local code.
  - When requirements vary, the more restrictive provision shall be followed.

3. FLANGE INSTALLATION

- **Toilet Flange Replacement**
  - If toilet flange is damaged/deteriorated too much to secure the toilet properly, it shall be repaired or replaced.
  - When waste pipe is cast iron:
    - Existing flange and pipe shall be properly removed and replaced with plastic parts.
    - Care shall be taken to not damage or break cast iron pipe that cannot be properly accessed for repair/replacement.
  - When the toilet flange is secured by screws, they shall penetrate solid material and be tightened properly.
- **Flange Extension Installation**
  - Height of the toilet flange shall be in accord with toilet manufacturer's instructions (typically 1/4-inch above the floor).
  - A flange extension:
    - Shall be utilized when necessary to achieve the required height.
    - Shall be installed, sealed, and secured in accordance with manufacturer's instructions.

4. TOILET INSTALLATION

- **Replaced Toilets**
  - Bowl height:
    - Shall be the option of the client, to the extent possible, and conform with CSD WIS Appendix A.
    - Shall meet ADA requirements, when applicable.
  - Toilet anchor bolts:
    - New bolts, washers, nuts, and caps shall be installed.
    - Bolts too long for caps to fit over shall be cut to proper length.
  - Toilet shall be set over the bolts and the wax ring pressed into place over the toilet flange.
    - Care shall be taken to ensure proper placement and compression of the wax ring.
  - If the toilet rocks because floor or toilet is uneven, or if toilet is not level, toilet shims shall be:
    - Installed to place the toilet bowl in a solid, level position,
    - Snapped off or trimmed at the edge of the toilet, and
    - Positioned so they will be covered by the sealer bead of caulk.
  - Nuts and Caps
    - Brass open-cap nuts shall be installed over corrosion-resistant washers and tightened snugly (avoid over-tightening).
    - Properly-fitting bolt caps shall be placed over the nuts.

5. TANK INSTALLATION

- **Water Tank**
  - With tank-to-bowl spud washer in place, tank bolts shall be hand-tightened evenly, and then tightened slightly with a wrench.
  - If there is a leak when tank is filled with water, bolts shall be tightened enough to stop the leak (avoid over-tightening).

6. WATER SHUTOFF VALVE (ANGLE STOP)

- **Shutoff Valve (Angle Stop) Replacement**
  - A new water shutoff valve shall be installed, when the existing valve is defective or leaking.
  - Pipe cement or Teflon® tape shall be applied to the threaded nipple, and valve shall be installed watertight.

7. WATER SUPPLY LINE

- **Line Replacement**
  - Toilet tank supply line shall always be replaced.
    - Note: If the supply line shut-off valve is a single unit, replacement shall require shut-off of the main house water supply.
  - Braided flexible supply line of proper length shall be installed in accordance with manufacturer's instructions.
  - Fittings shall be properly tightened to be leak-free.

8. FINAL INSTALLATION PROCEDURES

- **Toilet Seat**
  - The toilet seat shall be installed and secured in a centered position.
- **Sealer Bead**
  - After toilet is secured in final position, a neatly-tooled sealer bead of caulk shall be applied to form a watertight seal between the toilet and floor.
  - Caulk shall neatly and completely cover shims (trimmed), when present.

SEALER BEAD APPLIED AROUND ENTIRE BASE OF TOILET

PART 2: MOBILE HOME CRITERIA

9. INSTALLATION

- **General Requirements**
  - See Part 1: Installation Requirements for Conventional Homes.
- **Plastic Piping**
  - When the waste line is older plastic piping (e.g., polybutylene), it shall be carefully inspected and assessed.
  - Polybutylene pipe, gray tubing made between the late 1970s to mid-1990s, can be fragile and subject to leaking. It must be evaluated by an experienced plumber to determine if toilet replacement is feasible.
  - When existing old plastic piping can safely be used, a transition shall be installed as needed to properly join the new pipe to the old plastic pipe.

PART 3: MULTI-FAMILY WHOLE BUILDING CRITERIA

10. MULTI-FAMILY INSTALLATION REQUIREMENTS

- **General**
  - All measure installation for these projects must conform to the latest adopted version of the CSD Multi-Family Weatherization Installation Standards manual, which is incorporated here by reference and available on the CSD Providers' website.

PART 4: MEASURE-SPECIFIC POST-INSTALLATION REQUIREMENTS

11. OPERATIONAL CHECK

- **Quality Installation**
  - Tank shall be filled and flushed at least two times.
  - All joints shall be checked for water leaks, and tightened as needed for a proper seal.
  - Toilet shall be level, solid, and secure.

12. CUSTOMER INFORMATION

- **Instructions**
  - Both verbal and written instructions, and educational information, shall be provided regarding:
    - Operation of the toilet,
    - Care and cleaning, and
    - Acquisition of replacement parts.
- **Warranty**
  - Contractor's and toilet manufacturer's warranty documentation shall be given to the customer.

13. DISPOSAL REQUIREMENTS

- **All Units**
  - All scraps and debris associated with old toilet removal and new toilet installation shall be removed from the premises, and the worksite shall be left clean.
  - Removed toilet shall be disposed of (recycled when possible) in accordance with local requirements and practices.

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APPENDIX -A-

MATERIAL SPECIFICATIONS

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AIR CONDITIONER AND HEAT PUMPS—CENTRAL SYSTEM
(WIS Section 31)

Material	*Requirements*
AIR CONDITIONER	- ALL UNITS • All materials shall be in conformance with the California Building Code (CBC) and California Mechanical Code (CMC). – Installed appliances shall conform to CEC standards for efficiency, as verified by inclusion in the CEC's database of certified appliances, an equivalent federal directory, or an approved trade association directory. • Replacement air conditioning systems shall be: – In compliance with Title 24 efficiency standards, and – Rated by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI).  *Photo Credit: RHA, Inc.*
AIR FILTER	- CENTRAL AIR CONDITIONING AIR FILTER • Filters shall be selected in accordance with this appendix for "Air Filters."
DUCTS AND SEALANTS	- DUCTS AND SEALANTS • Materials shall be in conformance with this appendix for "Duct System Repair and Sealing."
GAS PIPES AND VALVES	- GAS PIPES AND VALVES • Gas values shall be UL-listed and AGA- or CSA-certified. • Gas flexible connectors shall be listed epoxy-coated or stainless steel units. • Pilot tubing shall be aluminum (copper not allowed). • Fuel-gas piping: – Shall be selected, sized and installed per 2013 CMC, Chapter 13. – Copper gas lines not allowed.
HEAT PUMP	- HEAT PUMP UNIT • Package Units – Minimum HSPF of 8. – Minimum SEER of 14. • Split Systems (including mini-split systems) – Minimum HSPF of 8.2. – Minimum SEER of 14. – Note: The SEER and HSPF shall be determined by the coil and condenser match as listed in the current AHRI Directory.
PACKAGE UNIT	- PACKAGE UNIT (DUAL PACK) • Furnace: Minimum AFUE rating of 81%. • Air Conditioner: Minimum SEER of 14; Minimum EER of 11.0.
SPLIT SYSTEM	- SPLIT SYSTEM • Furnace: – Furnace unit shall conform with the "Furnace—Central FAU" section of this appendix. – Units installed in a Mobile Home shall be listed for use in a Mobile Home, and inside the living space shall be Closed Combustion. • Air Conditioner: Minimum SEER of 14 with a thermostatic expansion valve (TXV). – The SEER shall be determined by the coil and condenser match as listed in the current AHRI Directory.
THERMOSTATS	- WALL THERMOSTATS • Programmable and manual wall thermostats shall be selected in accordance this appendix for "Thermostats."

Material	*Requirements*
VENT PIPES	- METAL VENT PIPES • All metal vent pipes, vent connectors and components shall be UL-listed. • Gas vent pipe shall be Type B. - NON-METALLIC COMBUSTION AIR AND VENT PIPES • Pipes and fittings shall be labeled to conform to ASTM D 1785 and D 2665. • Pipe cement and primer shall be labeled to conform to ASTM D 2564.

AIR CONDITIONER—WALL AND WINDOW
(WIS Section 32)

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td>AIR CONDITIONERS</td><td>
- ALL UNITS

Unit shall be UL-listed (or equivalent) and equipped with:

Minimum two-speed fan.
Adjustable thermostat with a minimum of six positions.
Removable filter.
Air directional control, minimum four-way.


Photo Credit: RHA, Inc.
</td></tr>
<tr><td>UNIT SIZING & EFFICIENCY</td><td>
- NEW UNIT

Installed appliances shall conform to CEC Title 20 efficiency standards for room air conditioners that are manufactured on or after June 1, 2014 (as verified by inclusion in the CEC's database of certified appliances, an equivalent federal directory, or an approved trade association directory).

<table>
<tr><th>Appliance</th><th>Louvered Sides</th><th>Cooling Capacity (Btu/hr)</th><th>Minimum Combined EER</th></tr>
<tr><td>Window/Wall AC</td><td>Yes</td><td>< 6,000</td><td>11.0</td></tr>
<tr><td>Window/Wall AC</td><td>Yes</td><td>≥ 6,000 – 7,999</td><td>11.0</td></tr>
<tr><td>Window/Wall AC</td><td>Yes</td><td>≥ 8,000 – 13,999</td><td>10.9</td></tr>
<tr><td>Window/Wall AC</td><td>Yes</td><td>≥ 14,000 – 19,999</td><td>10.7</td></tr>
<tr><td>Window/Wall AC</td><td>Yes</td><td>≥ 20,000 – 27,999</td><td>9.4</td></tr>
<tr><td>Window/Wall AC</td><td>Yes</td><td>≥ 28,000</td><td>9.0</td></tr>
<tr><td>Window/Wall AC</td><td>No</td><td>< 6,000</td><td>10.0</td></tr>
<tr><td>Window/Wall AC</td><td>No</td><td>≥ 6,000 – 7,999</td><td>10.0</td></tr>
<tr><td>Window/Wall AC</td><td>No</td><td>≥ 8,000 – 10,999</td><td>9.6</td></tr>
<tr><td>Window/Wall AC</td><td>No</td><td>≥ 11,000 – 13,999</td><td>9.5</td></tr>
<tr><td>Window/Wall AC</td><td>No</td><td>≥ 14,000 – 19,999</td><td>9.3</td></tr>
<tr><td>Window/Wall AC</td><td>No</td><td>≥ 20,000</td><td>9.4</td></tr>
<tr><td>Room AC Heat Pump</td><td>Yes</td><td>< 20,000</td><td>9.8</td></tr>
<tr><td>Room AC Heat Pump</td><td>Yes</td><td>≥ 20,000</td><td>9.3</td></tr>
<tr><td>Room AC Heat Pump</td><td>No</td><td>< 14,000</td><td>9.3</td></tr>
<tr><td>Room AC Heat Pump</td><td>No</td><td>≥ 14,000</td><td>8.7</td></tr>
<tr><td>Casement-Only Room AC</td><td>Either</td><td>Any</td><td>9.5</td></tr>
<tr><td>Casement-Slider Room AC</td><td>Either</td><td>Any</td><td>10.4</td></tr>
</table>

Shall also comply with manufacturer's recommendations for sizing and the policy guidelines in the table in the Field Guide measure-specific policy.

</td></tr>
<tr><td>WALL AIR CONDITIONER</td><td>
- WALL UNITS (CONVENTIONAL HOMES ONLY)

Shall be equipped with thru-the-wall chassis (sleeve).

</td></tr>
</table>

AIR FILTERS
(WIS Section 28)

Materials	*Requirements*
APPROVED MATERIALS	- ALL FILTERS • A MERV 6 filter shall be required for new, replacement appliances. • When a MERV 6 filter is not specifically allowed by the manufacturer's specifications for existing forced air appliances, a washable, "hog hair," foam, or other specialty-type filter (listed below) shall be installed in existing forced air systems (to prevent excessive static pressure that may cause the appliance to fail).
FILTER FOR <u>EXISTING</u> FORCED AIR SYSTEMS	- MERV 6 TYPE • When specifically allowed by manufacturer of the existing system. - "HOG HAIR" TYPE AND OTHER BONDED FILTER • 1" thickness shall be used in central HVAC systems. • 1/2" thickness shall be used in window/wall air conditioners. - FOAM FILTER • 1/4" single layer foam, 20 to 30 pores per inch (ppi). • Foam shall be installed only when bonded fiber is not feasible or prohibited by the appliance manufacturer. - OTHER MATERIALS • "Sock" type foam and other specialty materials shall only be installed where specified by appliance manufacturer.  *Photo Credit: RHA, Inc.*
FILTER FOR <u>NEW</u> FORCED AIR SYSTEMS	- NEW FORCED AIR SYSTEMS • Shall be MERV 6 or better, when installed in a new/replacement forced air unit or filter grille. • Shall be UL-listed Class 2 filter material. • Shall conform to AHRI 680 or AHRI 681 (SI), and UL-900. 
SUPPORT RODS AND FILTER SUPPORTS	- FOR UNFRAMED AIR FILTERS • Manufacturer's instructions shall be followed. • When <u>not</u> in conflict with appliance or filter manufacturer's instructions, steel rods (galvanized recommended) shall be internally installed, as needed, to stiffen filters that are 20" or longer in either direction.

ATTIC AND CRAWLSPACE VENTILATION
(WIS Section 21)

Materials	*Requirements*
VENT MATERIALS	- VENTS SHALL BE: • Made of corrosion-resistant material for their specific location (e.g., exterior soffit, gable end, roof, crawlspace, etc.) and material and intended use (e.g., metal vent on metal roof. • Installed with a protective barrier or baffle. - VENT SCREENS • All ventilation will have screens with non-corroding wire mesh with openings of 1/16" to 1/4" to prevent pest entry (e.g., birds, bats, bees, etc.). - POWERED ATTIC VENTS • Are not allowed within the weatherization program.

Photo Credit (upper and lower): RHA, Inc.

CARBON MONOXIDE (CO) ALARMS
(WIS Section 4)

Material	*Description*
ALARM ACCESSIBILITY	- COMPONENT ACCESSIBILITY • Sensor and any field sensitivity adjustment shall <u>not</u> be accessible without removing Alarm from its mounting.
CO ALARM	- ALL CO ALARMS SHALL BE: • Alarm shall include a digital readout that, with the single touch of a button, displays the current CO level as low as 10 PPM (low-level display CO alarm). • Alarm shall have the capacity to display peak CO leavel as low as 10 PPM and the time duration of the peak CO level. • UL-tested and -listed to latest ANSI/UL 2034 standard • Manufactured after August 2009. • Included on the State Fire Marshal's list of approved products. • A single-purpose alarm (CO only). • Alarm shall be battery-powered, and the battery shall be: – Non-rechargeable, long-life lithium type. • Warrantied by alarm manufacturer to power the alarm for a minimum of five years. – Non-removable: • Factory installed behind a door secured with tamper-resistant screw (i.e., battery door cannot be opened with standard screwdriver/wrench), <u>or</u> • Factory sealed with soldered connections. • Sensor shall be electrochemical type. • Alarm shall provide audible <u>and</u> visual warning signals when: – An internal malfunction occurs (i.e., electrical short or failure). – The sensor's life has expired. – The battery power is low (reaches the end of its useful life). - <u>HARD-WIRED</u> CO ALARM REQUIREMENTS • Shall be installed only when: – Interconnection is required to be compatible with the existing hardwired system, or – When required by the local jurisdiction (requires a program waiver or – To provide a CO alarm for a hearing-impaired person (requires a program waiver). • Hard-wired alarm shall be: – 120 VAC. – Factory preinstalled lithium battery back-up. – Inter-connected, when required by the local jurisdiction.  *Photo Credit: Defender*
MOUNTING SYSTEM	- MOUNTING SYSTEM • The mounting system shall be designed so the alarm is secured to the mounting plate or wall with one or more standard screws that extend through the alarm cover/body and into the mounting plate or wall.
SPECIALTY ALARM	- ALARM FOR THE HEARING IMPAIRED • When a home is occupied by a hearing-impaired person who qualifies for a CO alarm and requests an alarm for the hearing impaired: – A waiver shall be sought from CSD to install a special hard-wired alarm with strobe lights.

CAULKING
(WIS Section 8)

Materials	*Requirements*
SEALANTS	- ALL MATERIALS • Contractor shall comply with Proposition 65 requirements. • Sealants applied indoors shall be non-toxic. 
	- ACOUSTICAL CAULK/SEALANT • Non-hardening latex compound; ASTM C834.
	- SOLVENT RELEASE SEALANTS • Includes Acrylic, Butyl Rubber and Chlorosulfonated Polyethylene. • Conformance to ASTM C1311.
	- LATEX SEALANTS • Includes Latex, Acrylic Latex, and Siliconized Acrylic. • Conformance to ASTM C834.
	- ELASTOMERIC JOINT SEALANTS • Includes Polysulfide, Polyurethane, and Silicone. • Conformance to ASTM C920 or other ASTM Standards for Elastomeric Sealants (e.g., C603, C734, C1250, and D2202.
	- HIGH TEMPERATURE CAULK • Sealant rated for constant service up to at least 450°F (e.g., RTV red silicone, available for service up to 600°F, such as automotive RTV gasket sealant).
	- FOAM SEALANT • Class A, or Class 1 per ASTM E84. • Minimally expanding. • Fire-resistant foam compliant with ASTM E814 or UL 1479.

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CEILING FANS
(WIS Section 33)

Materials	*Requirements*
ALL CEILING FANS	- GENERAL SPECIFICATIONS • ENERGY STAR®–certified and UL-listed. • Ceiling mounted units only. • 110 volt electrical requirements. • Speed control: 3-speed or variable speed. • Separate fan and light switch controls on fan, when light kit is present. • UL-listed motor and/or fan unit. • Shall be capable of reversible fan action, in accordance with Title 20 Appliance Energy Efficiency Standards.  *Photo Credit: RHA, Inc.* • Shall permit convenient consumer adjustment of fan speed, by one or more wall-mounted switch(es), a remote control, or readily accessible pull (swag) chains. – Remote control shall be UL-listed and compatible with fan. - LIHEAP SPECIFICATIONS • New fan shall only be installed in a dwelling without an existing ceiling fan and be in conformance with the General Specifications above. • Light fixture shall be included when ceiling fan is installed in an existing overhead light location. - DOE SPECIFICATIONS • A new ceiling fan with a LED light kit shall replace an existing, non-ENERGY STAR ceiling fan where incandescent bulbs are installed in the light kit ONLY. • Replacement ceiling fan shall meet the General Specifications listed above, and also have a light kit that accepts LED installation. • LEDs shall be listed for use in a ceiling fan, or other location subject to vibration. • Light kits shall be ENERGY STAR–certified, for ceiling fans with light fixtures in locations where lighting shall be high-efficacy (see Residential Compliance Manual, Chapter 6, § 6.1.2).
CEILING FAN SIZING	- FAN SIZE • Shall be appropriate for room dimensions and by manufacturer specification. • When manufacturer specification is not available, the table below is a Ceiling Fan Sizing Guide from the ENERGY STAR website that shall be followed as closely as is possible and reasonable: **ROOM DIMENSIONS** / **CEILING FAN DIAMETER** Up to 75 sq. ft. — 29" – 36" 76 – 144 sq. ft. — 36" – 42" 145 – 225 sq. ft. — 44" 226 – 400 sq. ft. — 50" – 54"
SWAG CHAIN KIT	- SWAG CHAIN KIT • UL-listed (or equivalent) and properly grounded (compliant with local code).

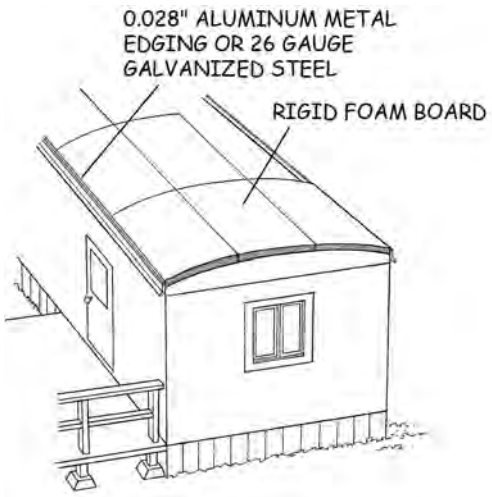
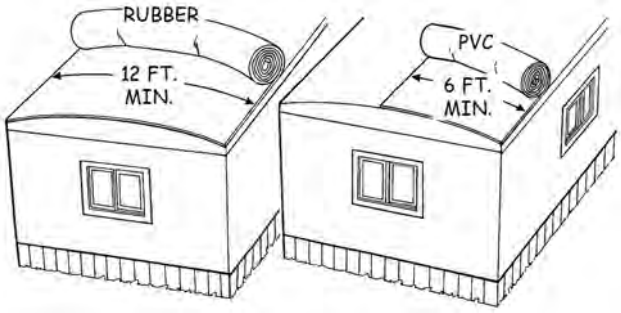
CEILING INSULATION FOR CONVENTIONAL HOMES
(WIS Section 20A)

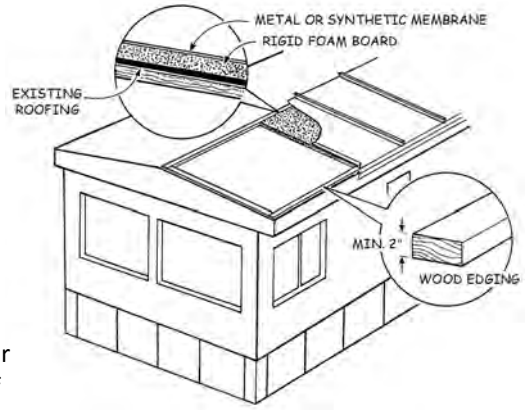
Materials	*Requirements*
APPROVED MATERIALS	- ALL INSULATION • Shall be certified to comply with the material specifications in CCR, Title 24, Part 12, Chapters 12-13, and "Standards for Insulating Material." • Maximum R-value for LIHEAP Contract: – Climate Zones 1 & 11 – 16: R-38 – Climate Zones 2 – 10: R-30 • R-value for DOE Contract shall be determined by: – the DOE Priority List Table; or – Energy Audit result. - MINERAL FIBER • Flexible (Batts): Conformance to ASTM C665. • Loose Fill: Conformance to ASTM C764. - CELLULOSE • Loose Fill – Licensed for sale in California. – Listed in Department of Consumer Affairs' "Directory of Certified Insulation Materials." - RIGID • Preformed Polyisocyanurate Board Foil Faced on Both Sides. – Conformance to FS HH-1-1972. • High Density Fiberglass Board: Conformance to ASTM C726.

Photo Credit: CAP of San Luis Obispo

CEILING/ROOF INSULATION FOR MOBILE HOMES
(WIS Section 20B)

Materials	*Requirements*
ALL INSULATION	- ALL INSULATION • Shall be certified to comply with the material specifications in CCR, Title 24, Part 12, Chapters 12-13, and "Standards for Insulating Material." • Actual roof cavity, type of insulation activity, and structural strength may limit R-value that can be installed. • Maximum R-value for LIHEAP Contract: – R-30 • R-value for DOE Contract shall be determined by: – the DOE Priority List Table; or – Energy Audit result.  *Photo Credit: WAPTAC.org*
ALL MECHANICAL FASTENERS	- SCREWS AND WASHERS • All screws shall be: – #8 minimum size. – Flathead. – Non-corrosive: cadmium plated or equivalent. – Proper type and size to assure a permanent attachment. • All washers: – Shall be 3" minimum diameter, and – Contain a center recess to place the screw head flush with or below the insulation surface.
ALL MINERAL FIBER	- FLEXIBLE • Conformance to ASTM C665. - ROOF BOARD HIGH DENSITY FIBERGLASS • Conformance to ASTM C726. • Minimum density 3 lbs./cu.ft. - LOOSE FILL FIBERGLASS • Conformance to ASTM C764. - LOOSE FILL ROCK WOOL OR CELLULOSE • Not allowed. 
ALL RIGID FOAM BOARD	- PREFORMED EXPANDED POLYSTYRENE. • Conformance to ASTM C578. • Minimum density 1 lbs./cu.ft. - PREFORMED FOIL FACED POLYISOCYANURATE OR POLYURETHANE • Conformance to FS HH-I-1972.
MOBILE HOME ROOF CAP INSULATION METHOD	
ALUMINUM ROOFING MATERIAL	- MINIMUM THICKNESS: 0.024" • Baked-on enamel or equivalent coating is best practice.

COVER MATERIAL	- COVER MATERIAL SHALL BE: • HUD-approved and -listed. • Approved by the manufacturer for mobile home roof cap application. • Adequately puncture resistant to withstand the environmental hazards of the location in which it will be installed, e.g. dropping pine cones, tree branches, etc. • Light in color.
INSULATION MATERIALS	- RIGID FOAM • Preformed Expanded Polystyrene • Preformed Polyisocyanurate - ROOF BOARD • High Density Fiberglass
OTHER SYSTEM COMPONENTS	- WOOD EDGING AND FURRING • Grade, Type, and Size – #2 or better Douglas Fir acceptable. – Redwood or pressure-treated fir preferred. – Nominal 2" x 2" minimum cross sectional dimensions. • Thickness – Height of wood shall equal height of insulation + 3/8". - ALL METAL COMPONENTS • Shall be manufactured for the application in which they are used. • Shall meet the thickness requirements listed below unless lighter weight material is approved by the HCD State Plan Check Engineer. • Shall be installed, secured, and sealed in conformance with manufacturer's instructions. - METAL EDGING WITHOUT WOODEN PERIMETER • Minimum thickness – Aluminum: .028" – Galvanized steel: 26-gauge - METAL DRIP RAILS, EDGE TRIM AND FLASHING, END AND RIDGE CAPS • Minimum thickness – Aluminum: .024" – Galvanized steel: 30-gauge 
SPLICING AND ATTACHMENTS	- PVC MATERIAL • Minimum thickness: 40 mil. • Imbedded rip-stop fiber scrim required. - EPDM AND HYPALON™ RUBBER • Minimum thickness: 45 mil. • Conformance to ASTM D4637. - OTHER MATERIALS • System design shall be submitted to and approved by the CA Department of Housing and Community Development (HCD) prior to any installation activities. 
STEEL ROOFING MATERIAL	- GALVANIZED STEEL. • Minimum thickness: 30-gauge. • Baked-on enamel or equivalent coating is best practice. • Shall conform to ASTM A361/361M.

MOBILE HOME GABLE END INSULATION METHOD	
EXTERIOR SURFACE MOUNT METHOD	- INSULATION • Minimum R-11 rigid insulation covered with a watertight metal enclosure. - ENCLOSURE • Minimum 0.019" aluminum or 30-gauge galvanized steel shall be used for the enclosure. - ATTACHMENTS (SCREWS AND WASHERS) • See above in “All Mechanical Fasteners.” - CAULKING • See Elastomeric sealing, per “Caulking” section of this Appendix. - PUTTY TAPE • Self-sealing adhesive, pliable, long-life-type.
INTERIOR TRUSS MOUNT METHOD	- INSULATION • Flexible or rigid mineral fiber insulation. • Foam not allowed unless ceiling is minimum 5/16" gypsum or equivalent.
MOBILE HOME EXTERIOR ROOF EDGE CAVITY FILL METHOD	
COMPONENT ATTACHMENT	- SCREWS, NAILS, OR STAPLES • All screws, nails, or staples shall be at least 3/4" in length and: – Non-corrosive: cadmium plated or equivalent. • All screws shall be #8 minimum size, flathead, and: – Proper type and size to assure a permanent attachment.
INSULATING MATERIALS	- APPROVED MATERIALS • Loose fill fiberglass: Conformance to ASTM C764 - MATERIALS NOT ALLOWED: • Cellulose • Rock Wool
SEALING MATERIALS	- SEALANT • Long-life sealant shall be minimum 1/8" putty tape or elastomeric sealant. • Elastomeric sealant shall be applied to exposed seams and screw heads as needed to achieve a permanent, watertight seal. - WASHERS • Exposed screws shall be sealed with a tight-fitting rubberized metal washer, or metal and rubber washer combination. Washers shall be 3" minimum diameter and shall contain a center recess to place the screw head flush with or below the surface of the insulation. 
MOBILE HOME INTERIOR CEILING BORE CAVITY FILL METHOD	
INSULATING MATERIALS	- APPROVED MATERIALS • Loose Fill Fiberglass: Conformance to ASTM C764. - MATERIAL NOT ALLOWED • Cellulose • Rock Wool
SEALING MATERIALS	- PLUGS • Custom made plugs matching existing ceiling material is a best practice. • Plastic plugs are acceptable.

COMBUSTION APPLIANCE SAFETY (CAS) INSPECTION EQUIPMENT
(Field Guide Appendix A)

Materials	*Requirements*
CO ANALYZERS	- CARBON MONOXIDE TESTERS • Shall be manufactured under an ISO 9001 quality management system or be ISO 9001–certified. • Shall, at a minimum, measure CO levels from zero ppm to 999 ppm. • <u>New Units</u>: Capable of providing air-free CO readings. • <u>New and Existing Units</u>: On-board or in-line NOx filter and condensate trap.  *Overall Photo Credit:*
CO ANALYZER SAFETY TEST ACCESSORIES	- SAFETY TEST ACCESSORIES • Monoxor Probe Extension materials: – 1/4" OD aluminum tubing (e.g., pilot tubing), cut in 1' & 2' (or longer) lengths (do not buy copper tubing) – 1/4" ID and 5/16" ID plastic tubing – Small stainless worm-drive clamp to fit over 5/16" ID plastic tubing • High-temperature caulk: Non-hardening sealant (e.g., RTV silicone) with a minimum service temperature of 450°F. • Aluminum foil tape: UL-listed, with minimum service temperature of 265°F (e.g., 181A-P duct tape). • Liquid gas leak detection compound with spray bottle: can be "neutral" leak detection soap (<u>not</u> dishwashing detergent). • Incense sticks: mildest scent available. • Smoke Sticks, Puffers, Pens to create smoke for diagnostic testing: commercially available. • Match Extender: Alligator clip on telescoping handle.
OTHER TEST EQUIPMENT	- DRAFT GAUGES • Draft gauges shall have a range of –0.25 to +0.05 inches of water column (IWC), or –62.5 to +12.5 Pascals (Pa). - THERMOMETERS • Thermometers shall have a range from 0°F to 250°F. - GAS LEAK DETECTORS • Gas Leak Detectors shall be listed to UL 913.
PLUG BUTTONS	- VENT "PLUG BUTTONS" • Metal and non-corrosive (e.g., nickel plated snap-in hole caps), sized to match drill bit(s) used to drill sampling holes (e.g., 5/16" and 3/8").
SAFETY TEST TOOLS	- SAFETY TEST TOOLS • Battery-powered nut driver, heavy duty, with 1/4" and 5/16" Magnetic Hex Nut Driver Bits. • 5/16" and 3/8" Drill Bits: Metal drills sized to match plug buttons. • Inspection Mirror: Small round or rectangular mirror on telescoping handle. • Propane Lighter: "Gas Match" type trigger-operated, long-nose lighter (flexible nose is best).

COMPACT FLUORESCENT FIXTURES—HARD-WIRED
(WIS Section 35)

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td>ADAPTERS</td><td>Adaptors which convert a threaded incandescent lamp holder to a high-efficacy luminaire shall not be used to change a fixture to high efficacy.</td></tr>
<tr><td>ADDITIONAL INSTALLATIONS</td><td>Local jurisdiction may require change-out of additional existing lighting to meet Title 24 requirements, but materials will have to be addressed on a case-by-case basis by programmatic waiver.</td></tr>
<tr><td>ALL FIXTURES</td><td>- CFF AVAILABILITY
• If a high-efficacy (pin-based) fluorescent hard-wired fixture is not available that meets CSD WIS Appendix A Material Specifications, it is required to install LEDs in an existing thread-based fixture.
• If the existing fixture is damaged, a new fixture (with thread-based LEDs) may be installed, upon approval of a waiver by CSD.
- FLUORESCENT FIXTURE GENERAL REQUIREMENTS
• Fixture shall be UL-listed, and , in accordance with local code(s) and NFPA 70 National Electric Code.
• Fixture shall allow for lamp replacement and utilize high efficacy pin-based lamps meeting the minimum standards shown in the Table below.
•
 
 
Photo Credit: RHA, Inc.
Photo Credit: WAPTAC.org
<table>
<tr><th>Luminaire (Fixture) Power Rating</th><th>Minimum Luminaire Efficacy to Qualify as High Efficacy</th></tr>
<tr><td>5 watts or less</td><td>30 lumens per watt</td></tr>
<tr><td>over 5 watts to 15 watts</td><td>45 lumens per watt</td></tr>
<tr><td>over 15 watts to 40 watts</td><td>60 lumens per watt</td></tr>
<tr><td>over 40 watts</td><td>90 lumens per watt</td></tr>
</table>
• Light output shall be sufficient to maintain pre-existing light level, unless a lower level is acceptable to the client.
• Lighting installed in attached and detached garages, laundry rooms, and utility rooms shall be high efficacy luminaires and controlled by vacancy sensors.</td></tr>
<tr><td>BALLASTS</td><td>• Ballast shall comply with ANSI/UL Standard 935 Class-P.
• Ballasts for fluorescent lamps rated 13 watts or greater shall be electronic and shall have an output frequency no less than 20 kHz.</td></tr>
<tr><td>COMMON AREA LIGHTING (MULTI-FAMILY)</td><td>- COMMON AREA LIGHTING
• In low-rise multi-family buildings with four or more dwelling units where common areas are 20% or less of the building area, lighting for common areas shall be high efficacy.
• Occupancy sensors used in common areas shall be able to turn the lights on automatically.
• In buildings where common areas are more than 20% of the building area, lighting in those common areas shall comply with the Title 24 nonresidential lighting requirements.
• Lighting in corridors and stairwells of multi-family buildings shall be controlled by occupant sensors that reduce the lighting by at least 50%.</td></tr>
<tr><td>HIGH-RISE MULTI-FAMILY</td><td>- OUTDOOR LIGHTING (4 STORIES OR MORE) – HIGH-RISE MULTI-FAMILY
• Outdoor lighting in high-rise multi-family buildings that is controlled from within a dwelling unit shall meet the requirements of single-family residential outdoor lighting.
• Outdoor lighting in high-rise multi-family that is not controlled from within a dwelling unit shall meet the Title 24 requirements of nonresidential buildings.</td></tr>
</table>

LIGHT OUTPUT	- LUMENS • Light output (lumens) level shall be sufficient to maintain pre-existing light level, unless a lower level is acceptable to the client.
LOW-RISE MULTI-FAMILY	- OUTDOOR LIGHTING (3 STORIES OR LESS) – LOW-RISE MULTI-FAMILY • Fixtures shall be high-efficacy lighting.
MULTI-FAMILY LOCATIONS	- ALL CFF LOCATIONS • Replacing incandescent fixtures with CFFs in dwelling units and common areas shall be determined by Energy Audit only in whole-building weatherization projects. • Multi-family whole building project lighting requirements should be confirmed with the local jurisdiction.

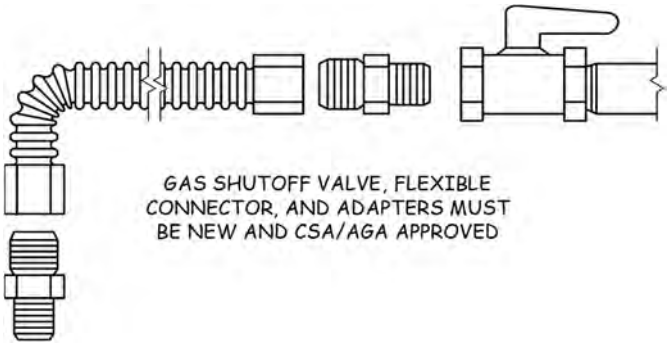
COMPACT FLUORESCENT LAMPS—THREAD-BASED
(WIS Section 34)

Materials	*Requirements*
ALL CFLs	- COMPACT FLUORESCENT LAMPS (CFLS) SHALL BE: • Listed in the California Energy Commission 2016 Title 20 Appliance Efficiency Database: https://cacertappliances.energy.ca.gov/Pages/ApplianceSearch.aspx • • If fluorescent lamps are not available that meet CSD WIS Appendix A Material Specifications, thread-based LEDs shall be installed. (Note: DOE feasibility for LEDs shall be determined by their line items on the priority list).  *Photo Credit: WAPTAC.org*

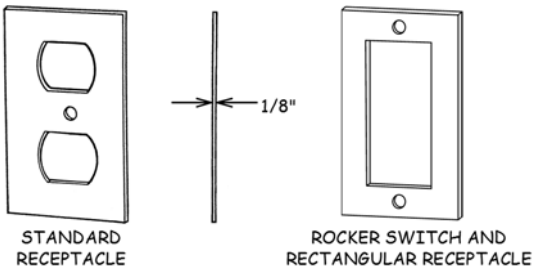
COOKING APPLIANCE REPLACEMENT—ELECTRIC
(WIS Section 40)

Materials	*Requirements*
ELECTRICAL COMPONENTS	- ELECTRICAL COMPONENTS • Receptacle shall match the plug on the Range power cord (pigtail) (e.g., NEMA type 14-50R 4-wire or 10-50R 3-wire 120/240 volt receptacle). • Components supplied by the installer shall meet NEMA standards and be UL-listed or equivalent (e.g., power supply cord, circuit breaker or fuse, and receptacle).  *Photo Credit: RHA, Inc.*
FREESTANDING ELECTRIC RANGE AND ELECTIC COOKTOP	- REPLACEMENT ELECTRIC RANGE OR COOKTOP • UL-listed, or equivalent. • In compliance with local code • Sealed or standard design burners, with a standard oven. - RANGE TYPE(S) NOT ALLOWED • Glass-top model • Self-cleaning model

COOKING APPLIANCE REPLACEMENT—GAS
(WIS Section 39)

Materials	*Requirements*
FREESTANDING GAS RANGE	- REPLACEMENT GAS RANGE • CSA-certified, UL-listed, or equivalent. • Compliance with ANSI Z21.1 (Household Cooking Gas Appliances) • Electronic ignition (shall not have standing pilots) • Range shall be compatible with the fuel used: natural gas or liquid petroleum (LP gas). • Sealed or standard design burners. • Unit with a standard oven. - FUEL "SWITCHING" • Conversion kit, when needed and approved in advance in writing by CSD, shall be obtained and specified by the stove manufacturer. - RANGE TYPE(S) NOT ALLOWED • Self-cleaning oven 
GAS COOKTOP	- REPLACEMENT GAS COOKTOP • Electronic ignition required, unless it is unfeasible to provide a 110-VAC circuit to the cooktop location.
VALVES AND FLEXIBLE GAS CONNECTORS	- VALVES AND FLEXIBLE GAS CONNECTORS • Gas shutoff valve and adapters shall be new brass and CSA or AGA approved. • Flexible gas connector shall be: – New stainless steel (coated or uncoated) up to 6' in length. – CSA Design–certified (per ANSI Z21.24/CSA 6.10), or AGA approved. 

COVER PLATE GASKETS
(WIS Section 11)

Materials	*Requirements*
GASKET MATERIAL	- ALL GASKETS SHALL BE: • Fire-resistant. • Pre-cut to fit. – Rocker-type switches and rectangular receptacles: Gaskets shall have rectangular perforations shaped for those applications (rather than using standard receptacle gaskets with rounded perforations). • Closed cell foam. • 1/8" thick minimum.   *Photo Credit: Public Domain*

DOOR REPAIR/REPLACEMENT
(WIS Section 14)

Materials	*Requirements*
CASING/TRIM	- WOOD • Exterior grade required in all exterior locations. • Paint grade acceptable, unless existing jamb has natural finish. - NAILS • Finishing or casing nails required for interior applications. • Galvanized nails required for exterior applications.
DEADBOLTS	- INTERIOR CONTROL • Knob is required on the interior side (key in lieu of a knob not allowed). • Shall be installed in accordance with the CSD Field Guide.
DOOR (EXTERIOR, HINGED)	- ALL EXTERIOR HINGED DOORS • Shall be in compliance with the fire-resistance requirements of local code (e.g., 2013 CRC Section R327.8). • Shall be equipped with safety glass when required by the local jurisdiction for the specific installation location. • Glass in doors greater than 3" shall always be safety glass. • Replacement doors shall be limited to standard solid core slab or panel doors (no ornate design, stained glass, decorative windows, etc., unless required by SHPO and approved by weatherization waiver). • Door "like for like" replacement shall not be allowed unless required by local code. • Hinged doors only, exterior grade. - DOOR COMPOSITION • Exterior replacement doors shall be a minimum 1-3/8" thick solid core wood door; or • Metal door, with a minimum R-6 insulated core; or • Any type of door, with a Fire Resistance Rating of at least 20 minutes, per NFPA 252. – Replacement doors shall be fire-rated in conformance with local code (e.g., for doors transferring from kitchen to garage in homes with attached garage, and in multi-family units). – Doors labeled to have a fire rating of at least 20 minutes shall not be modified or weatherstripped, except as prescribed and allowed by the manufacturer and local code. - NON-METALLIC VENEER FOR WOOD DOORS • Minimum 1/8" thick. • Hardboard veneer acceptable. • Exterior grade glue standard. 
DOOR JAMB	- REPLACEMENT MATERIAL • Exterior grade only. • 5/4" thick stock standard; 3/4" minimum.
DOORS WITH GLAZING **(GLASS INSET)**	- DOOR WITH GLAZING • Safety glass is required, except in jalousies, and windows with panes less than 3" in width or height. – Polycarbonate may be used in lieu of glass, if allowed by local code. • Includes doors with glazing that occupies more than 50% of the total area, and sliding glass doors. • U-Factor and Solar Heat Gain Coefficient (SHGC) shall be in compliance with the table on next page.

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td></td><td>
Glazed Door Performance Requirements
<table>
<tr><th>EFFICIENCY FACTOR</th><th>CLIMATE ZONE</th><th>MAXIMUM VALUE</th></tr>
<tr><td>U-Factor</td><td>All Climate Zones</td><td>O.32</td></tr>
<tr><td rowspan="2">Solar Heat Gain Coefficient (SHGC)</td><td>1, 3 & 5</td><td>No Requirement</td></tr>
<tr><td>2 &, 6 – 14</td><td>0.25</td></tr>
</table>
- LABELING
Safety glazing shall be permanently labeled and installed per the 2013 CRC, §R308.4.
</td></tr>
<tr><td>DOOR STOP</td><td>
- WOOD JAMBS
Stop shall be made of wood.
Paint grade acceptable, unless existing jamb has natural finish.
5/16" x 1-1/4" minimum dimensions.
</td></tr>
<tr><td>FINISH/ SEALER, EXTERIOR DOORS</td><td>
- ALL DOORS
Doors shall be sealed (painted or primed) to prevent moisture intrusion, including those that are cut to fit on-site. Pre-hung doors shall be already sealed (primed or painted) to be in compliance.
- WOOD DOOR
Acceptable sealers are:
Paint, urethane, and varnish.
Clear “water seal” products are not allowed.
- METAL DOOR
Acceptable sealers are:
Oil-base or epoxy paint only.
- JAMB AND CASING/TRIM
Acceptable sealers are:
Paint, urethane, and varnish.
Clear “water seal” products not allowed.
Exterior grade material shall be used in exterior locations.
</td></tr>
<tr><td>HINGES, EXTERIOR DOORS</td><td>
- HINGE REQUIREMENTS FOR EXTERIOR DOORS
Hinges shall:
Conform to ANSI/BHMA A156.1.
Be constructed of brass or stainless steel, minimum 0.120" thick.
Be loose-pin type, unless mounted toward exterior (fixed-pin not required on middle hinge).
- 1-3/8" DOORS
Minimum hinge size 3-1/2" x 3-1/2".
- 1-3/4" DOORS
Minimum hinge size 4" x 4".
- SCREWS TO ATTACH HINGES
Wood and Metal Jambs
Brass or stainless steel flathead screws shall be used, or as specified/supplied by manufacturer.
Pre-hung Units and Replacement Jambs
Screws shall penetrate trimmer stud at least 5/8".
</td></tr>
</table>

Materials	*Requirements*
INTERIOR/ APPLIANCE ENCLOSURE DOORS WITH HARDWARE	- ALL INTERIOR (ENCLOSURE) DOORS • Interior grade hollow-core and louvered doors are allowed (e.g., for appliance enclosures and communication between rooms for combustion air). • Hinged doors only. - THICKNESS • 1-3/8" or 1-3/4" thick. - VENEER • Minimum 1/8" thick. - HINGES • 2 or 3 hinges (3 hinges for solid wood or solid core). • Hinges shall be constructed of brass or stainless steel. • Conformance with ANSI/BHMA A156.1. • Minimum hinge size: 3-1/2" x 3-1/2" and 0.120" thick. - SCREWS FOR HINGES • Brass or stainless steel flathead screws shall be used.  *Photo Credit: www.pinedohomes.com*
MOBILE HOMES – EXTERIOR DOORS	- MATERIAL REQUIREMENTS FOR ALL SWINGING REPLACEMENT DOORS • Rigid stiles and rails (e.g., channel steel and/or wood). • Permanently-finished skin (e.g., fiberglass or vinyl-clad metal). - MATERIAL REQUIREMENTS FOR OUT-SWINGING REPLACEMENT DOORS • Pre-hung entrance door manufactured for mobile homes. • Flanged metal frame (jambs, header and sill) with integral weather seals (e.g., extruded flap vinyl, bulb seal, etc.). 
THRESHOLD SHIMS/ ELEVATORS	- MATERIALS ALLOWED INCLUDE: • Non-wood: Aluminum and Plastic (e.g., Vinyl). • Solid Wood: Redwood, Cedar, Pressure-treated Fir, or Solid Hardwood (i.e., shall be degradation-resistant and exterior grade).

DUCT INSULATION
(WIS Section 19)

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td>DRAWBANDS</td><td>
- DRAWBANDS

Weather- and UV-resistant (e.g., black) nylon duct straps/ties rated for outdoor use.
Service temperature rating of 165°F minimum.
Loop tensile strength rating of 50 pounds minimum.

</td></tr>
<tr><td>INSULATION MATERIAL</td><td>
- ALL MATERIALS

Maximum flame-spread index of 25 and smoke-developed index of 50, per ASTM E84, UL 723, OR NFPA 255.
Minimum R-value for duct insulation shall be in accordance with Title 24, by heating fuel and CEC Climate Zone, as follows:

<table>
<tr><th>Climate Zones</th><th>Minimum R-value</th></tr>
<tr><td>1-10, 12, 13</td><td>R-6.0</td></tr>
<tr><td>11, 14-16</td><td>R-8.0</td></tr>
</table>
Photo Credit: Public Domain


Graphic Credit: RHA, Inc.
- INDOOR INSULATION

Flexible or rigid fiberglass.
Facing shall be FSK foil or vinyl.

- OUTDOOR INSULATION

Shall be listed for exterior applications.

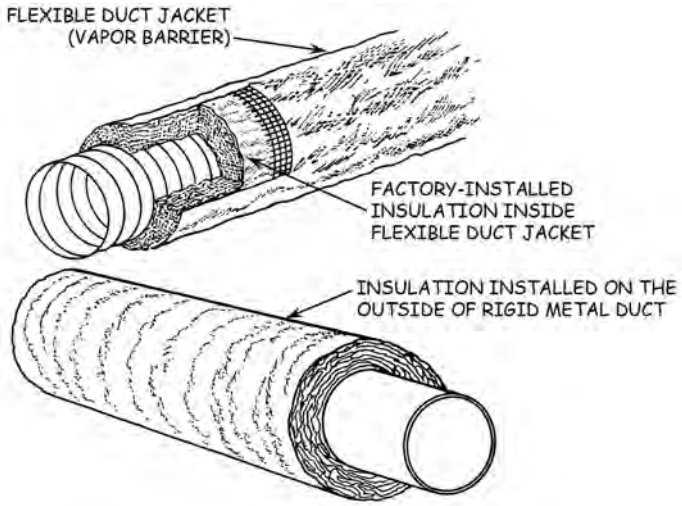
</td></tr>
<tr><td>TAPE (UL 181) FOR DUCTS</td><td>
- DUCT TAPE

Metallic or FSK duct tape only; cloth tape not allowed.
For rigid fiberglass:

UL-labeled “181A-P”
Minimum width 2".

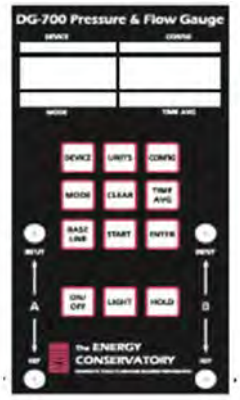
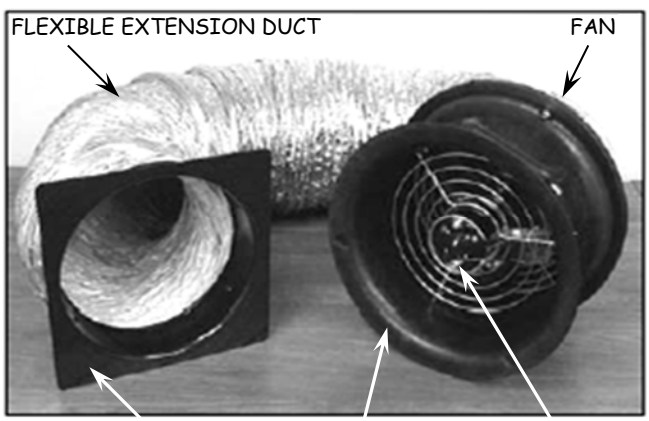
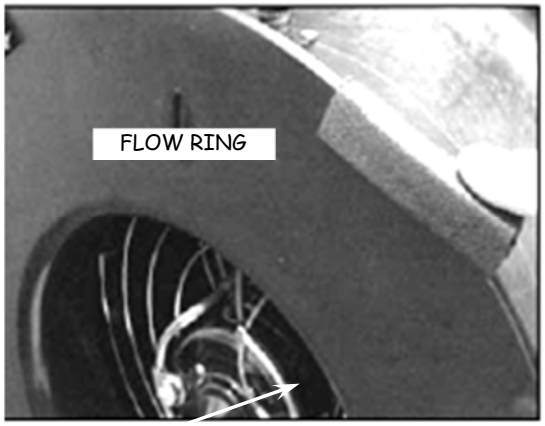
</td></tr>
<tr><td>VAPOR BARRIER/ RETARDER</td><td>
- ALL VAPOR RETARDER MATERIAL

Vapor barrier/retarder (facing or jacket) shall have a maximum perm rating (permeance) of 0.5.

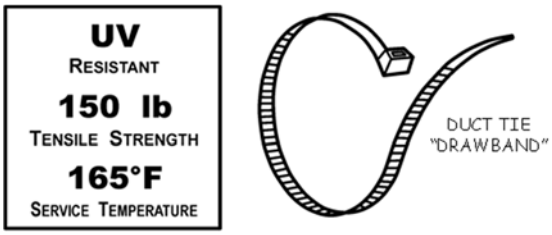


Graphic Credit: RHA, Inc.
</td></tr>
</table>

DUCT LEAKAGE TEST EQUIPMENT (DUCT BLASTER)
(CSD Field Guide Appendix B)

Materials	*Requirements*
DUCT LEAKAGE TESTERS	- EQUIPMENT • Pressure Measurements – Measurement systems shall have an accuracy of ± 0.2 Pa or 1% of reading, whichever is greater, and – Static pressure probes specified by the measurement equipment manufacturer shall be used. - DUCT LEAKAGE MEASUREMENTS • Duct leakage testing shall have an accuracy of ± 7% of measured flow in accordance with Title 24 Building Energy Efficiency Standards, and • Shall utilize digital gauges specified by the measurement equipment manufacturer. - TEST EQUIPMENT • Equipment used to measure duct leakage may include, but is not limited to, a Minneapolis Duct Blaster® or Retrotec Duc-Tester. • Smoke (e.g., from an incense stick, smoke pencil, smoke puffer, etc.) with tactile tests, gauge readings, etc. shall be used as appropriate to determine leak sources.  *Graphic Credit: Energy Conservatory* DUCT BLASTER® COMPONENTS   *Photo Credit: Energy Conservatory*
TESTER CALIBRATION	- CALIBRATION OF EQUIPMENT • Test equipment shall be maintained properly and calibrated regularly in accordance with manufacturer's recommendations. • Records of all calibrations and equipment checks shall be kept in an equipment calibration log, as specified by CSD. • Digital gauges shall be calibrated annually, by the factory, or by using field calibration procedures.

DUCT SYSTEM REPAIR AND SEALING
(WIS Section 6)

Materials	*Requirements*
CONVENTIONAL HOMES	
ALL DUCT REPAIR & SEALING MATERIALS	- GENERAL SPECIFICATIONS • Surface burning characteristics, in accordance with: – UL 723, ASTM E84, NFPA 255, or UL 2043: – Flame spread rating shall not exceed 25. – Smoke developed rating shall not exceed 50. – *Exception*: Wooden building materials inside building cavities. • Only exterior-rated products shall be used on the exterior (outdoors). • UL 181A- and 181B-listed sealants shall be labeled in accordance with the "Duct Mastic" and "Pressure-Sensitive Tape" sections below.  *Photo Credit: WAPTAC.org*
CAULKING MATERIALS	- ALL MATERIALS • Non-toxic. • See CSD WIS Section 8 (Caulking) material specifications. - LATEX SEALING COMPOUNDS • Conformance with ASTM C834. - BUTYL RUBBER SEALANTS • Conformance with F.S. A-A-272A - ELASTOMERIC JOINT SEALANTS (SILICONE, POLYURETHANE, POLYSULFIDE) • Conformance with ASTM C920 or F.S. A-A-1556A.
CORK TAPE	- GENERAL SPECIFICATIONS • Non-toxic and non-corrosive to copper. • Elongation: 200% minimum. • Hardening: 37% maximum.
DRAWBANDS AND CLAMPS	- ALL DRAWBANDS AND CLAMPS • Drawbands and clamps used to secure flexible non-metallic ducts shall comply with duct manufacturer's installation instructions. - DRAWBANDS • Weather and UV resistant (e.g., black) nylon duct straps/ties marked "181B-C." • Loop tensile strength: 150 pounds minimum. • Service temperature rating: 165°F minimum. • A manufacturer-approved adjustable tensioning tool is required for tightening drawbands. - CLAMPS • Stainless steel worm-drive clamps.  *Graphic Credit: RHA, Inc.*

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td>DUCT LINER (AKA “DUCT BOARD”)</td><td>
- ALLOWED MATERIALS

High Density Fiberglass Duct Board
Conformance to ASTM C612, or NFPA 90B, or UL Class 1.
Sheet Metal
Plywood

Graphic Credit: RHA, Inc.
- DUCT BOARD & BUILDING BOARDS

Foil-faced Rigid Fiberglass Insulation Board; ASTM C726
Foil-faced Fiberglass Duct Board; UL 181A

- MATERIALS <u>NOT</u> ALLOWED (AS BARRIER MATERIAL OR SEALANT IN THE REPAIR OF BUILDING CAVITIES USED AS DUCTS, PLATFORMS, OR OTHER DUCT SYSTEM COMPONENTS).

Foam Board and Foam Sealant
Drywall

</td></tr>
<tr><td>DUCT MASTIC</td><td>
- ALL DUCTS

Non-toxic and water resistant.
UL-listed and labeled per UL 181A or UL 181B standards by type at right.

<table>
<tr><th>DUCT TYPE</th><th>SEALING MATERIAL</th><th>UL IDENTIFICATION</th></tr>
<tr><td><u>RIGID</u> METAL AND FIBERGLASS DUCTS AND COMPONENTS [UL 181A STANDARD]</td><td>MASTIC</td><td>LABELED “181A-M” <u>OR</u> “181A-M/181B-M”</td></tr>
<tr><td><u>FLEXIBLE</u> DUCTS [UL 181B STANDARD]</td><td>MASTIC</td><td>LABELED “181B-M” <u>OR</u> “181A-M/181B-M”</td></tr>
</table>
</td></tr>
<tr><td>DUCT SUPPORTS</td><td>
- ALL DUCT SUPPORTS

Corrosion resistant
Conform to duct manufacturer's instructions.

- FLEXIBLE DUCT SUPPORT STRAPS (HORIZONTAL AND VERTICAL)

Non-Metallic

Only if allowed by the local jurisdiction.
Polypropylene monofilament, woven polyester, polyester scrim reinforced vinyl laminate, or equivalent.

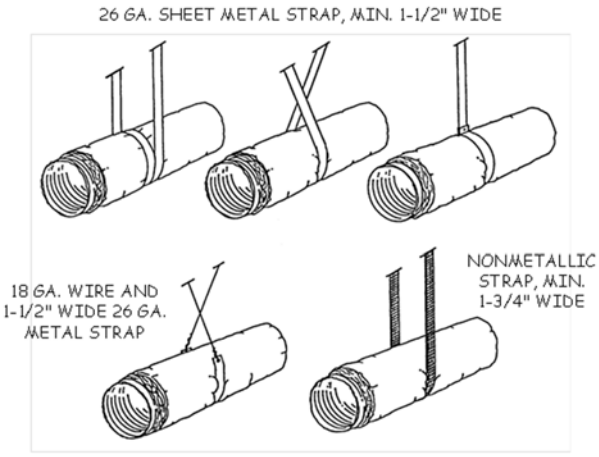
Minimum width: 1-3/4".
Minimum tensile strength: 70 lbs./inch of width.

Sheet Metal Straps and Saddles

Width: 1-1/2" minimum.
Thickness: 26-gauge minimum.

Support Saddles

Fit neatly around and cover lower half (180°) of duct.
Shall not constrict inner diameter of duct nor cut the jacket.



Graphic Credit: RHA, Inc.
- HORIZONTAL RIGID ROUND METAL DUCTS

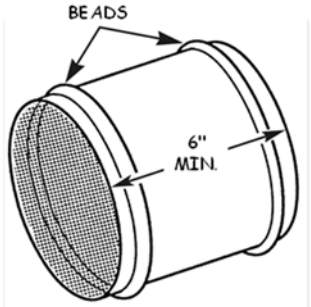
Up to 10" Diameter

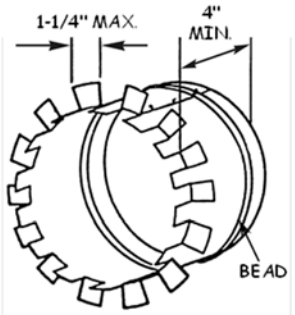
Galvanized steel straps, same gauge as duct, 1" minimum width, or
18-gauge galvanized steel wire.

11" to 40" Diameter

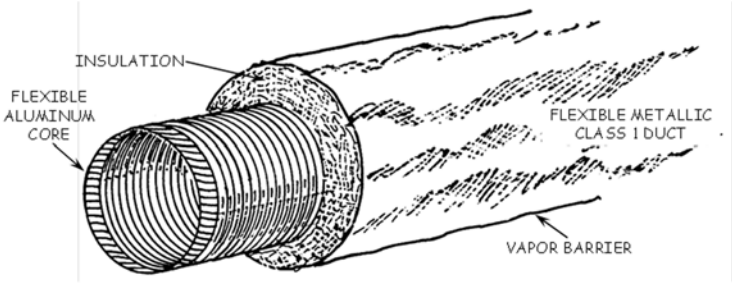
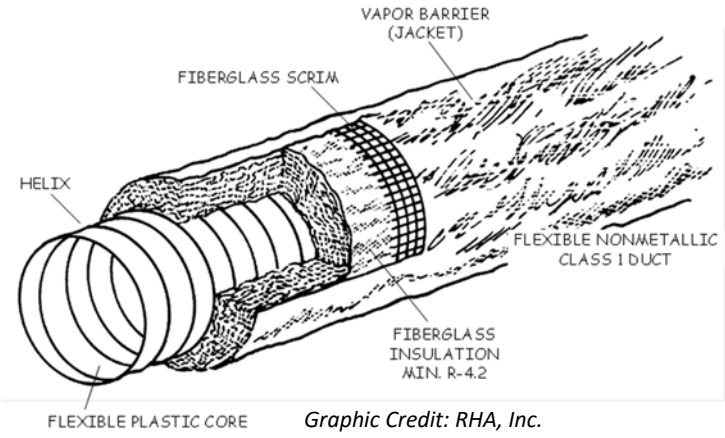
Galvanized steel straps, same gauge as duct, 1" minimum width, or

</td></tr>
</table>

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td></td><td>
– 8-gauge galvanized steel wire tied to a galvanized steel band, 1" minimum width, surrounding the duct.
- VERTICAL RIGID ROUND METAL DUCTS
• Up to 10" Diameter
– 18-gauge galvanized steel straps, 2" minimum width.
• 11" to 20" Diameter
– 16-gauge galvanized steel straps, 2" minimum width.
</td></tr>
<tr><td>FITTINGS (NEW) USED WITH FLEXIBLE <u>NON-METALLIC</u> DUCT</td><td>
- STARTING COLLARS
• 4" installed length (6" recommended).
• 26-gauge galvanized steel up to 14" diameter.
- SPLICING SLEEVES
• 6" length (8" recommended).
• 26-gauge galvanized steel up to 14" diameter.
- ALL FITTINGS
• Fittings shall be beaded at each core connection (e.g., both ends of a sleeve) when flexible non-metallic ducts are attached.


BEADED SLEEVE MINIMUM 6" LONG FOR FLEXIBLE NONMETALLIC DUCTS


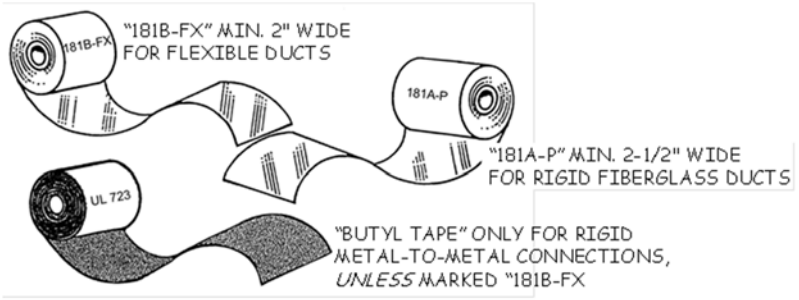
SHEET METAL COLLAR (DOVETAIL) MIN. 4" LONG AND BEADED FOR FLEXIBLE NONMETALLIC DUCTS
Graphic Credit: RHA, Inc.
</td></tr>
<tr><td><u>FLEXIBLE</u> DUCTS FOR CONVENTIONAL HOMES</td><td>
- <u>ALL</u> FLEXIBLE DUCTS FOR CONVENTIONAL HOMES
• Conform to NFPA 90B and UL 181 Class 1.
• Non-metallic insulated ducts with air-permeable core <u>not</u> allowed.
• Have duct insulation minimum insulation and vapor barrier as indicated in the table below, or greater if required by local code.
<table>
<tr><th colspan="3">Additional Requirements for Flexible Ducts</th></tr>
<tr><th></th><th>CLIMATE ZONES</th><th>R-VALUE</th></tr>
<tr><td rowspan="2"><u>DUCT INSULATION</u></td><td>1-10, 12, 13</td><td>R-6.0</td></tr>
<tr><td>11, 14-16</td><td>R-8.0</td></tr>
<tr><td><u>VAPOR BARRIER (JACKET) MATERIAL</u></td><td colspan="2">• Thickness: 2.5 mils minimum.
• Permeance: 1.0 perm maximum.
• Degradation Protection: UV-resistant material (e.g., silver metalized polyester jacket).</td></tr>
</table>
Continued on the next page.
</td></tr>
</table>

Materials	Requirements
	- FLEXIBLE METALLIC DUCTS FOR CONVENTIONAL HOMES • Rated to withstand designated pressures and velocity of the system, but not less than: – 2 inches of water column (IWC) (500 Pa) positive pressure. – 0.75 IWC (188 Pa) negative pressure, and – 2500 fpm velocity. • Fabricated from minimum 0.0065" thick aluminum material core or equivalent.  *Graphic Credit: RHA, Inc.* - FLEXIBLE NON-METALLIC DUCTS FOR CONVENTIONAL HOMES • Rated to withstand designated pressures and velocity of the system, but not less than: – 2 IWC (500 Pa) positive pressure, – 0.75 IWC (188 Pa) negative pressure, and – 2000 fpm velocity. • Duct Core ("Inner Liner") – Fabricated with a spring steel helix core bonded within a non-porous material (e.g., molded composite or two-ply lamination of polyester). • Air-permeable core is not allowed.  *Graphic Credit: RHA, Inc.*
MECHANICAL FASTENERS	- FASTENER TYPES BY PURPOSE • Securing and Sealing Ducts – #8 sheet metal screws and drawbands • Patches in Rodent Barrier – Outward clinch ("stitch") staples or equivalent. – Wooden strips attached and permanently secured by means of screws into floor joists, or wedged above adjacent girders. • To Hold Duct Insulation in Place: – Mechanical fasteners (e.g., wire, drawbands, metal straps, or equivalent that encircle ducts or attach to undercarriage) shall be added as needed to permanently secure insulation
MESH TAPE	- ALL DUCTS • Mesh fabric used to reinforce duct mastic shall comply with mastic manufacturer's instructions, or meet the following specifications: – Fiberglass mesh tape. – Weave per inch: 9 x 9 minimum. – Thickness: 0.006" minimum. - FLEXIBLE DUCTS AND RIGID METAL DUCTS • Mesh tape width: 2" minimum. - RIGID FIBERGLASS DUCTS • Mesh tape width: 3" minimum.

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td>PRESSURE SENSITIVE TAPE</td><td>
- APPROVED PRESSURE-SENSITIVE TAPES
  - UL-listed in accordance with the table below.

<table>
<tr><th>DUCT TYPE</th><th>SEALING MATERIAL</th><th>UL IDENTIFICATION</th></tr>
<tr><td>RIGID METAL AND FIBERGLASS DUCTS AND COMPONENTS [UL 181A STANDARD]</td><td>PRESSURE SENSITIVE TAPE</td><td>MARKED “181A-P” OR “181A-P/181B-FX”</td></tr>
<tr><td>FLEXIBLE DUCTS [UL 181B STANDARD]</td><td>PRESSURE SENSITIVE TAPE</td><td>MARKED “181B-FX” OR “181A-P/181B-FX”</td></tr>
</table>

  - Metallic Tape: Aluminum foil backing.
  - Plastic Tape: Polypropylene or similar backing.
  - “Butyl Tape” (also known as “Foil Mastic”):
    – Aluminum foil tape with minimum 15 mil butyl adhesive.
    – Marked “181B-FX” or “UL 723” (or ASTM E84 or NFPA 255).
    – Butyl tape without “181B-FX” marking shall not be used to seal flexible ducts.
- TAPES NOT ALLOWED: CLOTH-BACK RUBBER-ADHESIVE TAPES.
- SEALING FLEXIBLE NON-METALLIC AND FLEXIBLE METALLIC DUCTS
  - Tapes marked “181B-FX,” minimum 2" wide.
  - Cloth-back butyl-adhesive tapes are allowed if CEC-approved for use in California (e.g., indicated by “CA” in the product number).
- TAPES FOR SEALING RIGID METAL DUCTS AND COMPONENTS
  - Metallic tapes marked “181A-P” and/or “181B-FX,” minimum 2" wide.
    – *Exception*: “Butyl tape” without “181A-P” or “181B-FX” markings may be used to seal rigid metal-to-metal connections.
- TAPES FOR SEALING RIGID FIBERGLASS DUCTS
  - Metallic tapes marked “181A-P,” minimum 2-1/2" wide.

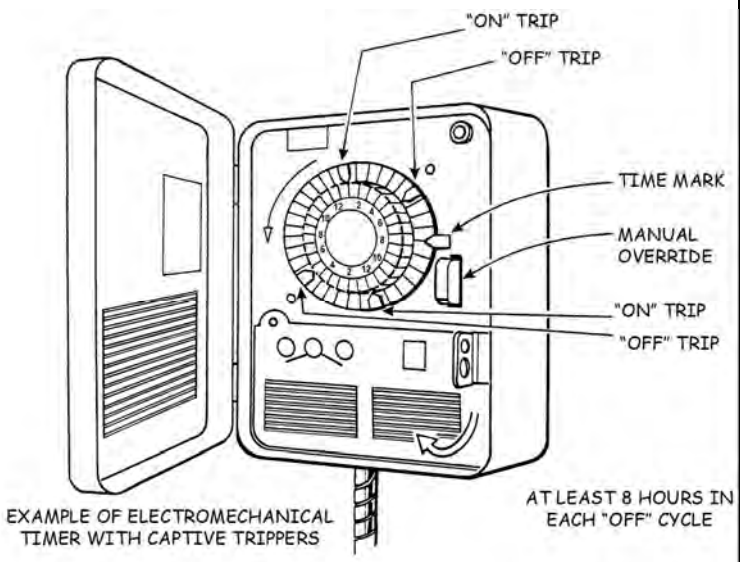


Graphic Credit: RHA, Inc.

- ACCESS PANELS
  - Metallic tapes with non-butyl (e.g., acrylic) adhesive.
- HIGH-TEMPERATURE APPLICATIONS
  - Metallic tapes with non-butyl (e.g., acrylic) adhesive and service temperature rating of at least 265°F.
</td></tr>
<tr><td>RIGID METAL DUCT</td><td>
- ALL RIGID METAL DUCT:
  - Conform to NFPA 90B and UL 181 Class 1 or Class 0.
  - Constructed of non-corrosive material.
  - Rectangular metal ducts shall conform to CMC requirements.
  - Round metal ducts shall conform to minimum thickness requirements of the CMC. Examples are in the table on the following page.
</td></tr>
</table>

Materials	Requirements
	ROUND METAL DUCTS AT POSITIVE STATIC PRESSURE UP TO 2 IWG (500 PA) **DIAMETER OF DUCT** / **MIN. SHEET GAUGE (GALVANIZED STEEL)** / **MIN. B. & S. GAUGE (ALUMINUM)** Up to 14" — 26 — 24 15" to 23" — 24 — 22 24" to 37" — 22 — 20 38" to 51" — 20 — 18 - ALL RIGID COMPONENTS • Constructed of non-corrosive materials. • Fittings' (starting collars, splicing sleeves/couplings, adjustable elbows, wyes, etc.) wall thickness (gauge) shall be no thinner than specified for attached ducts.
MOBILE HOME-SPECIFIC MATERIALS 	
ALL DUCT REPAIR & SEALING MATERIALS	- WHERE MATERIAL SPECIFICATION IS NOT IDENTIFIED SPECIFICALLY FOR MOBILE HOMES, THE CONVENTIONAL HOME SPECIFICATIONS SHALL APPLY. - GENERAL SPECIFICATIONS • When crawlspace ducts are accessible to animals: – Only internally-insulated rigid metal ducts shall be used. • When crawlspace ducts are <u>not</u> accessible to animals, flexible ducts may be installed to: – Replace damaged or deteriorated ducts (e.g., crossover ducts). – Install a new ducted return system.
FLEXIBLE DUCTS FOR MOBILE HOMES	- <u>ALL</u> FLEXIBLE DUCTS FOR MOBILE HOMES • Conform to NFPA 90B and UL 181 Class 1. • Have duct insulation minimum thermal resistance (R-value) of 4.2 or greater (when required by local code). • Shall have vapor barrier material as described below: – Be rated for mobile home use (e.g., with HUD markings on the jacket). – Have a minimum thickness of 3.5 mils. – Have a maximum permeance of 1.0 perm. - FLEXIBLE <u>NON-METALLIC</u> DUCTS • Non-metallic flexible duct core shall be fabricated with a spring steel helix bonded within non-porous material (e.g., molded composite or two-ply lamination of polyester). - FLEXIBLE <u>METALLIC</u> DUCTS • Metallic flexible duct core shall be fabricated from minimum 0.0065" thick aluminum material or equivalent.
RIGID METAL DUCTS	- METAL DUCTS • Only galvanized duct or aluminum duct shall be allowed. • Gauge of any rigid metal duct patch shall equal or exceed gauge of the existing duct.

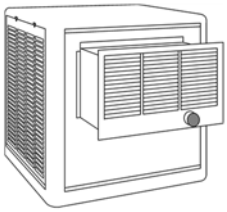
ELECTRIC WATER HEATER TIMERS
(WIS Section 44)

Materials	*Requirements*
ALL WATER HEATER TIMERS	- ELECTRICAL SPECIFICATION • Electrical current specification shall be greater than maximum electrical requirements of water heater.  *Graphic Credit: RHA, Inc.*
MECHANISM	- MECHANISM • UL-listed or equivalent • Electromechanical or digital timing mechanism. – Electromechanical timer should have captive trippers when feasible.
OUTDOOR USE	- OUTDOOR INSTALLATIONS • Timer shall have a weatherproof cover and be labeled for outdoor use.
PROGRAMMING	- PROGRAMMING • Minimum of two set-back periods per 24-hour day. • Minimum two hours between settings. • Manual override switch. • Seven-day programmability.

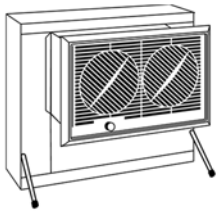
EVAPORATIVE COOLERS
(WIS Section 29)

Materials	*Requirements*
EVAPORATIVE COOLERS	- ALL UNITS • Surface burning characteristics shall be per UL 723 and ASTM E-84. • Air movement shall be tested per ANSI/AMCA Standard 210. - WINDOW/WALL UNITS • UL-listed (or equivalent) and compliant with UL 507. - SEALANTS • Sealants used in the unit shall meet the following standards: – Water immersion: ASTM D 870. – Flexibility: ASTM D 756. - CABINET AND PAD FRAMES • Constructed of galvanized steel or polymeric materials conforming to UL 94 and UL 746C. • Pump and grille assembly polymeric materials shall conform to UL94 and UL746A and 746C.
MEDIA	- STANDARD PADS • Aspen excelsior bound in netting, or type specified by cooler manufacturer. • Minimum thickness 1" (± 1/8"). • Size shall be as specified by cooler manufacturer. - HIGH-EFFICIENCY MEDIA • Only rigid media shall be used. • Size shall be as specified by cooler manufacturer. • Shall be rated to deliver evaporative efficiency of 0.85 or better.

Photo Credit: RHA, Inc.

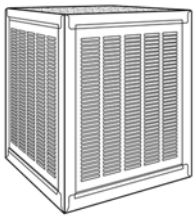


STANDARD WINDOW/WALL COOLER

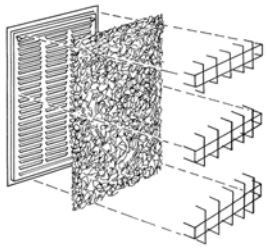


HIGH-EFFICIENCY WINDOW/WALL COOLER

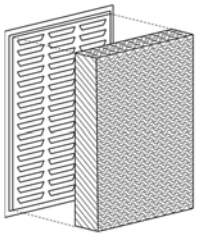
Graphic Credit: RHA, Inc.



ROOF-MOUNT COOLER

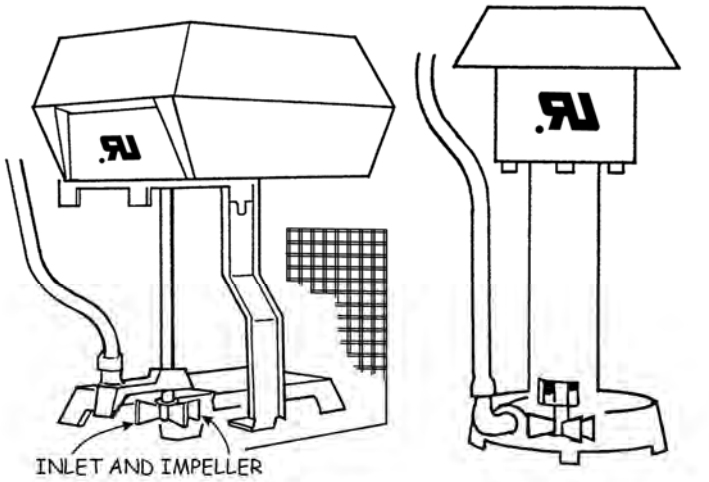


STANDARD EXCELSIOR PAD



HIGH-EFFICIENCY RIGID MEDIA

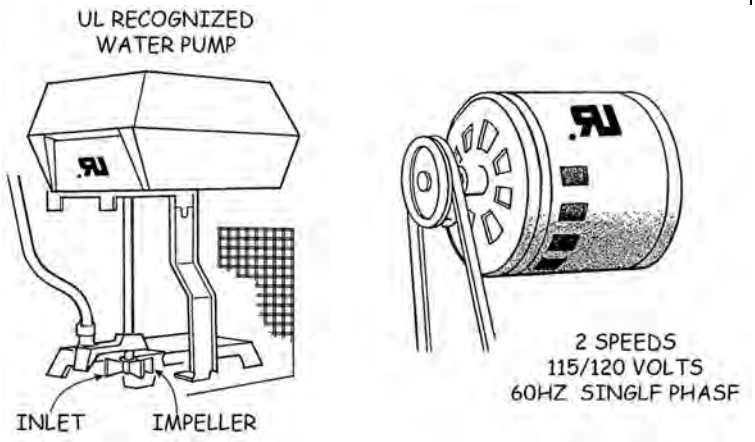
Graphic Credit: RHA, Inc.

Materials	*Requirements*
MOTOR	- ALL MOTORS SHALL BE: • UL-listed or a UL-recognized component. • In compliance with cooler manufacturer's specifications. • Wired for at least two speeds. • Rated at 115/120 volts, 60 Hz, single phase. - BRACKETS AND PULLEYS • Mounting brackets/supports shall be factory-supplied and adjustable. • Pulley shall be factory-supplied.
REPAIR COMPONENTS	- BLOWER MOTOR • Two-speed, equipped with thermal overload protection. – *Exception*: If existing motor is single speed, replacement may be single speed. • A UL-recognized component designed for moist conditions. • Warranted for one year. - BELT • General purpose "A" or "4L" section utility belts. - PADS • High efficiency aspen excelsior pads bound in netting, or • Slit, expanded, and reinforced cellulose fiber pad material, with even density, strengthened for long life, reinforced (e.g., with polyethylene), and with fungus resistance. • All pads shall have at least 1" thickness (two thinner pads may be used to achieve 1" thickness). - PUMP • Shall be a grounded UL-recognized component with thermal overload protection. - PULLEYS • Single-groove type designed for use with "A" or "4L" section V-belts. • Set screws shall be hollow hex head type. - SHUT-OFF VALVE AND FITTINGS • Brass shut-off valve: – 1/4" x 1/8" needle valve, or as required by local code. – Self-tapping needle valve not allowed. - FITTINGS • Brass fittings only - SUPPLY LINES • Replacement supply lines shall be copper.  UL RECOGNIZED PUMPS WITH THERMAL OVERLOAD PROTECTION *Graphic Credit: RHA, Inc.*
UNIT SIZING REQUIREMENTS	- COOLER CAPACITY (AIRFLOW IN CFM) • Minimum 3.0 CFM per sq. ft. of floor area in average climates: – 22.5 air changes per hour, with 8' ceilings. • Minimum 4.0 CFM per sq. ft. of floor area in hot, dry areas: – 30 air changes per hour, with 8' ceilings. • The following "Cooler Sizing Guidelines" table may be used as a guide.

Materials	Requirements
	- CAPACITY CALCULATION • Cooler capacity required for any size area is calculated by multiplying sq. ft. of the floor area to be cooled by the applicable CFM/sq. ft. (3.0 or 4.0) – (Floor Area Sq. Ft.) X (3.0) for average climates, or – (Floor Area Sq. Ft.) X (4.0) for hot, dry climates.
WATER PUMP	- ALL PUMPS SHALL BE: • UL-listed or a UL-Recognized Component. • Protected from water damage to motor winding (e.g., by shaft sleeve, skirting, etc.). - MOTOR SHALL: • Be grounded. • Have thermal overload protection. - PUMP SCREEN • Pump shall have a molded screen or other factory-supplied screening device to keep debris out of the impeller.
WATER SUPPLY	- NEW MATERIALS • Supply lines shall be minimum 1/4" OD copper tubing. • Shut-off valve and fittings shall be brass. - MATERIALS NOT ALLOWED • Plastic tubing, fittings, and valves. • Self-tapping needle valve.

COOLER SIZING GUIDELINES

COOLER CAPACITY[1] (AIRFLOW IN CFM) [1]	MAXIMUM SQ. FT. FLOOR AREA[2] AT 3.0 CFM/SQ. FT. –22.5 ACH– (AVERAGE CLIMATE) [2]	MAXIMUM SQ. FT. FLOOR AREA[2] AT 4.0 CFM/SQ. FT. –30 ACH– (HOT, DRY CLIMATE) [3]
3,000	1,000	750
3,500	1,165	875
4,000	1,330	1,000
4,500	1,500	1,125
5,000	1,665	1,250
5,500	1,830	1,375
6,000	2,000	1,500
6,500	2,165	1,625



Graphic Credit: RHA, Inc.

[1] For the applicable climate category (column 2 or 3), a cooler capacity (column 1) is selected which is adequate for the living space (floor area) to be cooled.

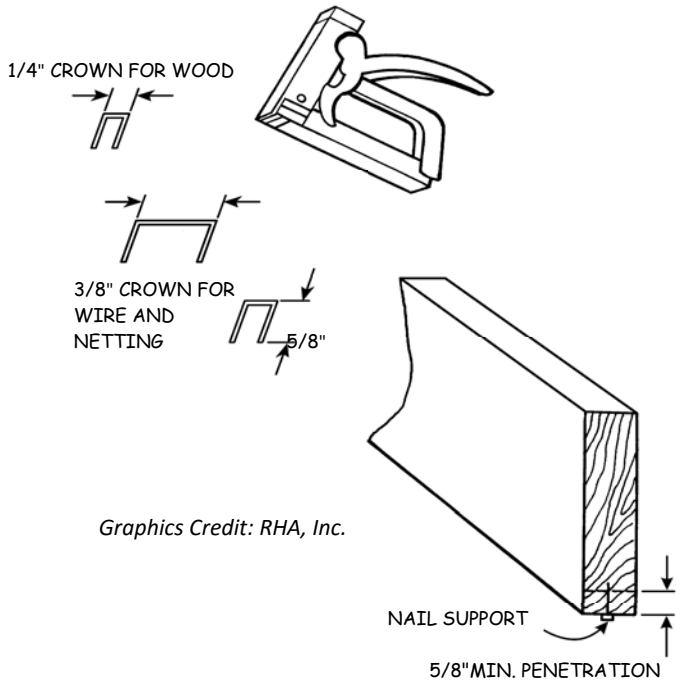
[2] When the floor area is between sizes shown in the table, the next larger cooler capacity is selected.

Back to Main ToC

FLOOR INSULATION FOR CONVENTIONAL HOMES
(WIS Section 22A)

Materials	*Requirements*
INSULATION MATERIAL	- ALL FLOOR INSULATION MATERIAL • All insulation shall be certified to comply with the CCR, Title 24, Part 12, Chapters 12-13, "Standards for Insulating Material." - MINERAL FIBER • Flexible (Batts and Blankets) – Conformance to ASTM C665. • High Density Fiberglass Board – Conformance to ASTM C726. - RIGID FOAM • Preformed polyisocyanurate board foil faced on both sides – Conformance to FS HH-I-1972 or ASTM C1289. • Rigid, cellular Polystyrene Thermal Insulation – Conformance to ASTM C578. - INSULATION COVER • For Floor Insulation, where no foundation wall exists: – If <u>not</u> exposed to precipitation, wind, and the elements support with woven wire or minimum 70 perm breathable cover is required.  *Photo Credit: RHA, Inc.*
R-VALUE	- ALL INSULATION MATERIALS • R-value shall be determined in accordance with: – the DOE Priority List Table; or – By Energy Audit; or – By LIHEAP contract guideline, when no existing insulation is present, insulation shall be installed to R-19. - CRAWLSPACE PERIMETER INSULATION—INTERIOR <u>OR</u> EXTERIOR • R-value shall be R-13. - BASEMENT WALL INSULATION • R-value shall be R-13
SUPPORTS AND ANCHORS	- LIFE EXPECTANCY • All attachment materials shall have a minimum expected service life of 10 years. - STAPLES • Zinc-coated, stainless steel, or similar corrosion-resistant material. • 18-gauge minimum diameter. • Minimum 1/4" crown for wood lath. • Minimum 3/8" crown for other insulation support systems. • Minimum 5/8" joist penetration. - NAILS • Galvanized nails. • 5/8" minimum joist penetration - WIRE SUPPORTS • Wire shall be zinc-coated, stainless, or similar corrosion-resistant material. • Minimum 20-gauge.

Materials	Requirements
	- NETTING FOR FLEXIBLE INSULATION TYPE • Woven wire shall be galvanized. • Netting shall be propylene or equivalent with a minimum 75-pound breaking strength.
VAPOR RETARDER	- EXISTING VAPOR RETARDER • Existing undamaged ground cover acceptable if at least 4 mil thick and in good condition after insulation is installed. - NEW VAPOR RETARDER • A <u>new</u> vapor retarder shall be installed in conformance with the Title 24 requirements below. • Vapor Barrier Material for Climate Zones 1-16: – A Class I or Class II vapor retarder shall be installed: • Class I – perm rating less than 0.1 (vapor retarder or barrier) • Class II – perm rating between 0.1 and 1.0 (vapor retarder). A ground moisture barrier shall be used that meets tear and puncture resistance standard ASTM D703.



Graphics Credit: RHA, Inc.

FLOOR/UNDERCARRIAGE INSULATION FOR MOBILE HOMES
(WIS Section 22B)

Materials	*Requirements*
INSULATION MATERIALS	- ALL MATERIALS • Selected material will be of minimal water absorbency. • Selected material will be noncorrosive. • Flame Spread – Flame spread index of selected materials shall not exceed 25 with an accompanying smoke-developed index not to exceed 450 when tested in accordance with ASTM E84 or UL 723. – Flame spread index of foam insulation will not exceed 75 and a smoke- developed index of no more than 450 when tested in the maximum thickness intended for use in accordance with ASTM E84 or UL 723. - MINERAL FIBER • Flexible (Batts and Blankets) – Conformance to ASTM C665. • Loose Fill Fiberglass – Conformance to ASTM C764. - FOAM INSULATION • Foam insulation shall be separated from the interior of the building by an approved thermal barrier a (minimum of 1/2" gypsum or a material that is tested in accordance with the acceptance criteria of both the Temperature Transmission Fire Test and the Integrity Fire Test of NFPA 275).
R-VALUE OF ADDED INSULATION	- ALL INSULATION MATERIALS • R-value shall be determined in accordance with: – The DOE Priority List Table; or – By Energy Audit; or – Up to R-19 by LIHEAP contract guideline. - ALL UNDERCARRIAGE INSULATION • Variable R-values from R-11 to R-30 in a single cavity fill allowed. • Replacement for missing insulation shall equal or exceed pre-existing R-value.
SEALING MATERIALS	- CAULKING, SEALANTS, AND TAPES: • Sealing materials shall conform to: – CSD Appendix A (Duct System Repair & Sealing); – CSD Appendix A (Minor Envelope Repair); and – CSD Appendix A (Caulking).
VAPOR RETARDER	- EXISTING VAPOR RETARDER • Existing undamaged ground cover acceptable if at least 4 mil thick and in good condition after insulation is installed. - NEW VAPOR RETARDER SHALL BE INSTALLED IN CONFORMANCE WITH THESE REQUIREMENTS: • Maximum of 0.1 perm moisture barrier material. • Shall meet tear and puncture resistance standard ASTM D703.

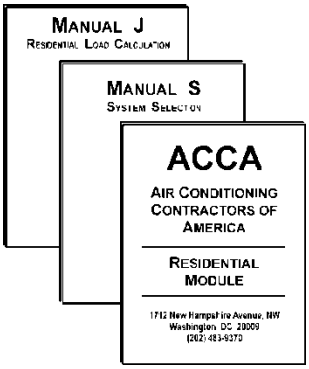
Photo Credit: WAPTAC.org

FLUORESCENT TORCHIERE LAMPS
(WIS Section 36)

Materials	*Requirements*
ALL LAMPS	- TORCHIERE AVAILABILITY • LIHEAP only: If a fluorescent torchiere lamp is not available that meets CSD WIS Appendix A Material Specifications, a waiver shall be requested to install a LED torchiere. (LED torchiere is not allowed under DOE). - FLUORESCENT TORCHIERE FLOOR LAMP SHALL BE: • UL-listed (or equivalent). • ENERGY STAR–certified. • Equipped with a: – Dimmer control or a 3-way switch for three levels of brightness. – Replaceable fluorescent lamp.  *Photo Credit: El Dorado County*

FURNACE—CENTRAL FORCED AIR
(WIS Section 24)

Materials	*Requirements*
AIR FILTERS	- FURNACE FILTERS • MERV 6 filter shall be selected for new FAUs in accordance with manufacturer's specifications and this appendix for "Air Filters."
ALL MATERIALS	• All FAUs shall be in conformance with the CBC and CMC. • HVAC units shall be in compliance with Title 24 efficiency standards.
CONVENTIONAL HOME FURNACE	- ALL UNITS • Units shall be in conformance with the current CBC, CMC, and Title 24 Building Energy Efficiency Standards (Residential Compliance Manual). – Installed appliances shall conform to CEC standards for efficiency, as verified by inclusion in the CEC's database of certified appliances, an equivalent federal directory, or an approved trade association directory. • All units and components shall be and/or have one of the following certifications: CSA, AGA, or GAMA. • Units installed in a mobile home shall be listed for use in a mobile home, and when inside the living space shall be Closed Combustion.  *Photo Credit: RHA, Inc.*
DUCTS AND SEALANTS	- ALL MATERIALS • Shall be in conformance with Duct Repair and Sealing material specifications provided in this appendix.
GAS PIPES AND VALVES	- GAS PIPES AND VALVES • Risers, flexible connectors, fittings, and valves shall be in conformance with manufacturer's specifications and the managing building authority (HCD or the local jurisdiction). • Components shall be new (re-use of existing materials shall not be allowed). • Gas valves: UL-listed and AGA- or CSA-certified. • Gas flexible connectors: IAPMO-listed epoxy-coated or stainless steel units. • Pilot tubing shall be aluminum (copper not allowed). • Fuel-gas piping: – Shall be selected, sized and installed per CMC, Chapter 13. – Copper gas lines not allowed.
MOBILE HOME FURNACE	- MATERIALS INSTALLED WITHIN A MANUFACTURED HOME: • Shall be in compliance with these specifications for conventional homes, HCD regulations, and HUD Mobile Home Code (MHCSS). • Furnace: Minimum AFUE rating of 80% (package unit or split system furnace).  - MATERIALS INSTALLED OUTSIDE A MANUFACTURED HOME: • Shall comply with HCD regulations; or, as applicable, requirements of the local building department.
PACKAGE UNITS	- PACKAGE UNITS (DUAL PACKS): • Furnace: Minimum AFUE rating of 81%. • Air Conditioner: Minimum SEER of 14.
SPLIT SYSTEMS	- SPLIT SYSTEMS • Furnace minimum AFUE rating: 80%: • UL-listed and certified by AGA or AHRI. • Air Conditioner, if replaced in conjunction with furnace shall be in accordance with "Air Conditioners and Heat Pumps—Central" section of this Appendix. – Minimum SEER of 14.

Materials	*Requirements*
OIL-FIRED OR ELECTRIC FURNACES*	- OIL-FIRED FURNACES* • Split Systems: AFUE 83% • Package Unit: AFUE 78% • Mobile Home: AFUE 75% - ELECTRIC FURNACES* • All Heaters: AFUE 78% *These heat sources shall be repaired or replaced by CSD waiver only.
SYSTEM DESIGN	- SYSTEM DESIGN AND PERFORMANCE • All Installations – Unit shall be properly sized in accordance with Title 24 or local code, whichever is more stringent. • For heating equipment sizing, reference CEC 2013 Building Energy Efficiency Standards, Subchapter 7, §150(h). – Building heating and cooling loads, which are used for equipment sizing and selection, shall be determined using a method based on one of the following: • ACCA Manual J, or • SMACNA Residential Comfort System Installation Standards Manual, or • ASHRAE Handbook (Equipment, Applications and Fundamentals Volumes). – Heating capacity of the new system shall be sized to meet the minimum requirements but not larger than necessary. – Distribution system shall be in conformance with HVAC manufacturer's specifications and local code.  *Graphic Credit: RHA, Inc.* ⚠ Before installation of any furnace, agency shall confirm that appliance sizing, venting, combustion ventilation air, gas piping, and all feasibility criteria will be met for the replacement unit.
TITLE 24 REQUIREMENTS	- TITLE 24 REQUIREMENTS • Title 24 requirements shall be met and verified by a HERS Rater when applicable for: – Duct Leakage Verification (all climate zones) – In all climate zones, when a package unit, air handler, air conditioner condenser, air conditioner evaporator coil, heating coil, furnace heat exchanger or more than 40’ of ducts in unconditioned space are replaced, duct leakage shall be verified by a HERS rater by one of the CEC-approved methods. – When new or replacement air conditioner or heat pump is installed, or when the condensor coil or a refrigerant-containing component is installed, correct refrigerant charge shall be measured by the installer and verified by a HERS Rater in CEC Climate Zones 2 and 8-15. – In all climate zones, when an entirely new space-conditioning system is installed (all equipment and ducts replaced) or 75% of the duct system is replaced, minimum airflow and maximum fan watt draw shall be verified.
VENT PIPES	- METAL VENT PIPES • All metal vent pipes, vent connectors and components shall be UL-listed. • Gas vent pipe shall be Type B or B-vent. - NON-METALLIC COMBUSTION AIR AND VENT PIPES • Pipes and fittings shall conform to ASTM D 1785 and D 2665. • Pipe cement and primer shall conform to ASTM D 2564.
THERMOSTATS	• All Thermostats shall be selected in accordance with this appendix and CSD WIS Section 27 (Thermostats—Programmable and Manual).

FURNACE—WALL, FLOOR, AND FREESTANDING UNITS
(WIS Section 25)

Materials	*Requirements*
ALL FURNACES	- ALL FURNACES SHALL BE: • Installed appliances shall conform to CEC standards for efficiency, as verified by inclusion in the CEC's database of certified appliances, an equivalent federal directory, or an approved trade association directory. • UL-listed and GAMA-certified. • The most efficient model feasible to install, but no lower in efficiency than specified in the table below (reference Title 24 2013 Residential Compliance Manual, Section 4.2). • Closed Combustion and listed for use in a Mobile Home, when installed in a Mobile Home.
GAS PIPES AND VALVES	- GAS PIPES AND VALVES • Gas Valves: UL-listed and AGA- or CSA-certified. • Gas Flexible Connectors: IAPMO-listed epoxy-coated or stainless steel. • Pilot tubing shall be seamless aluminum (copper not allowed). • Fuel-gas piping shall be selected, sized and installed per 2013 CMC Chapter 13.
THERMOSTAT	- ALL THERMOSTATS • Thermostat shall: – Be in conformance with manufacturer's instructions and selected in accordance with this appendix for "Thermostats—Programmable and Manual" and CSD WIS Section 27.
VENT PIPES	- METAL VENT PIPES • All metal vent pipes, vent connectors and components shall be: – UL-listed, and in compliance with furnace manufacturer's specifications. • Gas vent pipe shall be Type B or BW.

Photo Credit: RHA, Inc.

Furnace Type	Btu/hr. Output Capacity	Minimum AFUE (%)
Wall Furnace with Fan	• ≤ 42,000 • > 42,000	• 75% • 76%
Wall Furnace without Fan	• >10,000 - 27,000 • ≥ 27,001 - 46,000 • > 46,000	• 65% • 66% • 67%
Floor Furnace	• up to 37,000 • over 37,000	• 57% • 58%
Free-standing room heaters	• ≤ 20,000 • 20,001 – 27,000 • 27,001 – 46,000 • > 46,000	• 61% • 66% • 67% • 68%

UL® LISTED

GLASS REPLACEMENT AND WINDOW REPAIR
(WIS Section 12)

Materials	*Requirements*
FULLY TEMPERED GLASS	- ALL PANES • When fully tempered glass is installed, the maximum size also increases. Multiply the "Glass Materials" sizes by 4.
GLASS MATERIALS	- SINGLE STRENGTH (SS) • Maximum pane size: 16 sq. ft. - DOUBLE STRENGTH (DS) • Maximum pane size: 24 sq. ft. - 3/16" PLATE GLASS • Maximum pane size: 45 sq. ft. - 1/4" PLATE GLASS • Maximum pane size: 65 sq. ft.
GLASS MATERIALS FOR MOBILE HOMES	- SINGLE STRENGTH (SS) • Maximum pane size: 11 sq. ft. - DOUBLE STRENGTH (DS) • Maximum pane size: 15 sq. ft. - 3/16" PLATE GLASS • Maximum pane size: 30 sq. ft. - 1/4" PLATE GLASS • Maximum pane size: 43 sq. ft.
GLAZING COMPOUND	- GLAZING COMPOUND REQUIREMENTS • Shall be the type which remains pliable. • Shall conform to ASTM C669 for metal sashes
HEAT STRENGTHENED GLASS	- ALL PANES • When heat-strengthened glass is installed, the maximum size also increases. Multiply the "Glass Materials" sizes by two.
JALOUSIE WINDOWS	- JALOUSIE WINDOWS • Minimum 3/16" glass shall be installed. • Regular, patterned, frosted, tempered, and heat strengthened glass allowed. • Wired, laminated, and sandblasted glass not allowed.
PLASTIC MATERIALS	- ALL PANES • UV treated polycarbonate, minimum of 1/8" thick • Acrylic sheets and plastic film are not allowed.
SAFETY GLAZING	- GLAZING REQUIREMENTS • Safety glazing shall be permanently marked and meet specifications of ANSI Z97.1, and be permanently labeled per the California Residential Code, §R308.1.

Photo Credit: RHA, Inc.

Graphic Credit: RHA, Inc.

HIGH EFFICIENCY TOILETS
(WIS Section 55)

Materials	*Requirements*
APPROVED ACCESSORIES	- ACCESSORIES • Water Shutoff Valve (Angle Stop) and Supply Line – Water supply line: braided hose with brass fittings – Water shutoff valve: conformance with IAPMO and CPC requirements • Wax Ring with Flange – Good quality thick or reinforced wax, with polyethylene flange. – A flange not required on second ring placed on top for additional thickness. – Compliance with Federal Specification TT-P-1536A • Replacement Toilet Anchor Bolts ("johnny bolts"), Washers, Nuts – Brass bolts: 2-1/4" length by 5/16" diameter minimum – Captive washer included, to secure flange bolt in upright position – Brass open-cap acorn nuts – Corrosion-resistant washers (e.g., stainless steel) • Toilet Bolt Caps: plastic or ceramic, color-matched to toilet • Replacement Plastic Toilet Flanges, and Toilet Flange Extensions and spacers – Compliance with ASME A112.4.3. • Toilet Shims – White plastic or other waterproof material for use with toilets – Snap-off or easy to trim with sharp knife 
APPROVED TOILETS	- ALL TOILETS • Watersense Labeled High-Efficiency Toilet (HET) • Gallons per Flush (gpf) • Single-flush HET rated 1.28 gpf or lessMaP rating: ≥350 grams • Other Toilet Requirements – Trapway: Fully glazed, 2" minimum – Bowl Shape: Elongated or round, per availability, client preference, and location dimensions and clearances – Bowl Height: • 15" minimum (excluding seat) for standard toilet • When ADA compliance is required, the vertical distance from the finished floor to the top of the seat shall be a minimum 15" and maximum 19". • Unit height shall be selected in accordance with client's physical needs and wishes.
REPLACEMENT FLOORING MATERIAL	- FLOORING MATERIAL • Plywood shall be exterior grade, pressure treated, or marine grade material. • Replacement flooring shall match the height of the surrounding floor material. • Additional support to joists shall be installed when needed to make the floor solid.

Materials	*Requirements*
SEALANT	- CAULK (FOR SEAL BETWEEN TOILET BASE AND FLOOR) • Mold-resistant, acrylic latex or equivalent • Conformance with ASTM C834, C920, or C1311  *Photo Credit: RHA, Inc.*
TOILET SEAT	- TOILET SEAT • Thermoplastic (e.g., polypropylene injection molded plastic), or • Thermoset (e.g., Thermodur or Duroplast).

KITCHEN EXHAUST
(WIS Section 41)

Materials	*Requirements*
APPROVED MATERIALS	- ALL EXHAUST FANS/HOODS • Listed and labeled for kitchen ventilation by a recognized laboratory, such as UL, ETL, or CSA. • 100 CFM minimum, or as required per sizing calculations. • Rated noise level at 3.0 sones or less, unless their maximum rated airflow exceeds 400 cfm, in accordance with ASHRAE 62.2. - RANGE HOODS SHALL: • Be as wide as the cooktop and constructed of metal at least 0.0122 inch thick. • Have a light and multi- or variable-speed fan. - ALL DUCTED UNITS • Wall- and ceiling-mount fans shall be equipped with a removable interior grille. • Exhaust ducts shall be of metal and have smooth interior surfaces. • Vertical ducts shall include a roof flashing system and roof cap which provide a watertight seal. • Exterior wall components and attachment to the siding shall be durable and waterproof. - MOBILE HOME SIDEWALL EXHAUST FANS • Unit shall be designed to fit wall thickness at mounting location. - BACKDRAFT DAMPER • All exhaust systems shall be equipped with a backdraft damper. • Damper shall be located in the fan housing, in the vent duct, or in the wall or roof termination assembly.
KITCHEN EXHAUST REPAIRS	- MOTOR REPAIR AND OTHER COMPONENT REPAIRS • Motor shall be UL-listed or a UL-recognized component. • Motor and components shall be replaced with a manufacturer's replacement motor or, if necessary, a compatible model that fits without altering the motor or fan housing.

Photo Credit: WAPTAC.org

LED BULBS
(WIS Section 53)

Materials	Requirements
APPROVED MATERIALS	- ALL LED BULBS SHALL BE: • ENERGY STAR–certified, A-Lamp type bulbs. • In compliance with the requirements of CSD WIS Section 53, manufacturer's instructions and recommendations, and local code. • Warrantied for 3 years by the manufacturer. • Omni-directional (capable of at least 300° light direction) • Dimmable, for those locations on a dimming switch. • Light Quality (Correlated Color Temperature or CCT) shall be:

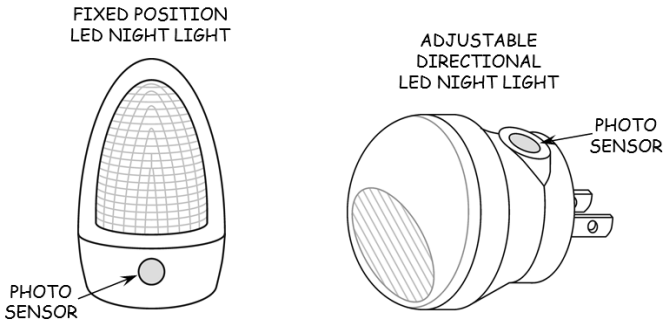
Graphic Credit: RHA, Inc.

Installation Location	Color Correlated Temperature (CCT)	Lighting Characteristic
Indoors	***2700Kelvin (K) to 3699K***	***Warmer, yellowish to natural white (daylight) lighting***
Outdoors	***3700Kelvin (K) to 5000K***	***Natural white (daylight) to bluish lighting***

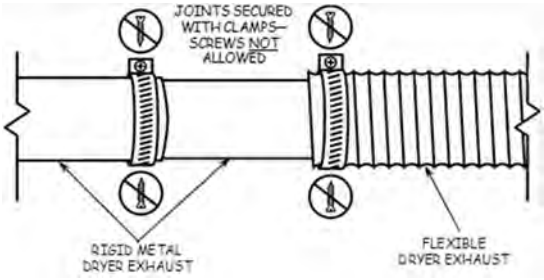
- Color-Rendering Index or CRI: Shall be a minimum of 80.
  - Note: In some cases, CRI of 90 or higher will improve a client's perception of color "true-ness" and may improve client satisfaction with the measure.
- Incandescent or Halogen Wattage Equivalencies: LED Bulbs shall provide light output (lumens) levels sufficient to maintain pre-existing levels, and in accordance with the specifications below, unless prohibited by the fixture manufacturer.

Old Incandescent and Halogen Bulbs (Watts)	ENERGY STAR Brightness (Minimum Lumens)
40	***450***
60	***800***
75	***1,100***
100	***1,600***
150	***2,600***

LED NIGHT LIGHTS
(WIS Section 54)

Materials	*Requirements*
APPROVED MATERIALS	- ALL LED NIGHT LIGHTS SHALL BE: • Maximum wattage 0.5 watts. • UL-listed or equivalent. • Equipped with an integrated photoelectric (auto-on) switch that turns on the night light when the room is dark.   *Photo Credit: RHA, Inc.*

LIMITED HOME REPAIR
(WIS Section 30)

Materials	*Requirements*
COVER PLATES	- SIZE AND SHAPE • Shall be plain (non-decorative) plastic only. – Wood or metal not allowed. • Shall properly fit the application. – Oversize and blank plates allowed where required. • Shall be of standard rectangular shape to fit standard electrical boxes. - COVER PLATE COLOR • Shall be standard color (ivory, white, almond,or black); and • Have color matched screws. • No cover plates shall be allowed with custom colors or decorative design.  CRACKED OR BROKEN COVER PLATE *Graphic Credit: RHA, Inc.*
DOMESTIC CLOTHES DRYER MOISTURE EXHAUST	- ALL DUCTS • A gas or electric clothes dryer moisture exhaust shall be of rigid metal and have a smooth interior surface. • Shall be minimum 4" diameter. • Shall comply with clothes dryer manufacturer's instructions and applicable local code. • Shall be no more than 14 total feet in length, and include no more than two 90° elbows. - RIGID DUCT WITH SMOOTH INTERIOR SURFACE • Galvanized Steel: minimum 26-gauge. • Aluminum: minimum 24-gauge. – *Exception*: UL-listed, flexible clothes dryer transition duct not more than six (6) feet in length may be used to connect the dryer to metal exhaust duct. – Flexible transition duct shall not be concealed within construction.  *Photo Credit: WAPTAC.org* - MOISTURE EXHAUST DUCT TERMINATIONS • Termination shall be UL-listed aluminum, sheet metal or UV-protected plastic with no mesh/screen. - DAMPERS • A metal or plastic gravity type backdraft damper shall be present in the termination. - CLAMPS AND HANGERS • Duct connectors shall be listed stainless steel or impact resistant plastic hose clamp style bands to be installed around a duct exterior. • Screws shall not be used to connect duct sections. • Duct hangers shall be rust- and corrosion-resistant.  *Graphic Credit: RHA, Inc.*

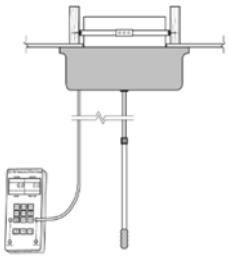
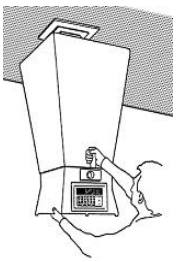
Materials	*Requirements*
EXHAUST FAN VENT EXTENSION	- ALL EXHAUST DUCTS • Shall comply with manufacturer's instructions and applicable local code (e.g., for Flame Spread Rating Index). - RIGID DUCT • Galvanized Steel: minimum 26-gauge. • Aluminum: minimum 24-gauge. • PVC smooth plastic pipe: minimum schedule 80. - FLEXIBLE DUCT • Semi-Rigid Metallic Aluminum: minimum of .0065" thick and UL-listed 181B. - EXHAUST DUCT TERMINATIONS AND DAMPERS • Shall be aluminum, sheet metal, or UV-protected plastic. • A compatible metal or plastic gravity type backdraft damper shall be present in the system.
FLOOR/PLATFORM REPAIR FOR APPLIANCES	- PLYWOOD SHEET • Horizontal surface – Minimum 1" thickness. – C-grade face or better and bonded with exterior glue resin. • Shear surround – Minimum 1/2" thickness. – C-grade face or better and bonded with exterior glue resin. • Primer shall be applied on all new wood used for outdoor applications. - STRUCTURAL WOOD MEMBERS • Pressure-treated or redwood. • 2 x 4 or larger. - FASTENERS • Shall be: – Minimum #8 size steel screws. – Rust and corrosion-resistant. • Nails not allowed. - DRYWALL FOR INDOOR APPLIANCE PLATFORMS • Minimum 1/2" thickness. • Moisture and mold resistant (e.g., green board). - DRYWALL SCREWS • Shall be sized to penetrate solid wood a minimum 5/8". - METAL WATER HEATER STAND • Shall be UL-listed (or equivalent) and compliant with local code. • Constructed of galvanized steel or aluminum. • Appropriately sized to support the entire footprint of the water heater.  *Photo Credit: RHA, Inc.*
MINOR ROOF REPAIR	- GENERAL REQUIREMENTS • Roof repair shall be completed only to protect installed measures from the weather. • Whenever possible, replacement materials shall match existing roofing materials in size, color, and quality. • All materials shall be UL-listed (or equivalent) and compliant with local codes. - REQUIRED SAFETY EQUIPMENT • All roof related work shall be conducted in adherence to all applicable Cal-OSHA regulations (e.g., wearing a safety harness, removal of materials, etc.).

Materials	*Requirements*
MOBILE HOME SKIRTING REPAIR	- ALL JOBS • Actual skirting materials needed for each job shall be identified by the Assessor, but standard materials specifications are provided below. - ALL SKIRTING MATERIALS • Shall be compliant with applicable HCD requirements. • When feasible, materials shall match existing skirting materials including size, color, and quality. - WOOD SKIRTING • All wood within 6" of earth or concrete shall be treated wood or wood of natural resistance to decay (i.e., redwood, cedar, or pressure-treated fir). • Frame structure shall be minimum 2" x 2" in size. • Plywood or composite sheeting shall be exterior grade, minimum 3/8" thickness and plies or fibers bonded with exterior glue resin. • Board siding shall be minimum 1/2" thickness - PRIMER • Shall be UV- and stain-resistant, and exterior-grade material. • At least one application shall be required on all new wood skirting. - FASTENERS • Shall be rust and corrosion-resistant steel. - VENTILATION SCREEN • Shall be 1/4" corrosion-resistant metal. • Shall match existing screens, when feasible.
ROUGH FRAMING TO SUPPORT WINDOW OR DOOR INSTALLATION	- ALL JOBS • Actual materials needed shall be identified by the Installer after the window or door jamb is removed, but standard materials specifications are provided below. - DIMENSIONAL FRAMING LUMBER • Douglas fir of standard-grade or better - FURRING STRIP • Douglas fir or redwood, of standard-grade or better. - PLYWOOD • APA-rated, exterior-grade. - ORIENTED STRAND BOARD (OSB) • APA-rated, exterior-grade. - FASTENERS • Shall be consistent with local code requirements.

Photo Credit: Pubic Domain

Photo Credit: Public Domain

MECHANICAL VENTILATION
(WIS Section 49)

Materials	*Requirements*
AIRFLOW MEASURING DEVICE	- THE DEVICE SHALL: • Measure airflow in CFM, with a range up to at least 120 CFM. • Have a resolution of at least 1.0 CFM or exhaust fan flow measurement accuracy of ±10%. - ACCEPTABLE DEVICES INCLUDE: • Exhaust Fan Flow Meter™ with Digital Gauge (up to 124 CFM, exhaust only) • Flow Capture Hood • The Energy Conservatory Duct Blaster® as a Powered Capture Hood (Exhaust or Supply; 10-300 CFM). • Large Vane Anemometer – Averaging or snapshot capability, with display showing airflow in CFM. – Multiple readings across fan required without funnel/hood; single reading acceptable with funnel/hood.  EXHAUST FAN FLOW METER™  FLOW CAPTURE HOOD  LARGE VANE ANEMOMETER WITH FUNNEL/HOOD ATTACHED *Graphic Credit: RHA, Inc.*
MV SYSTEM COMPONENTS (FANS, CONTROLLERS, & DUCTS)	- GENERAL SPECIFICATIONS • ASHRAE 62.2–2016 Compliant for WHOLE-HOUSE MECHANICAL VENTILATION USE • UL-listed or equivalent • Rated for continuous operation at required CFM • Minimum 1-year warranty • Certification for specific fan types – Ceiling Mount Exhaust or Inline Exhaust: ENERGY STAR–certified – Wall Mount Exhaust or Supply: HVI-certified – Inline Supply: ENERGY STAR–certified or HVI-certified – HRV or ERV: Exempt from ENERGY STAR or HVI certification requirement – Whole-House Ventilation/Kitchen Exhaust Combination Unit: ENERGY STAR–certified • Sound level not to exceed 1 sone, with the following exceptions: – Permissible to install up to a 1.2 sone through the wall fan. – Unit is installed with minimum 4-foot ductwork between grille and fan (e.g., HRV, ERV, inline fan).  *Photo Credit: Panasonic*
MV AIR FILTERS	- GENERAL SPECIFICATIONS • Mechanical ventilation systems that supply air to living space through ductwork more than 10 ft. in length, and through a thermal conditioning component (except evaporative coolers), shall have an air filter with a minimum efficiency of MERV 6 or better. • The air filter shall be tested to that efficiency in accordance with ANSI/ASHRAE Standard 52.2.

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td>DUCT INSULATION</td><td>
- ALL MATERIALS

Maximum flame-spread index of 25 and smoke-developed index of 50, per ASTM E84, UL 723, OR NFPA 255.
Shall be listed for exterior applications.
Minimum R-value for duct insulation shall be in accordance with Title 24, by CEC Climate Zone:

<table>
<tr><th>Climate Zones</th><th>Minimum R-value</th></tr>
<tr><td>1-10, 12, 13</td><td>R-6.0</td></tr>
<tr><td>11, 14-16</td><td>R-8.0</td></tr>
</table>
</td></tr>
<tr><td>DUCTS</td><td>
- ALL DUCTS

Shall comply with manufacturer’s instructions and local code (e.g., for Flame Spread Rating).

- RIGID DUCT

Galvanized Steel: minimum 26-gauge.
Aluminum: minimum 24-gauge.
PVC smooth plastic pipe: minimum schedule 80.

- FLEXIBLE DUCT

Semi-Rigid Metallic Aluminum: minimum of .0065” thick and UL-listed 181B.

</td></tr>
<tr><td>DUCT TERMINATIONS AND DAMPERS</td><td>
- ALL SYSTEMS

Terminal shall be constructed of aluminum, sheet metal, or UV-protected plastic, and equipped with maximum 1/2" weave rodent or insect screen.
A compatible metal or plastic damper shall be present in the system.

- EXHAUST SYSTEMS

A gravity type backdraft damper shall be located in the termination.

- SUPPLY SYSTEMS

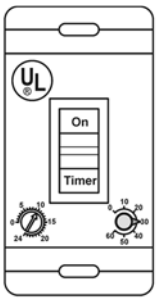
A metal spring-loaded butterfly damper shall be located on the inlet side of the fan.

</td></tr>
<tr><td>FAN CONTROLLER</td><td>
- TYPE

An integral part of the fan (inside the fan housing), <u>OR</u>
A separate unit (installed in the wall-mount electrical box).

- ADDITIONAL REQUIREMENTS

Shall fit in a single-gang box, if a separate unit.
Shall operate automatically.
Shall be rated for amperage that meets or exceeds fan load.



SEPARATE CONTROLLER FOR INTERMITTENT SYSTEM WITH RUNTIME CONTROLS —PLACED INSIDE A WALL-MOUNT ELECTRICAL BOX
Graphic Credit: RHA, Inc.
</td></tr>
<tr><td>FANS</td><td>
- SHALL BE:

Rated for continuous operation.
Sone rating, per label and ENERY STAR-Certified Products Directory, shall not exceed 1.0.

<u>Exception</u> #1: The 1.0 sone requirement shall be met to the extent possible. However, if a 1.0 sone product is not available, it is permissible to install up to a 1.2 sone in wall-mount supply fan.
<u>Exception</u> #2: Sone requirement does not apply to a fan mounted outside the living space, when there is at least 4' of ductwork between the exhaust or supply grille and the fan unit.

</td></tr>
</table>

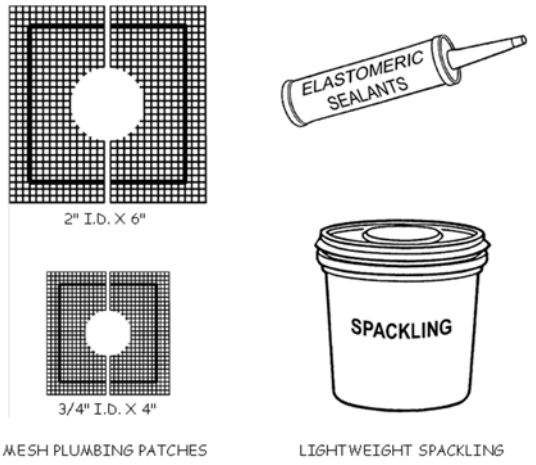
PASSIVE INLET VENTS	- PASSIVE INLET VENTS SHALL HAVE: • An indoor fresh-air inlet with: – A replaceable or washable filter for incoming air. – Manual flow control (e.g., shutter or louver) to control incoming air. – Thru-wall sleeve/duct that is adjustable to wall thickness. • Outdoor inlet that: – Protects from wind and precipitation (e.g., with hood and/or louvers). – Shall have a bug/bird screen to keep out insects and birds.

Photo Credit: WAPTAC.org

MICROWAVE OVENS
(WIS Section 38)

Materials	*Requirements*
APPROVED MATERIALS	- ALL UNITS • UL-listed countertop model • Electronic controls with 10 or more power settings. • Microwave oven capacity shall be 0.7-1.0 cu. ft. • Microwave oven power rating shall be between 800-1100 watts.  *Photo Credit: RHA, Inc.*

MINOR ENVELOPE REPAIR
(WIS Section 7)

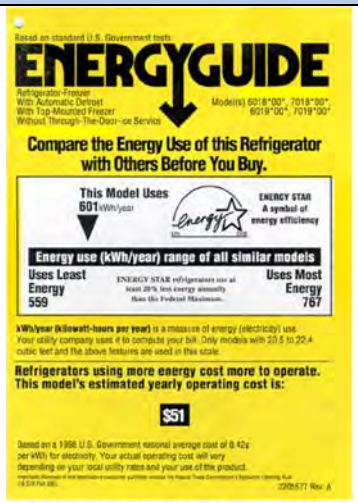
Materials	*Requirements*
MINOR ENVELOPE REPAIR	- GENERAL SPECIFICATIONS: • Where specific measures (line items) already exist, reference that shell sealing line item for material specifications (such as "Caulking" as a shell sealing activity). • Note: Activities such as Duct Sealing, Caulking, Cover Plate Gaskets, Glass and Window Repairs/Replacements, Sliding Glass Door and Standard Door Repair/Replacements, Interior Vent Covers, Kitchen Exhaust Repair/ Replacement, and Weatherstripping have separate specifications that are provided separately in the CSD WIS.  *Photo Credit: RHA, Inc.*
WALL OR SHELL PATCHING	- MESH PLUMBING PATCHES • 28-30–gauge non-corrosive metal with self-adhesive backing. – Backing shall be a strong pressure-sensitive adhesive film. – Backing shall be reinforced with fiberglass mesh or equivalent. – Patches shall be cut to fit snugly around pipes (e.g., pre-cut for installation around 2", 1-1/2", 3/4" and 1/2" pipes). - FINISHING COMPOUND • Lightweight, non-shrinking spackling compound, or • Drywall joint compound, or equivalent. - SHEET METAL • Aluminum or galvanized sheet metal; minimum thickness 0.007". - RADIANT BARRIER MATERIAL • Commercially available foil/bubble/foil. • Class A/Class 1; minimum thickness 5/16". - FOAM BOARD • Polyisocyanurate foil clad both sides; ASTM C 1289 or FS HH-I-1972.  *Graphic Credit: RHA, Inc.*
ATTIC ACCESS COVER—HORIZONTAL	- ATTIC ACCESS COVER—HORIZONTAL • Cover Material – Field-fabricated Access Door: Gypsum (drywall), minimum 5/8" thick – Prefabricated access door assembly: Commercially available • Framing Material (Joist Blocking) – Same dimension as joist (e.g., 2" x 4" or 2" x 6") – No. 2 Hem fir or better • Trim Material – Window/door trim/molding (interior or exterior grade) – Adequate thickness and width to attach to ceiling joists and extend into the opening far enough to support the cover (e.g., 5/8" x 3-1/2") – Spackle or wood putty (to cover recessed nails) • Attachments – Minimum 3" nails for blocking

Materials	Requirements
ACCESS COVER—HORIZONTAL (CONT.)	– Finish nails for attaching trim (long enough to penetrate joist at least 1/2", e.g., 1-5/8" long) • Weatherstripping – Open or closed cell foam tape, in accordance with material specification for Weatherstripping. • Insulation – Flexible or rigid insulation, with an R-value equal to the R-value of insulation on the attic floor.
ATTIC ACCESS COVER--VERTICAL	- ATTIC ACCESS COVER—VERTICAL • Cover Material – Gypsum (drywall), minimum 1/2" thick; or – Plywood • Minimum 5/8" plywood (interior or exterior grade, CCX or better), for wood-only cover/door. • Minimum 1/2" plywood (interior or exterior grade, CDX or better), to serve as backing for gypsum-clad cover/door. • Framing Material – Same dimension as studs (e.g., 2" x 4") – No. 2 Hem fir or better • Trim Material – Window/door trim/molding (interior or exterior grade), minimum 2" wide – Spackle or wood putty (to cover recessed nails) • Hinges in Firewall Applications – Minimum 3-1/2" x 3-1/2" spring-loaded with adjustable tension – Adequate spring tension to make access cover self-closing • Attachments – Minimum 3" nails for blocking – Finish nails for attaching trim (long enough to penetrate joist at least 1/2", e.g., 1-5/8" long) – Corrosion-resistant screws for hinges • Sized per hinge manufacturers specifications, and • Long enough to penetrate framing at least 1/2" – Heavy duty construction adhesive (to glue plywood to gypsum) • Weatherstripping – Open or closed cell foam tape, in accordance with material specification for weatherstripping, or – Entrance door weatherstripping material specification. • Insulation – Flexible or rigid insulation, with an R-value equal to knee walls.
CRAWLSPACE ACCESS COVER--HORIZONTAL	- CRAWLSPACE ACCESS COVER—HORIZONTAL (INDOORS) • Cover Material – Prefabricated access door assembly (commercially available); or – Field-fabricated access door • Substrate of 3/4" plywood, CCX or better • Finish lumber: No. 2 or better • Framing Material (Joist Blocking) – Same dimension as joist (e.g., 2" x 4" or 2" x 6") – No. 2 Hem fir or better • Attachments – Minimum 3-inch nails for blocking – Corrosion-resistant screws for hinges • Sized in accordance with hinge manufacturers specifications, and • Long enough to penetrate framing at least 5/8". • Weatherstripping – Open or closed cell foam tape, in accordance with material specification for Weatherstripping. • Insulation – Flexible or rigid insulation, with R-value equal to the R-value of insulation on the floor insulation.

Materials	*Requirements*
CRAWLSPACE ACCESS COVER--VERTICAL	- CRAWLSPACE ACCESS COVER—VERTICAL (OUTDOORS) • Cover Material – Metal • Screened metal vent, (commercially available or shop fabricated), or • Solid metal access cover (commercially available or shop fabricated) • Metal: Minimum 20-gauge • Screen: 1/4" metal mesh or expanded metal, or equivalent – Wood • Minimum 1/2" exterior grade plywood, CCX or better • Framing Material (Box Frame) – Minimum 1" x 2" redwood or pressure-treated fir, no. 2 or better • Hinges – Cabinet hinges or better – Corrosion-resistant • Latches – Cabinet latches or better – Corrosion-resistant • Attachments – Box Frame and Metal Frame • Concrete nails or corrosion-resistant screws and anchors • Sized for 1/2" penetration into concrete – Corrosion-resistant screws for hinges • Sized in accordance with hinge manufacturers specifications, and • Long enough to penetrate framing at least 5/8".
FIREPLACE CHIMNEY DAMPER	- FACTORY-BUILT (ZERO CLEARANCE) FIREPLACES • Repair or replacement parts shall be specified by the fireplace manufacturer. - MASONRY FIREPLACES • Commercially available top-sealing (chimney top) dampers. • Sized to fit the chimney termination. • Controllable from indoors (e.g., with a control cable inside the fireplace).
FIREPLACE GLASS DOORS	- ALL GLASS DOORS • Shall fit smallest dimensions of the fireplace opening. • Shall seal against the fireplace surface (e.g., with gasket or strips of fiberglass insulation). • Shall meet the requirements listed below, based on Fireplace Type. - FACTORY-BUILT (ZERO CLEARANCE) FIREPLACES • Commercially available glass doors. • Designed for use with zero clearance fireplaces. • Sized and shaped to fit against and seal off the fireplace opening. - MASONRY FIREPLACES • Commercially available glass doors. • Designed for use with masonry fireplaces. • Sized and shaped to fit against and seal off the fireplace opening.

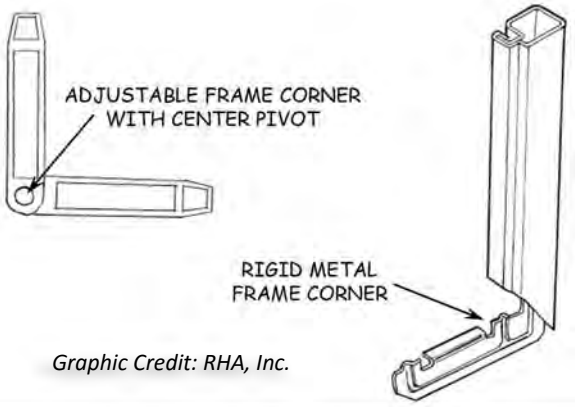
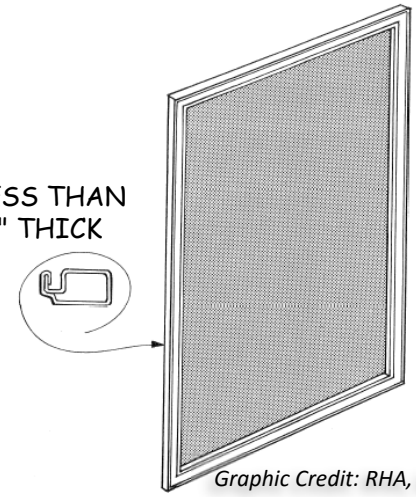
REFRIGERATOR REPLACEMENT
(WIS Section 37)

Materials	*Requirements*
REPLACEMENT REFRIGERATOR	- ALL UNITS SHALL BE: • UL-listed. • ENERGY STAR–certified. – A non-ENERGY STAR refrigerator may be installed, provided: (a) it meets CEC energy efficiency standards, and (b) SIR for that model is verified to be higher than the SIR for a comparable ENERGY STAR model. • Frost free, but no extra specialty features. • Maximum capacity of 23 cu. ft. (per Sizing Guide in CSD Field Guide). • White in color. Client-requested color is allowed if available at no cost increase. • Freezer normally on top, but side-by-side is allowed in larger sizes, when top freezer is not available or bottom freezer costs more. - REFRIGERATOR TYPE(S) NOT ALLOWED • Unit equipped with ice maker or water dispenser.



ENERGY GUIDE LABEL WITH ENERGY STAR® LOGO

SHADE SCREENS
(WIS Section 46)

Materials	*Requirements*
FRAME CORNERS	- SQUARE CORNERS • Rigid metal internal frame corners shall be used; adjustable and plastic corners not allowed. - ANGLED CORNERS (RAKE WINDOWS) • Adjustable internal frame corners are allowed. – Shall be durable, solid plastic (two legs riveted in the center), when adjustable metal frame corners are not available.  *Graphic Credit: RHA, Inc.*
FRAME MATERIAL	- WOOD • Not allowed. - RIGID VINYL • Not allowed. - STEEL • Zinc or cadmium plated. - ALL ALUMINUM • A minimum of .025" thickness, 7/16" x 1" dimension for windows up to 25 sq. ft.. • A minimum of .032" thickness, 7/16" x 1" dimension for windows over 25 sq. ft..  *Graphic Credit: RHA, Inc.*
SCREEN MATERIAL	- VINYL OR FIBERGLASS • Lead-free • Flame-resistant (e.g., NFPA 101 Class B; CS-191 53; CFR Part 1610.61; IBC 903.1, Class A). - METAL LOUVERS • Not allowed.  *Photo Credit: Project Go, Inc.*
SCREEN SHADING PERFORMANCE	- ALL SHADE SCREENS • Shall have shading coefficient of 0.36 or less at 75° profile angle on clear single-pane glass, or be rated to block/absorb/dissipate at least 70% of the sun's heat and glare..
SPLINE	- ALL SHADE SCREENS: • Sized to fit properly in frame channel.
TURN CLIPS	- CLIPS SHALL BE: • Corrosion-resistant metal (not plastic) • Compatible with screen frame and sized so barrel rests on the mounting surface.

SHELL LEAKAGE TEST EQUIPMENT (BLOWER DOOR)
(CSD Field Guide Appendix C)

Materials	*Requirements*
SHELL LEAKAGE TESTING EQUIPMENT	- STANDARD TESTING EQUIPMENT • Shell leakage testing shall be performed with standard blower door and in accordance with manufacturer's instructions, except as noted in "Alternative Testing Equipment" below. • Equipment shall comply with the following requirements: – Commercially-produced equipment shall be used. – Analog (magnehelic) gauges or a digital Manometer (pressure gauge) shall be used. – House Pressure gauge shall display pascals with a range from 0 to 60 Pa, and an accuracy of ±10%. – Fan Flow gauge shall display Pascals and CFM with a range of 500 to 6000 CFM, and an accuracy of ±10%. – Gauges may be calibrated in Inches of Water Column if the range is between 0 and 0.25 IWC with an accuracy of ±5%. • Smoke generators may include incense sticks, smoke pencils, smoke puffers, etc. to accomplish effective shell sealing.  *Photo Credit: CAP of San Luis Obispo*
ALTERNATIVE TESTING EQUIPMENT FOR MULTI-FAMILY UNITS ONLY	- ALTERNATIVE TESTING EQUIPMENT • Shell Leakage Testing with a Minneapolis Duct Blaster® and DG-700 Digital Gauge is allowed only under the following condition: – A Minneapolis Duct Blaster fan may be used in lieu of a blower door fan *only when* the fan control can produce at least 30 Pa of house pressure (MUD units only).  *Photo Credit: WAPTAC.org*
CALIBRATION OF TESTING EQUIPMENT	- CALIBRATION OF EQUIPMENT • Records of all calibrations and equipment checks shall be kept in an equipment calibration log. • Digital gauges shall be calibrated annually, by the factory, or by using field calibration procedures. – For Minneapolis, using the available field calibration plate. – For Retrotec, using items and instructions supplied with the gauge. - BLOWER DOOR FANS MUST BE FIELD-CHECKED USING MANUFACTURER'S RECOMMENDED PROCEDURES: • Annually, or whenever a fan has been dropped or damage is suspected. • All equipment shall be checked by the factory after damage has occurred or field checks reveal deviations that require factory service—in accordance with factory recommendations. • Equipment manufacturer's assistance shall be used as needed to properly maintain test equipment. – For Energy Conservatory (Minneapolis) Blower Doors, find calibration information and instructions at: http://www.energyconservatory.com/support/support7.htm – For Retrotec Blower Doors, find equipment information at: http://www.retrotec.com

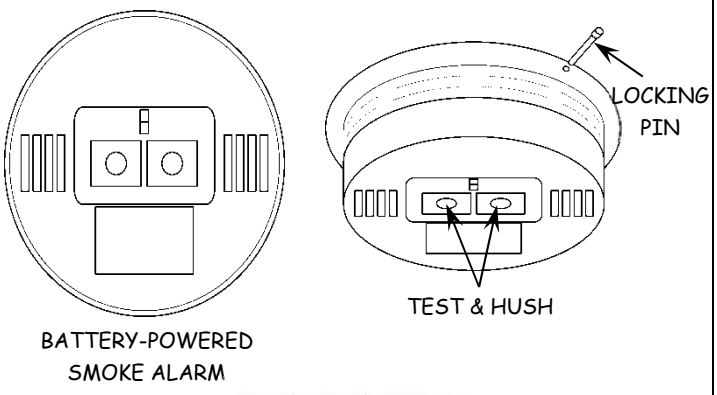
SHOWERHEADS AND FAUCET AERATORS
(WIS Section 45)

Materials	*Requirements*
AERATORS AND SHOWERHEADS	- GENERAL SPECIFICATIONS • WaterSense® labeled. • Self-cleaning" or cleanable without being unscrewed from the shower arm. • Features will be selected that meet any special needs of the occupant (e.g., shut off, swivel, handheld showers) . - AERATORS • Shall be metal (e.g., chrome-plated brass). • Shall conform to ANSI/ASME A112.18.1 (2012) • Shall be metal (e.g., chrome-plated brass). - SHOWERHEADS • Features will be selected that meet any special needs of the occupant (e.g., shut off, swivel, handheld showers) in compliance with the CSD Field Guide. • All showerheads shall be pressure-compensating type for consistent performance (i.e., maintain constant temperature under varying pressures). - REQUIRED FLOW RATES • Showerhead: Maximum flow rate: 2.0 gpm at 80 psi. • Faucet Aerators – Maximum flow rate: • Kitchen: 1.8 gpm with optional temporary flow of 2.2 gpm at 60 psi • Bath: 1.2 gpm at 60 psi. – Minimum flow rate: 0.8 gpm at 20 psi  *Photo Credit: CAP of San Luis Obispo*  *Photo Credit: RHA, Inc.*
SHOWER CONTROL VALVE	- SHOWER CONTROL VALVE ("TRICKLE VALVE") • Chrome-plated brass. • Designed to fit standard 1/2" showerheads and arms. • Flow rate from 2.5 gpm to a trickle. • May be separate or built into the showerhead.
SHOWERARM ADAPTER	- SHOWERARM ADAPTERS • Adapter shall be metal (e.g., chrome-plated brass). • Minimum 5/8" long male pipe threads with a minimum taper of 3% on showerhead end.
SHOWERHEADS, HAND-HELD	- HAND-HELD SHOWERHEADS SHALL HAVE: • Hose: Minimum 48" length, capable of swiveling at both ends, and constructed of flexible vinyl or PVC material, reinforced (e.g., with nylon). • Mounting Bracket: Designed to attach to the shower arm (not wall), and constructed of heavy-duty thermoplastic (e.g., ABS) or equivalent, with all-metal swivel ball (e.g., chrome-plated brass). • Attachment: Shall fit standard-thread shower arms and standard adapters. • An anti-siphon valve.
SHOWERHEADS, WALL-MOUNT	- WALL-MOUNT SHOWERHEADS • "Self-cleaning" type or cleanable without being unscrewed from the showerarm. • Non-aerating type. • Ball joint shall be metal (e.g., chrome-plated brass).

SMOKE ALARMS
(WIS Section 5)

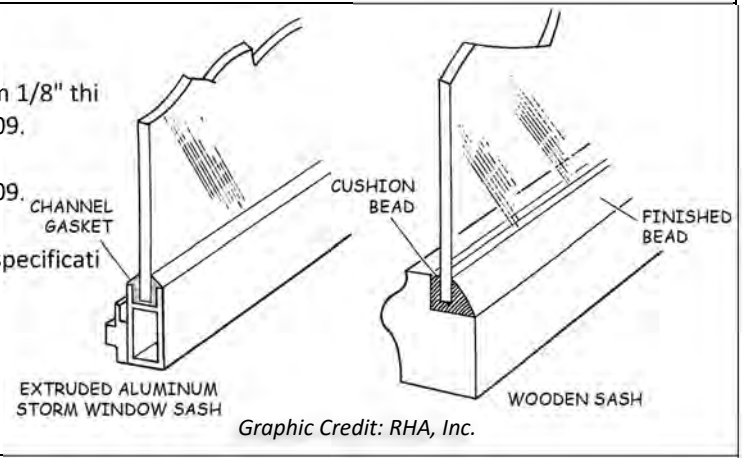
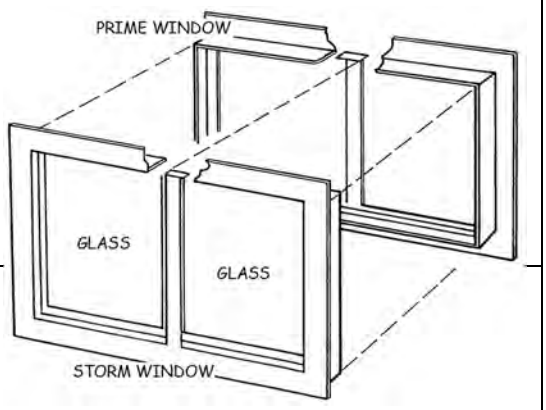
Materials	*Requirements*
INTERCONNECTED ALARMS	- INTERCONNECTED ALARMS • If more than one hard-wired alarm is installed, they shall be interconnected, if required by code. • If multiple hard-wired smoke alarms are present and interconnected, and at least one within the group will be replaced: – The replacement alarm shall be compatible with the existing interconnection system, or – All of the interconnected smoke alarms shall be replaced, when required by the local jurisdiction (condition shall be documented in the permanent file).
MOUNTING SYSTEM	- MOUNTING SYSTEM • Alarm shall: – Have tamper-resistant mounting, such as a locking pin or tamper-resistant tabs, and – Be secured to the mounting surface by at least two standard screws.
SMOKE ALARM	- ALL ALARMS • Listed to UL 217. • Single-purpose alarm (smoke only). • Photoelectric or Ionization-type. – Note: When the required 20' minimum horizontal distance from an open combustion appliance cannot be met, installation of a *photoelectric-type* alarm shall reduce the minimum distance to as little as 10'. • On the California State Fire Marshal's list of approved smoke alarms, and have these features: – Date of manufacture on the alarm label. – Test and hush buttons to check alarm electronics and temporarily silence unwanted nuisance alarms. – End-of-life feature that indicates the alarm must be replaced. - BATTERY-POWERED • Battery(ies) shall be non-replaceable, non-removable, and capable of powering the alarm for a minimum of 10 years. - HARD-WIRED • 120 VAC. • Factory preinstalled lithium battery backup. • Inter-connectable, when required as described above in "Interconnected Alarms."

Photo Credit: Public Domain

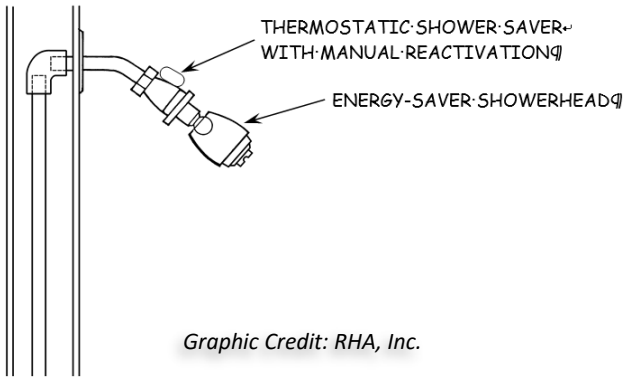


Graphic Credit: RHA, Inc.

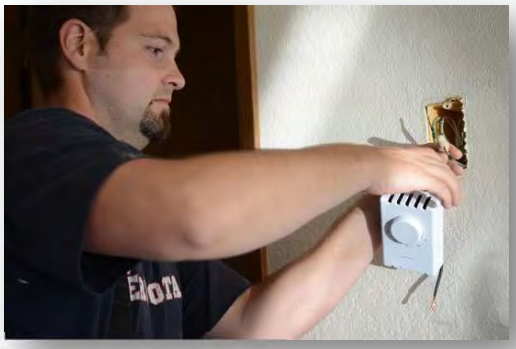
STORM WINDOWS
(WIS Section 15)

Materials	*Requirements*
HARDWARE AND FASTENERS	- HARDWARE AND FASTENERS • Aluminum, stainless steel, or other non-corrosive material compatible with frame. - ANGLED CORNERS (RAKE WINDOWS) • Adjustable internal frame corners are allowed. – Shall be durable, solid plastic (two legs riveted in the center), when adjustable metal frame corners are not available.  *Photo Credit: RHA, Inc.*
SEALANTS	- ALL SEALANTS • Glazing Tape – Closed-cell foam, minimum 1/8" thi – Conformance to ASTM C509. • Pre-formed Gaskets – Conformance to ASTM C509. • Caulk – Conformance to material specificati  *Graphic Credit: RHA, Inc.*
STORM WINDOW FRAME	- ALUMINUM FRAME WINDOWS • Conformance to ANSI/AAMA 1002.10. - WOOD FRAME WINDOWS • Conformance to Section 3 of ANSI/NWWDS I.S.2. - RIGID-VINYL FRAME WINDOWS • UV-resistant. • Conformance to ASTM.  *Graphic Credit: RHA, Inc.*
STORM WINDOW MATERIAL	- GLASS • Conformance to AAMA 1701.2. - POLISHED WIRE GLASS • Conformance to ANSI Z97.1. - SAFETY GLASS • Conformance to ANSI Z97.1 and permanently labeled. - PLASTIC GLAZING • UV- and scratch-resistant polycarbonate, minimum 1/8". • Conformance to ANSI Z97.1. - WINDOW GLAZING • Glass recommended; plastic glazing is acceptable. • Safety glass or polycarbonate, where glazing is required and required by the local jurisdiction.

THERMOSTATIC SHOWER VALVES AND THERMOSTATIC SHOWERHEADS
(WIS Section 51)

Materials	*Requirements*
THERMOSTATIC SHOWER VALVES & SHOWERHEADS	- ALL UNITS SHALL BE COMPLIANT WITH: • Uniform Plumbing Code (IAPMO IGC 244, latest adopted version). - ALL UNITS SHALL BE: • Designed to automatically reduce flow in response to incoming water temperatures exceeding a preset actuation temperature. • Designed to automatically reset after the valve cools down following completion of showering. • Easily reactivated with manual control. • Threaded with a female 1/2" NPT to fit standard showerarms threaded with a male 1/2" NPT, in accordance with ANSI/ASME B1.20.1. **Note**: When a thermostatic shower valve is installed in conjunction with an energy-saver showerhead, the showerhead (and adapter if used) shall be in compliance with CSD WIS Section 45 (Showerheads and Faucet Aerators). • If showerhead is a hand-held type, it shall be equipped with an anti-siphon valve.  *Photo Credit: Evolve Technologies LLC*  *Graphic Credit: RHA, Inc.*

THERMOSTATS—PROGRAMMABLE AND MANUAL
(WIS Section 27)

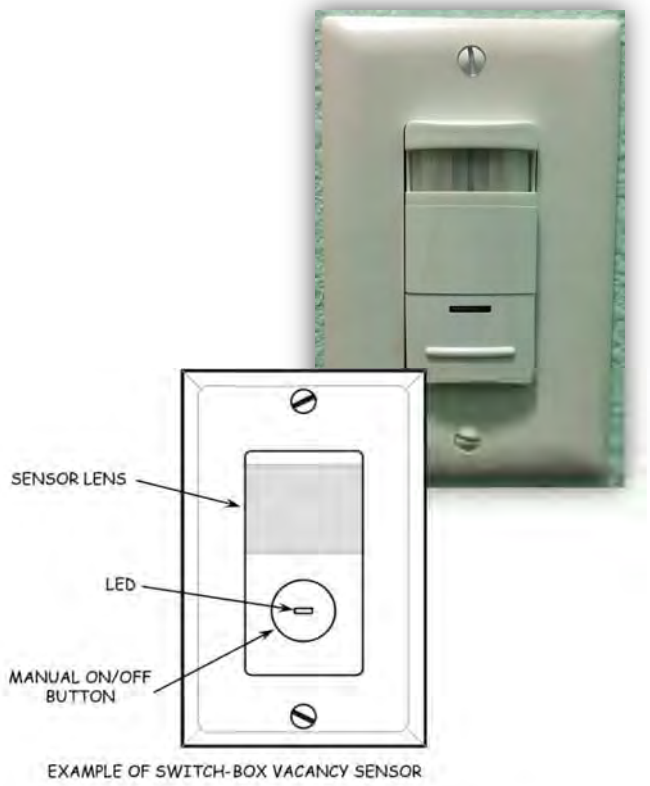
Materials	*Requirements*
MANUAL THERMOSTAT	- MANUAL REQUIREMENTS • Alternative when client refuses programmable thermostat. • Digital with built in anti-short-cycle feature. • Conforms with HVAC manufacturer's instructions. • Compatible with HVAC equipment it will control. • Includes a positive on/off switch.  *Photo Credit: WAPTAC.org*
PROGRAMMABLE THERMOSTAT	- REPLACEMENT PROGRAMMABLE THERMOSTATS SHALL BE/HAVE: • Programmable and ENERGY STAR–certified. • System powered, not battery powered, on 24 volt systems. • Battery backup, or other program-saving backup system. • Lithium battery for power and for backup. • Digital with anti-short-cycle feature. • At least 4 setback periods per 24-hour day, with: – Change cycle increments ≤ 30 minutes. – Setback capability ≥ 10°F • Programmable for both weekdays and weekends. • Manual override and positive on/off switch that is easily accessible. • Compatible with the HVAC equipment it will control. - THERMOSTATS FOR HEAT PUMPS • Shall prevent supplementary electric resistance heater operation when the heat pump alone can meet the heating load. • May be a "smart thermostat" with intelligent recovery, staging, ramping, or other control that prevents unnecessary use of electric resistance heating; however installation of a "smart thermostat" requires a waiver from CSD.  *Photo Credit: RHA, Inc.*

TIER 2 AUDIO-VISUAL ADVANCED POWER STRIPS
(WIS Section 52)

Material	*Requirements*
ADVANCED POWER STRIPS	- TIER 2 AUDIO-VISUAL ADVANCED POWER STRIPS (T2 AV APS) SHALL BE: • Underwriters Laboratories Tested and Listed – ALL APS UL-listed to latest UL1449 standard – Corded APS also UL-listed to latest UL1363 standard • Infrared (IR) controlled, with an IR remote sensor that detects control signals (e.g., volume or channel changes) from the television IR remote control. • Rated for 120 volts and 15 amps. • Three-pronged right-angle corded connector, or three-prong direct wall plug-in. • Resettable circuit breaker.  *Photo Credit: Embertec* - ALL T2 AV APS SHALL BE EQUIPPED WITH: • Minimum 1,000 joules of surge protection for all outlets. • "Smart" power-saving function that automatically turns off power to all switched devices within 5 minutes after the TV is turned off with its IR remote control. • Adequate sensitivity for any TV connected to it, including LED and Plasma TVs. The APS: – Shall detect when the TV is turned off—thus activating the function that turns off all switched outlets. – Shall not turn off any switched outlets when very low power consumption occurs in an LED TV (e.g., due to a dark scene on the screen). • Adjustable Timer (Delay Period) – Factory preset to automatically turn off TV and switched outlets after a delay period of approximately 1 hour, when no IR activity is detected by the APS IR remote sensor. – Can be manually programmed to automatically turn off TV and switched outlets after a longer delay period without detectable IR activity. – Produces a warning signal that alerts the user before power to the TV and peripheral devices is turned off. • Switched and Unswitched Outlets: – Corded T2 AV APS shall have at least four switched (power-saving) outlets, one of which may be specified for the TV, and at least two unswitched (always-on) outlets. – Direct wall plug-in T2 AV APS shall have a least one switched (power-saving) outlet and at least two unswitched (always-on) outlets. – Visual indicator which verifies the unit is active and functioning.  *Photo Credit: Tricklestar*

VACANCY SENSOR SWITCHES
(WIS Section 50)

Materials	*Requirements*
VACANCY SENSOR SWITCHES	- ALL VACANCY SENSORS SWITCHES SHALL BE: • UL-listed. • Designed for installation in a wall-mount switch box • Title 24–compliant and listed in the CEC's Appliance Efficiency Database • Adjustable time delay, with maximum 30-minute delay • "Manual-On/Automatic-Off" • Not convertible to an occupancy sensor. - IN ADDITION, SENSORS SHALL BE SELECTED IN ACCORDANCE WITH CIRCUIT TYPE: • For single light-only circuits: single pole • For bathroom light and exhaust fan controlled by one switch: Dual load and rated for the fan load • For 3-way and 4-way lighting circuits: Multi-way - SENSOR • Passive Infrared (PIR), or • Ultrasound (US), or • Combination of both sensor types • Appropriate for the location.



EXAMPLE OF SWITCH-BOX VACANCY SENSOR

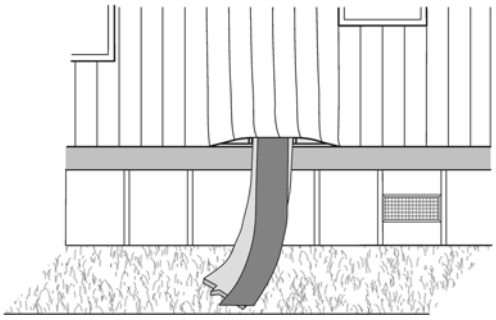
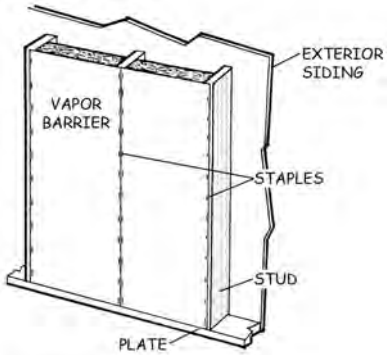
Photo and Graphic Credit: RHA, Inc.

VENT COVERS - INTERIOR
(WIS Section 10)

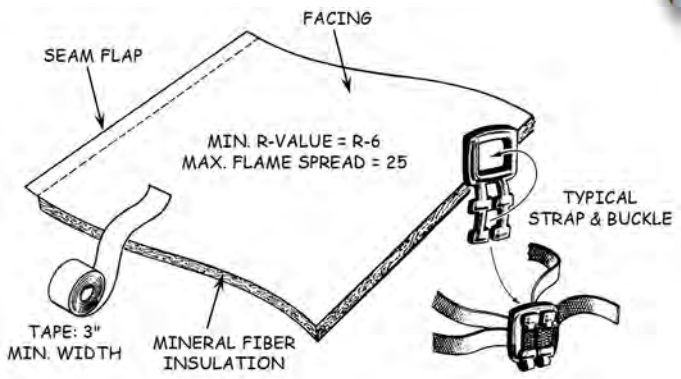
Materials	*Requirements*
ALL VENT COVERS	- ALL COVERS • Covers shall be for interior vents for Evaporative Coolers and Window/Wall Air Conditioner vents only. • Maximum perm rating shall be 1.0.  *Photo Credit: Public Domain*
EXTERIOR COVERS	- WINDOW/WALL AC OUTDOOR COVERS • Installed by programmatic waiver only when an existing unit is missing or does not have a damper. • Shall be a heavy duty, commercial grade, water-repellant canvas with secure attachment (e.g., integral rope tie in the open end hem) to create a tight fit around the AC unit. • Vinyl covers shall not be allowed.
MAGNETIC SHEETING VENT COVERS	- MAGNETIC SHEETING • Minimum 30 mil flexible magnetic sheeting with vinyl face (white, or colored to blend with surrounding material).
METAL VENT COVERS	- METAL COVERS • Shall be aluminum, galvanized, or painted metal only.
PLASTIC FILM AS A VENT COVER	- PLASTIC FILM • Minimum 12-mil film. • Film shall be framed with aluminum, rigid plastic or finished hardwood.
PLASTIC VENT COVER	- RIGID PLASTIC COVER • Shall be one-piece or multi-piece adjustable. • Adjustable cover shall consist of pieces that bond together to form the equivalent of a one-piece cover.
WOOD COVERS	- WINDOW/WALL AC WOOD COVERS • Installed by programmatic waiver only when an existing unit is missing or does not have a damper. • Shall be finished wood only. • Bare wood shall be sealed/finished with paint, urethane, varnish, or stain. • May be installed only when other types are not feasible.

WALL INSULATION
(WIS Section 23)

Materials	*Requirements*
ALL WALL INSULATION	- FLEXIBLE AND RIGID INSULATION MATERIALS • All insulation shall be certified to comply with the CCR, Title 24, Part 12, Chapter 12-13, "Standards for Insulating Material." • Facing shall meet applicable code requirements. • A non-absorbent, fire-rated insulation will be used with a minimum life expectancy of 10 years. - MINERAL FIBER • Flexible – Conformance to ASTM C665. • High Density Fiberglass Board – Conformance to ASTM C726. • Loose Fill – Conformance to ASTM C764. - CELLULOSE • Loose Fill – Shall be licensed for sale in California. – Listed in the Department of Consumer Affairs "Directory of Certified Insulation Materials." - RIGID FOAM • Preformed Foil Faced Polyisocyanurate Board that conforms to FS HH-I-1972/1. • Facing shall be a code-approved fire rated material (confirm allowed material with local jurisdiction).  *Photo Credit: WAPTAC.org*  *Graphic Credit: RHA, Inc.*
DENSE PACK INSULATION	- INSTALLATION DENSITY • Blown fiberglass, mineral fiber, or rock and slag wool used in an enclosed cavity will be installed at or above the manufacturer recommended density to limit air flow that corresponds to an air permeance value of 3.5 cfm/sq. ft. at 50 pascals, as measured using BPI-102 "Standard for Air Resistance of Thermal Insulation Used in Retrofit Cavity Applications – Material Specification" or ASTM C 522, E 283, or E 2178. • The number of bags installed will be confirmed and will match the number required on the coverage chart.
INSULATION R-VALUE	- ALL FLEXIBLE AND RIGID MINERAL FIBER AND RIGID FOAM INSULATION MATERIALS • R-value shall be determined in accordance with: – DOE Priority List Table; or – By Energy Audit; or – As prescribed by insulation manufacturer and the LIHEAP guidelines below <u>when existing R-value is less than R-11</u>: • In 2 x 6 walls: R-19 • In 2 x 4 walls: R-13 for cellulose/R-13 for fiberglass material.

Materials	*Requirements*
MOBILE HOME INSTALLATIONS	 - FIBERGLASS INSULATION MATERIALS • Flexible: – High-density R-13 fiberglass blankets or minimum 8-foot-long batt). – Width for 16″ OC stud spacing (or actual stud spacing, if different). – Unfaced, plastic-jacketed, or kraft faced. • Loose-fill: Fiberglass blowing wool. - OTHER MATERIALS • Vapor Retarder: 6-mil plastic sheeting cut into strips: – Slightly wider than the blankets/batts (to wrap around edges of the stuffing tool), and – Slightly longer than the insulation length (to serve as a vapor retarder. • Screws: Aluminum hex-head screws (to replace old screws when re-installing mobile home siding). – Same diameter as, or larger than, the existing screws. – At least 1/8″ to 1/4″ longer than the existing screws. - SPECIALIZED TOOLS • Long, straight pry bar. • Stuffing tool made with a strip of sturdy, flexible polycarbonate (e.g., Lexan) or galvanized metal (used to push the fiberglass insulation into an enclosed wall cavity). • Stuffing Tool Construction: – Dimensions: • 1 foot wide by 8 feet long for full-length cavities • 1 foot wide by 4 feet long for shorter cavities (under windows, etc.) – Thickness: 5/16″ plastic, or 20-gauge metal – Bend (5-15° angle), 10-12" from one end, to help clear obstructions inside the wall cavity. – For plastic, apply indirect heat at bend location to achieve the angle.  METAL SIDING PULLED AWAY FROM FRAME, AND STUFFING TOOL USED TO PUSH FIBERGLASS *Graphic Credit: RHA, Inc.*
VAPOR RETARDER, ALL DWELLING TYPES	- TO BE INSTALLED WITH FLEXIBLE AND RIGID INSULATION MATERIALS WHEN REQUIRED BY THE LOCAL JURISDICTION. • Shall have a maximum perm rating of one.  *Graphic Credit: RHA, Inc.*

WATER HEATER INSULATION
(WIS Sections 16 and 17)

Materials	*Requirements*
INSULATION/ BLANKET	- BLANKET MATERIAL • Applies to standard and multi-family central water heaters. • Maximum flame-spread index of 25 and maximum smoke-developed index of 50, per ASTM E84, or UL 723, or NFPA 255. • Mineral fiber only, with vinyl or fiber-reinforced foil facing. • R-6 minimum R-value.  *Photo Credit: WAPTAC.org*  *Graphic Credit: RHA, Inc.*
STRAPS AND BUCKLES	- STRAPS AND BUCKLES • Maximum flame-spread index of 25 and maximum smoke-developed index of 50, per ASTM E84, or UL 723, or NFPA 255. • Polypropylene blanket straps and compatible buckles or other mechanical strap locks; tying of straps is not allowed.
TAPE	- TAPE • Maximum flame-spread index of 25 and maximum smoke-developed index of 50, per ASTM E84, or UL 723, or NFPA 255. • Vinyl or fiber-reinforced foil compatible with, or the same material as, facing. • Minimum width 3". • Duct tape not allowed.

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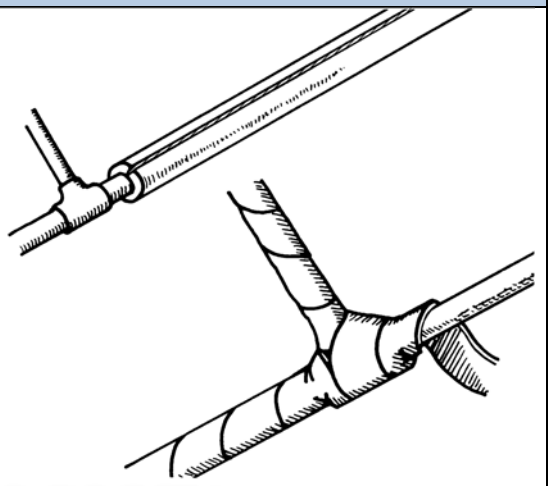
WATER HEATER PIPE INSULATION
(WIS Section 18)

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td>GLUE</td><td>- GLUE
Maximum flame-spread index of 25 and maximum smoke-developed index of 450, per ASTM E84, or UL 723, or UBC Standard 8-1.
Compatible with insulation material and manufacturer’s instructions. 
Graphic Credit: RHA, Inc.</td></tr>
<tr><td>PIPE INSULATION MATERIAL</td><td>- PIPE INSULATION
Maximum flame-spread index of 25 and maximum smoke-developed index of 450, per ASTM E84, or UL 723, or UBC Standard 8-1.
Preformed foam (e.g. closed cell polyethylene) conforming to ASTM C534.
Inside diameter of preformed material shall be appropriate for the size pipe being insulated.
Rated for temperatures up to 180°F.
R- Value in conformance with the following table:
PIPE INSULATION MINIMUM R-VALUE<table><tr><th>Condition</th><th>Required R-value</th></tr><tr><td>No new tank or water pipes installed</td><td>R-4</td></tr><tr><td>New tank or water pipes installed during weatherization work (pipe ≤1" and temperature ≤140°F)</td><td>Minimum 1" insulation thickness</td></tr></table>- PIPE INSULATION TYPES NOT ALLOWED
Sheet or semi-molded insulation.
Heat tape or strap insulation.</td></tr>
<tr><td>TAPE</td><td>- TAPE
Maximum flame-spread index of 25 and maximum smoke-developed index of 450, per ASTM E84, or UL 723, or UBC Standard 8-1.
Tape specified by insulation manufacturer, or
Minimum 2" wide pressure-sensitive metallic tape labeled UL 181A-P or UL 181B-FX.
Cloth duct tape and electrical tape are not allowed.</td></tr>
<tr><td>TIES</td><td>- TIES
Maximum flame-spread index of 25 and maximum smoke-developed index of 450, per ASTM E84, or UL 723, or UBC Standard 8-1.
Plastic cable ties.
Corrosion-resistant wire and metal sleeves</td></tr>
</table>

WATER HEATER—STORAGE ELECTRIC
(WIS Section 43)

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td>ELECTRIC WATER HEATERS</td><td>
- ALL STORAGE WATER HEATERS

Comply with ASHRAE 90.1b and UL 174.
Minimum Energy Factor (EF) shall be in compliance with Title 24 energy efficiency requirements, per the table below.

MINIMUM EF FOR STORAGE ELECTRIC WATER HEATERS*
<table>
<tr><th>Tank Volume (Gallons)</th><th>Minimum Energy Factor (EF)</th></tr>
<tr><td>30</td><td>0.96</td></tr>
<tr><td>40</td><td>0.96</td></tr>
<tr><td>50</td><td>0.96</td></tr>
<tr><td colspan="2">*Based on Table F-3 in the CEC Appliance Efficiency Regulations.

Note: Tanks with lower energy factors would have to be externally wrapped with a minimum R-12 insulation.</td></tr>
</table>

Photo Credit: Public Domain

Installed appliances shall conform to CEC standards for efficiency, as verified by inclusion in the CEC's database of certified appliances.
Minimum of R-16 internal insulation.
Listed and labeled in conformance with local code.

</td></tr>
<tr><td>MOBILE HOME WATER HEATER INSTALLATION</td><td>
- ALL MOBILE HOME STORAGE WATER HEATERS


Shall be in compliance with requirements of the California Department of Housing and Community Development (HCD).
Water heater is not required to be listed/labeled for installation in a mobile home, unless required by HCD.

</td></tr>
<tr><td>SEISMIC (EARTHQUAKE) STRAPS</td><td>
- ALL STRAP KITS SHALL:

Be a an approved bracing system (strap kit) certified by the California Division of the State Architect's (will have the stamp of approval on the box) and comply with California Health and Safety Code Section 19211.

Meet or exceed bracing requirements for the tank's size.

</td></tr>
<tr><td>TEMPERATURE & PRESSURE (T&P) VALVE</td><td>
- T&P VALVE

Shall be listed and manufactured to ANSI Z21.22.
Meets sizing/pressure requirements of the Water Heater listing.

</td></tr>
<tr><td>WATER PIPING</td><td>
- ALL STORAGE WATER HEATERS

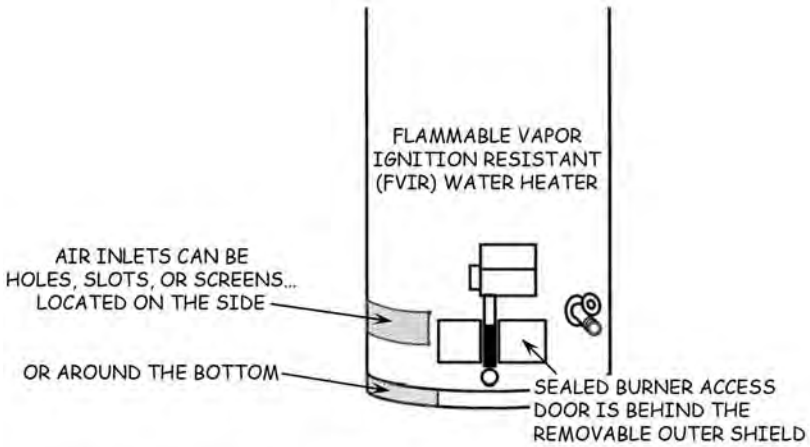
Installed water lines and valves shall be lead-free.

</td></tr>
</table>

WATER HEATER—STORAGE GAS
(WIS Section 42)

Materials	*Requirements*
GAS PIPING AND VALVES	- GAS PIPES • All valves and flexible connectors shall be new. • Gas valves shall be listed (UL or equivalent) and AGA- or CSA-certified. • Flexible connectors shall be listed (e.g., by IAPMO) epoxy-coated or stainless steel units. • Fuel-gas gas piping shall comply with latest adopted CMC. • Copper gas lines and butt-soldered joints not allowed.
GAS WATER HEATERS	- ALL NATURAL GAS OR LP GAS-FUELED STORAGE TYPE STORAGE WATER HEATERS • Under the LIHEAP Program, replacement water heater shall be: . – ENERGY STAR–certified. – Low NOx burner system, when required by local code. – Installed in conformance to to CEC standards for efficiency, as verified by inclusion in the CEC's database of certified appliances. – Listed and labeled in conformance with local code. – Manufactured to ANSI Z21.10.1. – Minimum of R-12 internal insulation. – Equipment will be functional at high efficiency under all load conditions. – Minimum Energy Factor (EF) shall be in compliance with Title 24 energy efficiency requirements, per the table below. MINIMUM EF FOR STORAGE GAS WATER HEATERS* **Tank Volume (Gallons)** / **Minimum Energy Factor (EF)** 30 / 0.64 40 / 0.63 50 / 0.61 *Based on Table F-3 in the CEC Appliance Efficiency Regulations. Note: Tanks with lower energy factors would have to be externally wrapped with a minimum R-12 insulation. – When unit to be replaced is an open combustion unit, it shall also have a Flammable Vapor Ignition Resistant (FVIR) combustion chamber (as shown in the picture on the following page).

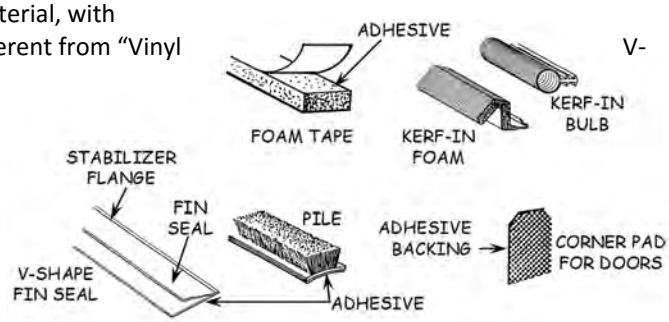
Photo Credit: RHA, Inc.

Materials	Requirements
	 *Graphic Credit: RHA, Inc.* - ALL STORAGE WATER HEATERS FOR DOE PROGRAM • Under the DOE Program, replacement water heater shall: – Require a cost benefit analysis to determine type (i.e., natural draft, direct vent, etc.) – When cost benefit allows, the unit shall be direct vent or power vent-type. – Meet all of the requirements above, *except* the condition to have a FVIR combustion chamber.
MOBILE HOME WATER HEATER INSTALLATION	- ALL MOBILE HOME STORAGE WATER HEATERS  • Shall be in compliance with requirements of the California Department of Housing and Community Development (HCD). • Water heater is not required to be listed/labeled for installation in a mobile home, unless required by HCD (e.g., when the appliance is located inside the living space).
SEISMIC (EARTHQUAKE) STRAPS	- ALL STRAP KITS SHALL: • Be a an approved bracing system (strap kit) certified by the California Division of the State Architect's (will have the stamp of approval on the box) and comply with California Health and Safety Code Section 19211. • Meet or exceed bracing requirements for the tank's size.
TEMPERATURE & PRESSURE (T&P) VALVE	- ALL T&P VALVES • Listed and manufactured to ANSI Z21.22. • Meets sizing/pressure requirements of the water heater listing.
VENT SYSTEMS	- VENTS • Shall be UL-listed vent connectors, components, and Type B vent pipes. • Non-metallic systems shall conform to ASTM D 1785 and D 2665.
WATER PIPING	- WATER PIPES • Installed water lines and valves shall be lead-free.

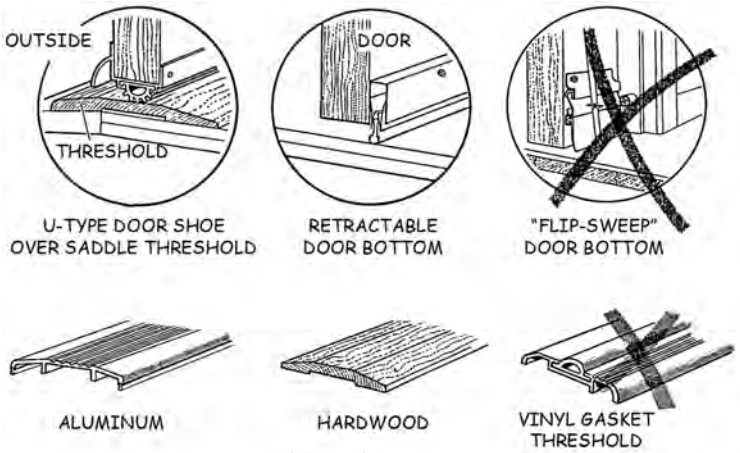
WEATHERSTRIPPING
(WIS Section 9)

Materials	*Requirements*
WEATHER-STRIPPING MATERIALS	- RIGID GASKET JAMB MATERIALS (ALUMINUM CARRIER) • Solid extruded aluminum carrier 0.05" minimum nominal thickness. • Pliable gasket of vinyl, thermoplastic elastomer (TPE), silicone, or equivalent. • Carrier shall have elongated mounting holes, 9" OC maximum. • Secondary seal between carrier and mounting surface shall be a minimum of 1/8" wide and extend the full length of the carrier. - SPRING AND CUSHION METAL • Brass, bronze, or stainless steel only; aluminum not allowed. - CUSHION SYNTHETIC PRESSURE SENSITIVE DOOR GASKETING • Polypropylene, TPE, silicone, or equivalent. • L-shaped stabilizer with self-adhesive backing. - FLANGED BULB (COMPRESSION BULB) • Pliable gasket of TPE or silicone (e.g., teardrop-shaped Seal). • Minimum 3/8" wide with self-adhesive stabilizer flange. - ROUND TUBE • Pliable gasket of TPE, silicone, or equivalent. - FOAM TAPE • Color shall be compatible with surrounding materials (i.e., light color foam for light color surfaces). • Closed Cell Foam Tape – Shall be UV-resistant with self-adhesive backing. • Open Cell Foam Tape – Shall have self-adhesive backing. - V-SHAPE FIN SEAL • Durable V-seal of silicone or equivalent material, with stabilizer flange and adhesive backing (different from "Vinyl Strip"). - REPLACEMENT KERF-IN BULB AND FOAM • Properly sized for retaining channel. - REPLACEMENT PILE • Fin seal type, whenever feasible. • Properly sized for retaining channel. - CORNER PADS • Pile pad with self-adhesive backing. - MECHANICAL ATTACHMENTS • All screws, nails, staples, and other fasteners shall be: – Metal and non-corrosive. – Properly sized for each application. - PRESSURE-SENSITIVE ADHESIVE • Minimum adhesion strength of 65 oz./in. on all self-adhesive products. • Required on all self-adhesive products.

Photo Credit: CAP of San Luis Obispo



Graphic Credit: RHA, Inc.

Materials	*Requirements*
SHOES, DOOR BOTTOMS, AND SWEEPS	- DOOR SHOE, AUTOMATIC DOOR BOTTOM, STATIONARY SWEEP, METAL SADDLE THRESHOLD, AND BUMPER THRESHOLD • Solid aluminum extrusions. • Gaskets shall be pliable vinyl, TPE, silicone, or equivalent. • Solid aluminum carrier 0.05" nominal thickness minimum, with elongated mounting holes 9" OC maximum. – *Exception* for shoes: plastic carrier allowed per CSD Field Guide measure-specific policy.  *Graphic Credit: RHA, Inc.* • Shoes: – Shall have rain drip in exposed outdoor locations. – Tall (e.g. 3" high) U-shoe may be used when door bottom is cut too short or is too worn/weak to accept a standard (1-1/2" high) U-shoe. • Stationary sweeps shall have pliable gasket of vinyl or silicone. - AUTOMATIC DOOR BOTTOM • Retractable type only; flip sweep not allowed. - METAL SADDLE THRESHOLD • Solid aluminum only; “gasket saddle” with vinyl top gasket not allowed. • Shall have floor-sealer gasket of vinyl, TPE, silicone, or equivalent. - WOODEN SADDLE THRESHOLD • Hardwood only; “gasket saddle” with vinyl top gasket not allowed.

WINDOWS AND SLIDING GLASS DOORS
(WIS Section 13)

<table>
<tr><th>Materials</th><th>Requirements</th></tr>
<tr><td>WINDOW AND SLIDING GLASS DOOR MATERIALS</td><td>
- ALL REPLACEMENT WINDOWS SHALL BE:

ENERGY STAR-compliant.
Compliant with local code and bear an NFRC temporary label.
Compliant with Warranty Requirements in CSD WIS Appendix B.
In compliance with Title 24 energy efficiency standards (CEC-400-2013-CMF, Section 8.3, “Building Envelope” as listed below:

<table>
<tr><th>EFFICIENCY FACTOR</th><th>CEC CLIMATE ZONE</th><th>MAXIMUM VALUE</th></tr>
<tr><td>Maximum U-Factor</td><td>All Climate Zones</td><td>0.32</td></tr>
<tr><td rowspan="2">Maximum Solar Heat Gain Coefficient (SHGC)</td><td>1, 3, 5</td><td>No Requirement</td></tr>
<tr><td>2, 4, 6-16</td><td>0.25</td></tr>
</table>

Photo Credits: Public Domain
- REPLACEMENT WINDOW TYPE

Replacement windows shall be selected by type in accordance with Table below.

<table>
<tr><th>EXISTING WINDOW TYPE</th><th>REPLACEMENT WINDOW TYPE</th></tr>
<tr><td>Horizontal Slider</td><td>Horizontal Slider</td></tr>
<tr><td>Vertical Slider</td><td>Vertical or Horizontal Slider</td></tr>
<tr><td>Picture Window</td><td>Picture or Sliding Window</td></tr>
<tr><td>Jalousie Window</td><td>Vertical or Horizontal Slider</td></tr>
</table>
- WINDOW EGRESS REQUIREMENTS

Egress requirements apply to all rooms used for sleeping.
When a sleeping room has no operable exterior door, at least one window shall meet the egress requirements of:

– Local code, or
– Latest adopted CRC §R310.1.

</td></tr>
<tr><td>INSECT SCREENS</td><td>
- OPENABLE WINDOWS

All openable windows shall be equipped with insect screens.

</td></tr>
<tr><td>SEALANTS</td><td>
- CAULKING MATERIALS

Shall comply with the “Caulking” section of this Appendix.
Caulking shall be non-toxic and paintable.
Caulking shall be clear when dry, or color coordinated with surrounding color.

- FOAM

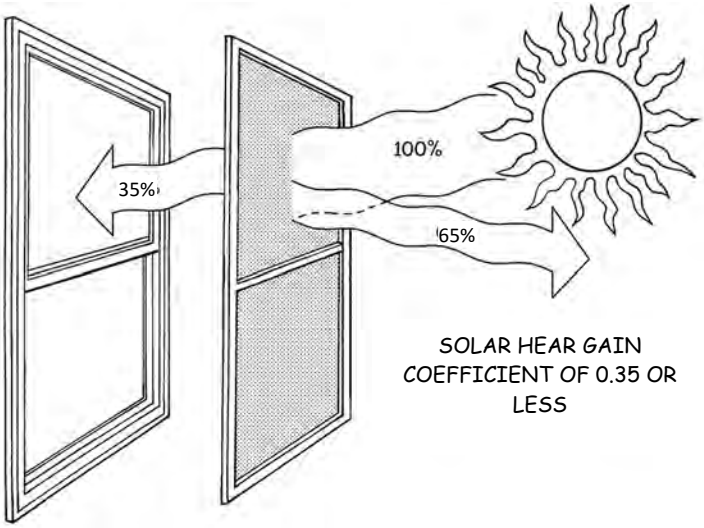
Injected foam appropriate for sealing gaps and cracks.
Shall only be minimally expanding type.
Injected foam is allowed only if intended for that purpose and installed strictly in conformance with manufacturer instructions. Overfilling the cavity in a manner that warps the SGD or window frame shall not be allowed.

</td></tr>
</table>

WINDOW FILM
(WIS Section 47)

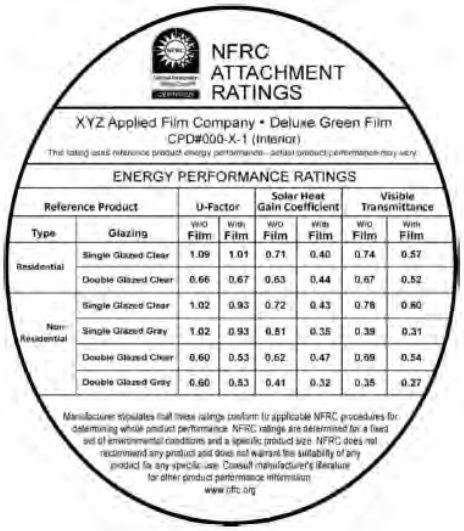
Materials	*Requirements*
APPROVED MATERIALS	- ALL TYPES • Shall be selected to reduce heat and light energy transmission through windows. – Solar Heat Gain Coefficient of 0.35. – A U-factor of 0.40. – Shall be UV-treated. – Shall be self-adhering. • Separate adhesives not allowed. - POLYESTER • Minimum thickness: 0.0010 inches (1 mil).

Photo Credit: MasterWindowFilms.com



SOLAR HEAR GAIN COEFFICIENT OF 0.35 OR LESS

Graphic Credit: RHA, Inc.



NFRC ATTACHMENT RATINGS

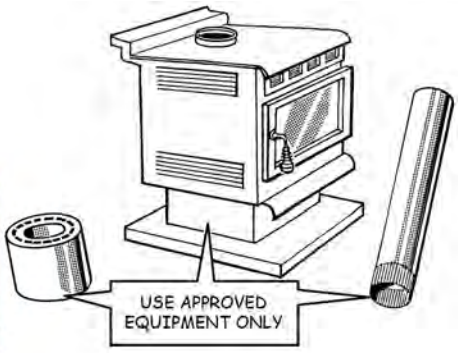
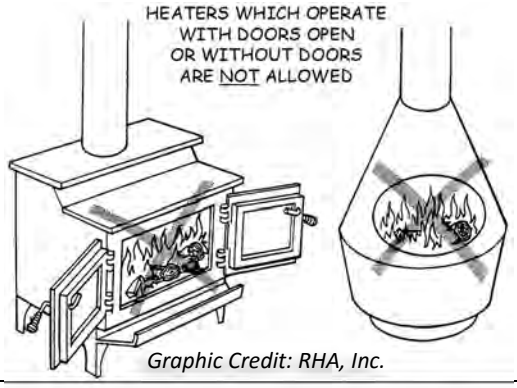
XYZ Applied Film Company • Deluxe Green Film
CPD#000-X-1 (Interior)

ENERGY PERFORMANCE RATINGS

Reference Product		U-Factor		Solar Heat Gain Coefficient		Visible Transmittance	
Type	Glazing	W/O Film	With Film	W/O Film	With Film	W/O Film	With Film
Residential	Single Glazed Clear	1.09	1.01	0.71	0.40	0.74	0.57
	Double Glazed Clear	0.66	0.67	0.63	0.44	0.67	0.52
Non-Residential	Single Glazed Clear	1.02	0.93	0.72	0.43	0.76	0.60
	Single Glazed Gray	1.02	0.93	0.51	0.35	0.39	0.31
	Double Glazed Clear	0.60	0.53	0.62	0.47	0.69	0.54
	Double Glazed Gray	0.60	0.53	0.41	0.32	0.35	0.27

Manufacturer stipulates that these ratings conform to applicable NFRC procedures for determining whole product performance. NFRC ratings are determined for a fixed set of environmental conditions and a specific product size. NFRC does not recommend any product and does not warrant the suitability of any product for any specific use. Consult manufacturer's literature for other product performance information.
www.nfrc.org

WOODBURNING SPACE HEATERS
(WIS Section 26)

Materials	*Requirements*
CHIMNEY AND COMPONENTS	- LISTED COMPONENTS • Only factory built UL-listed heaters, chimneys, connectors, and other associated hardware/components specified by the heater manufacturer shall be installed, including: – Ceiling support package when vent connector is used. – Insulation shield when penetrating an attic. – Chimney cap and spark arrestor. – Electrical components shall be UL-labeled.  *Photo Credit: commons.wikimedia.org*  *Graphic Credit: RHA, Inc.*
CONNECTOR TYPES	- CONNECTORS AND RELATED COMPONENTS SHALL BE: • Those specified by the heater manufacturer. • Factory-built. • Laboratory-listed.
EMISSION STANDARDS	- ALL HEATERS SHALL: • Meet EPA emission standards. • Comply with federal, state, and local codes.
HEATER TYPES	- REQUIRED TYPES • Freestanding Heaters – Designed to operate only with fire chamber door closed. – Woodburning units. – Radiant or convective type. - NOT ALLOWED • Units designed to operate with fire chamber door open. • Units without doors.  *Graphic Credit: RHA, Inc.*
LABELS	- TEMPORARY LABEL • When purchased by agency or contractor, unit shall bear temporary label(s) certifying conformance to EPA emission standards. - PERMANENT LABEL • All heaters shall bear permanently affixed label stating “For use with solid fuel only.” • Heater shall have permanent factory label(s) in conformance with EPA regulations stating: – Required clearance to combustibles, including walls, ceiling and floor. – Proper fuel. – Connector and chimney size and type. – Operation and safety information. – Floor protection requirements. – Wall/ceiling protection requirements.

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APPENDIX -B-

MINIMUM WARRANTY REQUIREMENTS

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APPENDIX -B-

MINIMUM WARRANTY REQUIREMENTS

1.0 INTRODUCTION

1.1 This appendix lists warranty requirements, in accordance with state-wide policy, for each measure installed in the CSD weatherization program. These are *minimum* requirements.

1.2 Warranty Categories/Types

1. Warranty requirements are divided into two categories:
   a. Contractor (or Agency), and
   b. Manufacturer.
2. Manufacturer warranties shall cover the primary measure material or replaced appliance.
3. Contractor warranties are subdivided into Ancillary Materials and Labor warranties.

1.3 Repair vs. Replacement

1. Within each Health and Safety measure, there is a specified warranty period for repaired appliances, and a different warranty period for those measures that are replaced. This is indicated in parentheses. Some other measures have the same warranty period for repair and replacement activities.

1.4 Component Type

1. Within some Manufacturer Warranty field, the type of component for which the warranty period applies is indicated in parentheses. For example, for window replacement:
   a. "IGU" means the warranty period applies only to the insulated glazing unit.
   b. "Other" refers to the warranty period that applies to all other components of a window.

1.5 Complaint Process/Contractors State License Board Regulations

1. Consumers have four (4) years to file a complaint with the Contractors State License Board (CSLB) about a faulty project. That deadline is extended if additional warranties are written into the CSD weatherization program warranty requirements.

1.6 General Conditions

1. At a minimum, the following concerns and warnings will be addressed within the warranty:
   a. Possible drying and shrinking effects
   b. Storage of hazardous and flammable materials
   c. Mold/moisture creation

2.0 MINIMUM WARRANTY REQUIREMENTS PER MEASURE

CSD Weatherization MINIMUM Warranty Requirements			
	Contractor Warranty		
Measure	Ancillary Materials	Labor	Manufacturer Warranty (Primary Material/Appliance)
Health & Safety			
Carbon Monoxide Alarm	1 yr.	1 yr.	5 yrs.
Central Air Conditioner—Repair	1 yr.	1 yr.	1 yr.
Central Air Conditioner—Replacement	1 yr.	1 yr.	5 yrs. (compressor)/1 yr. (other)
Cooking Appliance Repair	1 yr.	1 yr.	90 days
Cooking Appliance Replacement	1 yr.	1 yr.	1 yr.
Evaporative Cooler—Repair	1 yr.	1 yr.	90 days
Evaporative Cooler—Replacement	1 yr.	1 yr.	5 yrs. (pan)/1 yr. (other)

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CSD Weatherization MINIMUM Warranty Requirements			
Measure	Contractor Warranty		Manufacturer Warranty (Primary Material/Appliance)
	Ancillary Materials	Labor	
Health & Safety (cont.)			
FAU—Repair	1 yr.	1 yr.	90 days
FAU—Replacement	1 yr.	1 yr.	5 (compressor)/1 yr. (other)
Floor Furnace—Repair	1 yr.	1 yr.	90 days
Floor Furnace—Replacement	1 yr.	1 yr.	1 yr.
Heat Pump—Repair	1 yr.	1 yr.	90 days
Heat Pump—Replacement	1 yr.	1 yr.	5 yrs. (compressor)/1 yr. (other)
Smoke Alarms	1 yr.	1 yr.	10 yrs.
Wall Furnace—Repair	1 yr.	1 yr.	90 days
Wall Furnace—Replacement	1 yr.	1 yr.	1 yr.
Water Heater—Repair	1 yr.	1 yr.	90 days
Water Heater—Replacement	1 yr.	1 yr.	5 yrs. (tank)/1 yr. (other)
Window/Wall Air Conditioner—Repair	1 yr.	1 yr.	90 days
Window/Wall Air Conditioner—Replacement	1 yr.	1 yr.	5 yrs. (compressor)/1 yr. (other)
Woodstove/Insert	1 yr.	1 yr.	3 yrs. (unit)/1 yr. (other)
Insulation			
Attic/Crawlspace Ventilation	1 yr.	1 yr.	1 yr.
Ceiling Insulation	1 yr.	1 yr.	1 yr.
Duct Insulation	1 yr.	1 yr.	1 yr.
Floor Insulation	1 yr.	1 yr.	1 yr.
Kneewall Insulation	1 yr.	1 yr.	1 yr.
Wall Insulation	1 yr.	1 yr.	1 yr.
Vapor Retarder and Fasteners (when associated with installation of insulation)	1 yr.	1 yr.	10 yrs.
Infiltration Reduction			
Caulking	1 yr.	1 yr.	10 yrs.
Cover Plate Gaskets	1 yr.	1 yr.	1 yr.
Door Repair/Replacement	1 yr.	1 yr.	1 yr.
Duct & Register Repair/Replacement	1 yr.	1 yr.	1 yr.
Glass Replacement	1 yr.	1 yr.	1 yr.
Kitchen Exhaust	1 yr.	1 yr.	1 yr.
Minor Envelope Repair	1 yr.	1 yr.	1 yr.
Sliding Glass Door Repair/Replacement	1 yr.	1 yr.	10 yrs. (IGU)/3 yrs. (other)
Vent Cover, Interior	1 yr.	1 yr.	1 yr.
Weatherstripping, Hinged Door	1 yr.	1 yr.	3 yrs.
Weatherstripping, Other	1 yr.	1 yr.	3 yrs.
Window Repair/Replacement	1 yr.	1 yr.	10 yrs. (IGU)/3 yrs. (other)

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CSD Weatherization MINIMUM Warranty Requirements			
Measure	Contractor Warranty		Manufacturer Warranty (Primary Material/Appliance)
	Ancillary Materials	Labor	
General Heat Waste			
Air Filter Replacement (Air Conditioner/Furnace)	90 days	90 days	90 days
General Heat Waste (cont.)			
Hot Water Flow Restrictors (Faucet Aerators)	1 yr.	1 yr.	3 yrs.
Low Flow Showerheads	1 yr.	1 yr.	3 yrs.
Thermostatic Shower Valves and Showerheads	1 yr.	1 yr.	1 yr.
Water Heater Insulation	1 yr.	1 yr.	1 yr.
Water Heater Pipe Insulation	1 yr.	1 yr.	1 yr.
Electric Baseload			
CFLs	1 yr.	1 yr.	1 yr.
Exterior Hard Wired CFL Fixtures	1 yr.	1 yr.	1 yr.
Fluorescent Torchiere	1 yr.	1 yr.	1 yr.
Interior Hard Wired CFL Fixtures	1 yr.	1 yr.	1 yr.
LED Bulb	1 yr.	1 yr.	3 yrs.
LED Nightlight	1 yr.	1 yr.	1 yr.
Microwave Oven	1 yr.	1 yr.	1 yr.
Refrigerator Replacement	1 yr.	1 yr.	1 yr.
Tier 2 Audio-Visual Advanced Power Strips	90 days	1 yr.	3 yrs.
Vacancy Sensor	1 yr.	1 yr.	1 yr.
Other Measures			
High-Efficiency Toilets	1 yr.	1 yr.	3 yrs.
Mechanical Ventilation	1 yr.	1 yr.	1 yr.
Thermostat (Programmable; Manual)	1 yr.	1 yr.	1 yr.
Optional Measures (LIHEAP)/Energy Audit-Driven (DOE)			
Ceiling Fans	1 yr.	1 yr.	3 yrs.
Cooling Replacement for Energy Efficiency Upgrade	1 yr.	1 yr.	1 yr.
Electric Water Heater Timer	1 yr.	1 yr.	1 yr.
Exterior Water Pipe Wrap	1 yr.	1 yr.	1 yr.
Floor Foundation Venting	1 yr.	1 yr.	1 yr.
Heating Replacement for Energy Efficiency Upgrade	1 yr.	1 yr.	1 yr.
Shade Screens	1 yr.	1 yr.	1 yr.
Storm Windows/Doors	1 yr.	1 yr.	1 yr.
Window Film	1 yr.	1 yr.	10 yrs.
Window Replacement for Energy Efficiency Upgrade	1 yr.	1 yr.	1 yr.

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NOTES

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APPENDIX -C-

CALIFORNIA ENERGY COMMISSION CLIMATE ZONES

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APPENDIX -C-
CALIFORNIA ENERGY COMMISSION
CLIMATE ZONES

1.0 INTRODUCTION

This appendix provides an extensive table that lists California Energy Commision (CEC) climate zones (CZ) by county and location (see Section 2.0). The table is organized alphabetically, first by county, and then by city/town/area. Section 1.2 features a CZ map to provide a bird's eye view of the state's climate zones.

1.1 USING THIS APPENDIX

This appendix may be used to determine the CEC climate zone for each job location, based on where the home is located. It is necessary to know the CZ for certain measures, such as ceiling insulation, duct testing, and duct repair and sealing. To determine the CZ for a job location, do the following:

1. Using the table in Section 2.0, find the appropriate county, and then the nearest city, town, or area (e.g., weather station). The CZ is in the "Zone" column.
2. For rural locations, places not listed in the table, and areas on the edge of a CZ, find additional resources at the following CEC website: http://www.energy.ca.gov/maps/building_climate_zones.html There are climate zone maps and a table that lists CZs by zip code, which may be helpful for locations not listed in Section 2.0.

1.2 CLIMATE ZONE (CZ) MAP

The CEC CZ map provides a broad overview of where the 16 climate zones are located. There are two places in the Title 24 Standards manuals where climate zone information and maps are available. They are:

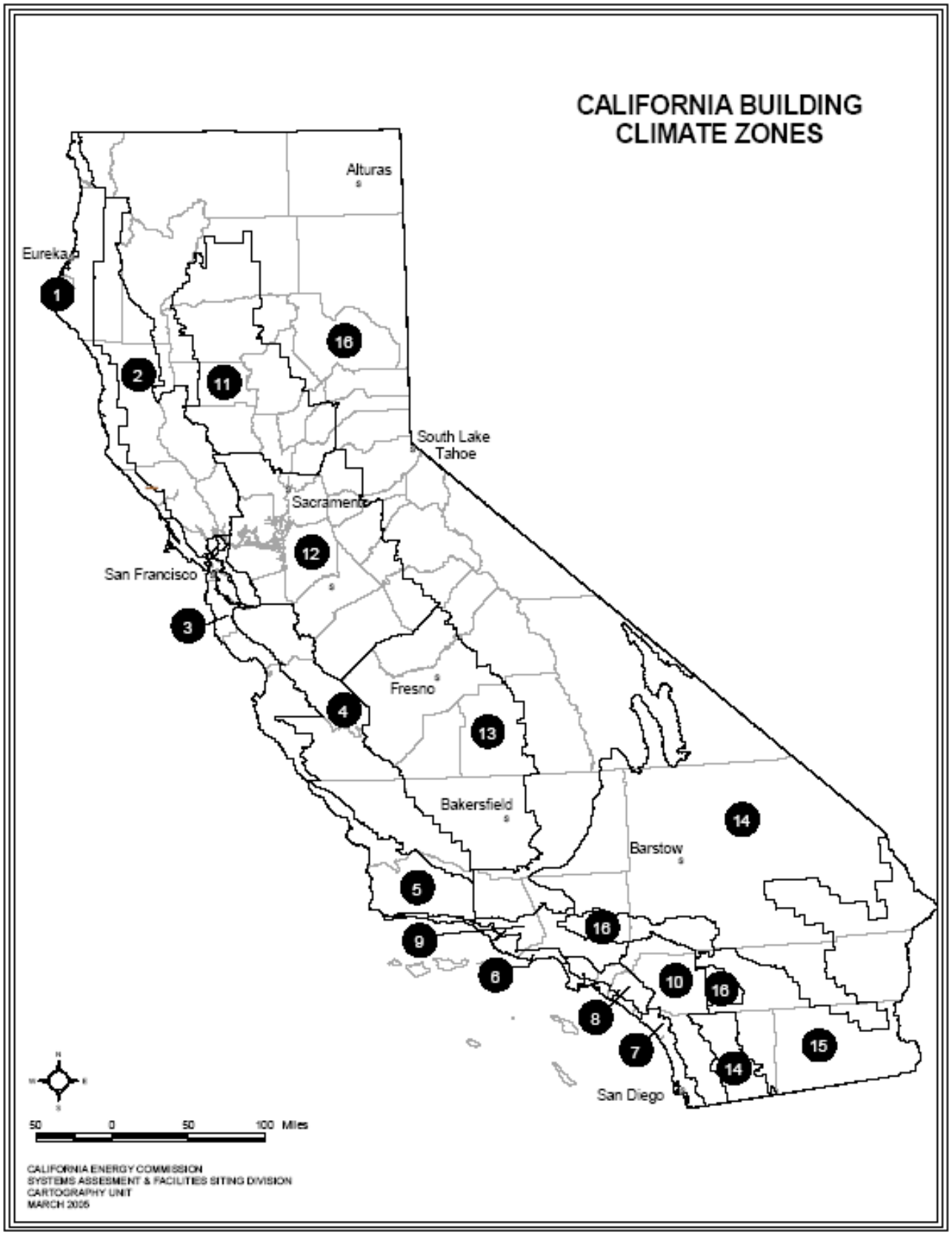
1. Page 47 of the CEC "2008 Building Energy Efficiency Standards for Residential and Non-residentisal Buildings, Regulations/Standards" (CEC-400-2008-001-CMF). That map is reproduced on the following page.
2. CEC Title 24 *Joint Appendix JA2-2008,* in the "Reference Appendices for the 2008 Building Energy Efficiency Standards for Residential and Non-residentisal Buildings" (CEC-400-2008-004-CMF). That CEC appendix features the complete list of "Counties and Cities with Climate Zone Designations".

Both of those CEC manuals are available at: http://www.energy.ca.gov/title24/2008standards/

The California Energy Commission analyzed weather data from many weather stations, and with that information, they created representative temperature data for each climate zone. Although there are several cities and towns in each CZ (see Section 2.0 of this appendix), the representative city for each one is shown below:

CZ 1: Arcata
CZ 2: Santa Rosa
CZ 3: Oakland
CZ 4: Sunnyvale
CZ 5: Santa Maria
CZ 6: Los Angeles
CZ 7: San Diego
CZ 8: El Toro
CZ 9: Pasadena
CZ10: Riverside
CZ11: Red Bluff
CZ12: Sacramento
CZ13: Fresno
CZ14: China Lake
CZ15: El Centro
CZ16: Mount Shasta

CEC Climate Zone Map—
from Building Energy Efficiency Standards
for Residential and Non-residential Building Standards



2.0 CEC CLIMATE ZONES BY COUNTY AND CITY/TOWN/AREA

The following table lists California Energy Commission (CEC) climate zones (CZ) by county and by city, town, or area (e.g., weather station). To find the CZ for a job address, do the following:

1. Go to the appropriate county, and then find the city, town, or area nearest the job address. The climate zone is in the "CZ" column.
2. If uncertain about the location, it is possible to also check by zip code at the CEC website listed in Section 1.1.2 above.
3. If still in doubt, consult the local Building Department, and use the CZ designation they recommend.

County & City/Town Area	CZ
Alameda County	
Altamont	12
Calaveras Reservoir	12/4
Dublin	12
Lake Del Valley	12
Livermore	12
Midway	12
Corral Hollow	12
Pleasanton	12
San Antonio Reservoir	12
Sunol	12
All other locations	3
Alpine County	
All locations	16
Amador County	
Bear River	16
Cooks Station	16
Pioneer	16
Plasse	16
Salt Springs Reservoir	16
Silver Lake	16
All other locations	12
Butte County	
Big Bend	16
Brush Creek	16
Butte Meadows	16
Clipper Mills	16
Feather Falls	16
Feather River (Middle Fork)	16
Feather River (North Fork)	16
Forbestown	16
Inskip	16
Jonesville	16
Lomo	16
Pulga	16
Stirling City	16
All other locations	11
Calaveras County	
Arnold	16
Dorrington	16
Ganns	16
Hathaway Pines	16
Salt Springs Reservoir	16
Stanislaus	16
All other locations	12
Colusa County	
All locations	11
Contra Costa County	
El Cerrito	3
El Sobrante	3
Hercules	3
Pinole	3
Richmond	3
Rodeo	3
San Pablo	3
Tassajara	2
Vine Hill	3
All other locations	12
Del Norte County	
Crescent City	1
Elk Valley	16
Fort Dick	1
Gasquet	16
Gordon Mountain	16
Hiouchi	1
Horse Flat	16
Idlewild	1
Klamath	1
Klamath Glen	1
Lake Earl	1
Patrick Creek	16
Point Saint George	1
Red Mountain	16
Requa	1
Siskiyou Mountains	16
Smith River	1
Smith River (Middle Fork)	16
Smith River (North Fork)	16
Smith River (South Fork)	16
El Dorado County	
Aukum	12
Cameron Park	12
Camino	12
Clarksville	12
Coloma	12
Cool	12
Diamond Springs	12
El Dorado	12
El Dorado Hills	12
Garden Valley	12
Georgetown	12
Greenwood	12
Kelsey	12
Latrobe	12

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County & City/Town Area	CZ
El Dorado County (cont.)	
Lotus	12
Outingdale	12
Pilot Hill	12
Placerville	12
Rescue	12
Shingle Springs	12
Smithflat	12
Somerset	12
All other locations	16
Fresno County	
Big Creek	16
Cedar Grove	16
Courtright Reservoir	16
Dinkey Creek	16
Florence Lake	16
Hume	16
Huntington Lake	16
Kalser Peak	16
Kings River (Middle Fork)	16
Kings River (North Fork)	16
Kings River (South Fork)	16
Lakeshore	16
Mammoth Pool Reservoir	16
Meadow Lakes	16
Mono Hot Springs	16
Mount Darwin	16
Mount Pinchot	16
Pine Ridge	16
Pinehurst	16
Roaring River	16
Shaver Lake	16
Spanish Mountain	16
Thomas A. Edison Lake	16
Trimmer	16
Vermilion Valley Dam	16
Wishin Reservoir	16
All other locations	13
Glenn County	
Black Butte	16
All other locations	11

County & City/Town Area	CZ
Humboldt County	
Alderpoint	2
Bear Buttes	2
Benbow	2
Blocksburg	2
Briceland	2
Bridgeville	2
Dinsmores	2
Eel Rock	2
Fort Seward	2
Garberville	2
Harris	2
Hoopa	2
Mail Ridge	2
McCann	2
Miranda	2
Mount Lassic	2
Myers Flat	2
Orleans	2
Phillipsville	2
Redway	2
Richardson Grove	2
Salmon Mountain	16
Sequoia	2
Weitchpec	2
All other locations	1
Imperial County	
Midwell Well	14
All other locations	15
Inyo County	
Airport Lake	14
Amargosa Range	14
Amargosa River	14
Ballarat	14
Bennetts Well	14
Death Valley	14
Death Valley Junction	14
Death Valley Wash	14
Echo Canyon	14
Franklin Well	14
Funeral Park	14
Furnace Creek Wash	14

County & City/Town Area	CZ
Greenwater Range	14
Midway Well	14
Miller Spring	14
Nopah Range	14
Owlshead Mountains	14
Pahrump Valley	14
Panamint Springs	14
Panamint Valley	14
Rhodes Wash	14
Ryan	14
Sheep Canyon	14
Shoshone	14
Slate Range	14
Stovepipe Wells	14
Tecopa	14
Valley Wells	14
Wingate Wash	14
Cottonwood Canyon	14/16
All other locations	16
Kern County	
Actis	14
Alta Sierra	16
Bissell	14
Bodfish	16
Boron	14
Breckenridge Mountain	16
Brown	14
Buckhorn Lake	14
Caliente	16
California City	14
Cantil	14
China Lake	14
Claraville	16
Cuddy Canyon	16
Edwards Air Force Base	14
El Paso Mountains	14
Frazier Park	16
Freeman Junction	14
Fremont Valley	14
Garlock	14
Glennville	16
Gold Canyon	16

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County & City/Town Area	CZ
Kern County (cont.)	
Golden Hills	16
Greenhorn Mountains	16
Havilah	16
Hillcrest Center	16
Indian Wells Valley	14
Inyokern	14
Isabella Reservoir	16
Johannesburg	14
Keene	16
Kern River (South Fork)	16
Kernville	16
Koehn Lake	14
Lake Isabella	16
Last Chance Canyon	14
Lebec	16
Little Dixie Wash	14
Lone Tree Canyon	16
Loraine	16
Miracle Hot Springs	16
Mojave	14
Monolith	16
Neuralia	14
North Edwards	14
Onyx	16
Randsburg	14
Ridgecrest	14
Rogers Lake	14
Rosamond	14
Rosamond Lake	14
Saltdale	14
Searles	14
Tehachapi	16
Tehachapi Mountains	16
Tehachapi Pass	16
Walker Pass	16
Weldon	16
Willow Springs	14
Wofford Heights	16
All other locations	13
Kings County	
All locations	13

County & City/Town Area	CZ
Lake County	
All locations	2
Lassen County	
All locations	16
Los Angeles County	
Acton	14
Aliso Canyon	16
Alondra Park	6
Antelope Center	14
Antelope Valley	14
Artesia	8
Avalon	6
Avocado Heights	16
Bell	8
Bell Gardens	8
Bellflower	8
Big Pines	16
Big Rock Wash	14
Big Tujungs Canyon	16
Carson	6
Caswell	16
Cerritos	8
Commerce	8
Compton	8
Cornell	6
Cudahy	8
Culver City	8
Del Aire	6
Desert View Highland	14
Devils Canyon	16
Dominguez	8
Downey	8
East Compton	8
East Pasadena	16
El Segundo	6
Elizabeth Lake Canyon	16
Fairmont	14
Florence	8
Gardena	8
Gorman	16
Green Valley	16
Harbor City	8

County & City/Town Area	CZ
Hawaiian Gardens	8
Hawthorne	8
Hermosa Beach	6
Hi Vista	14
Hidden Springs	16
Huntington Park	8
Inglewood	8
Juniper Hills	14
Lake Los Angeles	14
Lakewood	8
Lancaster	14
Lawndale	8
Lennox	8
Leona Valley	14
Little Rock Wash 4	14
Littlerock	14
Llano	14
Lomita	6
Long Beach	6/8
Los Angeles	8/9
Lynwood	8
Malibu	6
Manhattan Beach	6
Maywood	8
Monte Nido	6
Mount San Antonio	16
Mount Wilson	16
Norwalk	8
Pacific Palisades	6
Pacoima	16
Pacoima Canyon	16
Palmdale AP	14
Palos Verdes Estates	6
Paramount	8
Pearblossom	14
Pearland	14
Point Dume	6
Point Fermin	6
Pyramid Lake	16
Quartz Hill	14
Rancho Palos Verdes	6
Redman	14
Redondo Beach	6

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County & City/Town Area	CZ
Los Angeles County (cont.)	
Rolling Hills	6
Rolling Hills Estates	6
Rosamond Lake	14
San Antonio Canyon	16
San Clemente Island	6
San Gabriel Mountains	16
San Gabriel River (West Fork)	16
San Pedro	6
San Pedro Bay	6
Sandberg	16
Santa Catalina Island	6
Santa Monica	6
Santa Monica Bay	6
Santa Monica Mountains	6
Saugus	6
Signal Hill	6
South Gate	8
Tarzana	6
Tejon Pass	16
Tejon Rancho	16
Three Points	14
Topanga	6
Topanga Beach	6
Topanga Canyon	6
Torrance	6
U.S.N. Facility, San Clement Is.	6
U.S.N. Shipyard, Long Beach	6
Valyermo	14
Venice	6
Vernon	8
Vincent	14
Walnut Park	8
West Athens	8
West Carson	6
West Compton	8
Westmont	8
Willow Brook	8
Willowbrook	8
Wilsona Gardens	14
Zuma Canyon	6
All other locations	9

County & City/Town Area	CZ
Madera County	
Bass Lake	16
Mammoth Pool Reservoir	16
Mount Lyell	16
North Fork	16
San Joaquin River (East Fork)	16
San Joaquin River (Middle Fork)	16
San Joaquin River (North Fork)	16
San Joaquin River (South Fork)	16
San Joaquin River (West Fork)	16
Sierra Nevada	16
Wishin	16
All other locations	13
Marin County	
Black Point	2
Burdell	2
Corte Madera	2
Fairfax	2
Forest Knolls	2
Hamilton A.F.B.	2
Kentfield	2
Larkspur	2
Nicasio	2
Novato	2
Petaluma River	2
Ross	2
San Anselmo	2
San Quentin	2
San Rafael	2
Santa Venetia	2
Woodacre	2
All other locations	3
Mariposa County	
Buck Meadows	16
El Portal	16
Fish Camp	16
Half Dome	16
Merced River (South Fork)	16
Midpines	16
Pilot Peak	16

County & City/Town Area	CZ
Usona	13
Wawona	16
Yosemite Valley	16
Yosemite Village	16
All other locations	12
Mendocino County	
Albion	1
Anchor Bay	1
Black Butte River	16
Branscomb	1
Bruhel Point	1
Caspar	1
Cleone	1
Comptche	1
Elk	1
Etsel Ridge	16
Fort Bragg	1
Gualala	1
Gualala River (South Fork)	1
Hales Grove	1
Inglenook	1
Leech Lake Mountain	16
Leggett	1
Little River	1
Manchester	1
Mendocino	1
Point Arena	1
Ranch	1
Rockport	1
Westport	1
All other locations	2
Merced County	
All locations	12
Modoc County	
All locations	16
Mono County	
All locations	16
Monterey County	
Alisal	3
Alisal Slough	3
Aromas	3

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County & City/Town Area	CZ
Monterey County (cont.)	
Bolsa Knolls	3
Carmel Highlands	3
Carmel Valley	3
Carmel-by-the-Sea	3
Castroville	3
Chualar	3
Del Rey Oaks	3
Elkhorn Slough	3
Fort Ord	3
Gonzales	3
Gorda	3
Lucia	3
Marina	3
Monterey	3
Monterey Bay	3
Moss Landing	3
Notleys Landing	3
Pacific Grove	3
Pebble Beach	3
Point Lobos	3
Point Sur	3
Posts	3
Prunedale	3
Salinas	3
Sand City	3
Seaside	3
Soledad	3
Spence	3
Spreckels	3
U.S.N. Facility, Point Sur	3
All other locations	4
Napa County	
Berryessa Peak	2/12
All other locations	2
Nevada County	
Cedar Ridge other	11
Chicago Park other	11
French Corral other	11
Grass Valley other	11
Higgins Corner other	11
La Barr other	11
Nevada City other	11
North Columbia other	11
North San Juan other	11
Penn Valley other	11
Pilot Peak other	11
Rough and Ready other	11
All other locations	16
Orange County	
Capistrano Beach	6
Corona Del Mar	6
Costa Mesa	6
Dana Point	6
Emerald Bay	6
Fountain Valley	6
Huntington Beach	6
John Wayne AP	6
Laguna Niguel	6
Newport Bay	6
Newport Beach	6
San Clemente	6
San Juan Capistrano	6
Seal Beach	6
South Laguna	6
Sunset Beach	6
Surfside	6
U.S.N. Weapons Station, Seal Beach	6
Westminster	6
Laguna Hills	6/8
La Habra	9
All other locations	8
Placer County	
Applegate	11
Auburn	11
Bowman	11
Clipper Gap	11
Colfax	11
Elders Corner	11
Granite Bay	11
Hidden Valley	11
Lincoln	11
Loomis	11
Meadow Vista	11
Newcastle	11
North Auburn	11
Penryn	11
Rocklin	11
Roseville	11
Sheridan	11
Weimar	11
Whitney	11
All other locations	16
Plumas County	
All locations	16
Riverside County	
Anza	16
Banning	15
Big Maria Mountains	15
Blythe	15
Box Canyon	15
Cabazon	15
Cahuilla	16
Cathedral City	15
Chiriaco Summit	14
Chuckwalla Mountains	14
Chuckwalla Valley	15
Coachella	15
Coachella Valley	15
Deep Canyon	15
Desert Beach	15
Desert Center	15
Desert Hot Springs	15
Durmid	15
Eagle Mountain	14
Eagle Mountains	14
Ford Dry Lake	15
Fried Liver Wash	14
Hayfield	14
Hayfield Lake	14
Idyllwild	16
Inca	15
Indian Wells	15
Indio	15
La Quinta	15

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County & City/Town Area	CZ
Riverside County (cont.)	
Martinez Canyon	15
McCoy Wash	15
Mecca	15
Mesaville	15
Midland	15
Mount Center	16
Mount San Jacinto	16
Nicholls Warm Springs	15
Nightingale	16
North Palm Springs	15
Oasis	15
Palen Lake	15
Palen Mountains	15
Palm Canyon	15
Palm Desert	15
Palm Desert Country	15
Palm Springs	15
Palo Verde Valley	15
Pinkham Wash	15
Pinto Mountains	14
Pinto Wash	14
Porcupine Wash	14
Rancho Mirage	15
Rice Valley	15
Ripley	15
Salton Sea	15
San Gorgonio Pass	15
San Gorgonio River	15
San Jacinto Mountains	15
Santa Rosa Mountains	15
Smoke Tree Wash	14
Thermal	15
Thomas Mountain	16
Thousand Palms	15
White Water	15
All other locations	10
Sacramento County	
All locations	12
San Benito County	
All locations	4

County & City/Town Area	CZ
San Bernardino County	
Alta Loma	10
Amboy	15
Bagdad	15
Big Bear City	16
Big Bear Lake	16
Black Meadow Landing	15
Bloomington	10
Bristol Lake	15
Cadiz	15
Cadiz Lake	15
Cadiz Valley	15
Cajon Junction	16
Cajon Summit	16
Camp Angelus	16
Chambless	15
Chino	10
Chino Hills	10
Chubbuck	15
Colorado River	15
Colton	10
Crestline	16
Cross Roads	15
Cucamonga	10
Danby Lake	15
Del Rosa	16
Devore	10
Earp	15
East Highlands	10
Fawnskin	16
Fontana	10
Forest Falls	16
Grand Terrace	10
Green Valley Lake	16
Grommet	15
Havasu Lake	15
Highland	10
Java	15
Lake Arrowhead	16
Lake Havasu	15
Loma Linda	10
Los Serranos	10
Lytle Creek	16

County & City/Town Area	CZ
Mentone	10
Milligan	15
Montclair	10
Mount Baldy	16
Mount San Antonio	16
Muscoy	10
Needles	15
Norton AFB	10
Ontario	10
Parker Dam	15
Prado Flood Control Basin	10
Rancho Cucamonga	10
Redlands	10
Rialto	10
Rice	15
Running Springs	16
Saltmarsh	15
Saltus	15
San Bernardino	10
San Bernardino Mountains	16
San Gorgonio Mountain	16
Seven Oaks	16
Silverwood Lake	16
Upland	10
Vidal	15
Vidal Junction	15
Vidal Valley	15
Vidal Wash	15
Whipple Mountains	15
Whitewater River (North Fork)	16
Whitewater River (South Fork)	16
Wrightwood	16
Yucaipa	10
All other locations	14
San Diego County	
Agua Caliente Springs	15
Alpine	10
Barona	10
Barrett Dam	10
Barrett Junction	10
Bonsall	10
Borrego	15

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County & City/Town Area	CZ
San Diego County (cont.)	
Borrego Springs	15
Bostonia	10
Boulevard	14
Camp Pendleton	10
Campo	14
Casa de Oro, Mount Helix	10
Cuyamaca Peak	14
De Luz	10
Del Dios	10
Descanso	14
Dos Cabezas	15
Duguynos Canyon	15
Dulzura	10
El Cajon	10
El Capitan Reservoir	14
Encanto	10
Escondido	10
Fallbrook	10
Fernbrook	10
Guatay	14
Harbinson Canyon	10
Henshaw Dam	10
Jacumba	14
Jacumba Mountains	15
Jamul	10
Julian	14
Lake Henshaw	14
Lakeside	10
Live Oak Springs	14
Loert Otay Reservoir	10
Lower Bear River Reservoir	16
Margarita Peak	10
Mesa Grande	14
Monument Peak	14
Morena VIllage	14
Mount Laguna	14
Oak Grove	14
Ocotillo Wells	15
Pala	10
Palomar Mountain	14
Pauma Valley	10
Pine Valley	14

County & City/Town Area	CZ
Potrero	14
Poway Valley	10
Rainbow	10
Ramona	10
Ranchita	14
Rancho Bernardo	10
Rancho San Diego	10
San Diego	7/10
San Felipe	14
San Luis Rey River (West Fork)	14
San Marcos	10
San Mateo Canyon	10
San Onofre Canyon	10
San Pasqual	10
San Vicente Reservoir	10
San Ysidro Mountains	10
Santa Ysabel	14
Santee	10
Spring Valley	10
Suncrest	10
Sweetwater Reservoir	10
Tecate	14
Tierra del Sol	14
Valley Center	10
Warner Springs	14
Wynola	14
All other locations	7
San Francisco County	
Farallon Island	1
All other locations	3
San Joaquin County	
All locations	12
San Luis Obispo County	
Arroyo Grande	5
Avila Beach	5
Baywood Park	5
Cambria	5
Cayucos	5
Edna	5
Estero Bay	5
Grover Beach	5

County & City/Town Area	CZ
Grover City	5
Harmony	5
Huasna	5
Huasna River	5
Irish Hills	5
Lopez Lake	5
Los Berros Canyon	5
Los Osos	5
Morro Bay	5
Nipomo	5
Oceano	5
Pismo Beach	5
Point Buchon	5
Point Piedras Blancas	5
San Luis Obispo	5
San Luis Obispo Bay	5
San Simeon	5
Santa Maria River	5
Whale Rock Reservoir	5
All other locations	4
San Mateo County	
All locations	3
Santa Barbara County	
Cuyama	4
Cuyama Valley	4
New Cuyama	4
Ventupopa	4
Capitan	6
Carpinteria	6
Concepcion	6
Drake	6
Gaviota	6
Gaviota Pass	6
Goleta	6
Isla Vista	6
Montecito	6
Naples	6
Point Conception	6
San Miguel Island	6
Santa Barbara	6
Santa Barbara Island	6
Santa Cruz Island	6

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County & City/Town Area	CZ
Santa Barbara County (cont.)	
Santa Rosa Islands	6
Summerland	6
Tajiguas	6
All other locations	5
Santa Clara County	
Calaveras Reservoir 12/4	12/4
All other locations	4
Santa Cruz County	
All locations	3
Shasta County	
Big Bend	16
Big Lake	16
Bollibokka Mountain	16
Burney	16
Burney Mountain	16
Cassel	16
Castella	16
Cayton	16
Dana	16
Delta	16
Fall River	16
Fall River Mills	16
Glenburg	16
Hat Creek	16
Knob	16
Lake Britton	16
Lakehead	16
Lamoine	16
Lassen Peak	16
Manzanita Lake	16
McArthur	16
McCloud River	16
Montgomery Creek	16
Obie	16
O'Brien	16
Old Station	16
Pittville	16
Round Mountain	16
Shasta Lake	16
Shingletown	16
Trinity Mountains	16

County & City/Town Area	CZ
Viola	16
All other locations	11
Sierra County	
All locations	16
Siskiyou County	
All locations	16
Solano County	
Mare Island Naval Facility	3
Monticello Dam 2	
U.S.N. Facility, Vallejo	3
Vallejo	3
All other locations	12
Sonoma County	
Annapolis	1
Bodega	1
Bodega Bay	1
Bodega Head	1
Cazadero	1
Duncans Mills	1
Fort Ross	1
Jenner	1
Ocean View	1
Plantation	1
Soda Springs	1
Stewarts Point	1
All other locations	2
Stanislaus County	
All locations	12
Sutter County	
All locations	11
Tehama County	
Barkley Mountain	16
Lyonsville	16
Manton	16
Mill Creek	16
Mineral	16
North Yolla Bolly Mountains	16
Saint Bernard	16
South Yolla Bolly Mountains	16
All other locations	11

County & City/Town Area	CZ
Trinity County	
Island Mountain	2
Kekawaka	2
Kettenpom	2
Zenia	2
All other locations	16
Tulare County	
California Hot Springs	16
Camp Nelson	16
Fairview	16
Florence Peak	16
Giant Forest	16
Grant Grove	16
Greenhorn Mountains	16
Johnsondale	16
Kaweah River (Middle fork)	16
Little Kern River	16
Mineral King	16
Mount Whitney	16
Olancha Peak	16
Pine Flat	16
Sherman Peak	16
Silver City	16
Tobias Peak	16
Wilsonia	16
Yucca Mountain	16
All other locations	13
Tuolumne County	
Big Oak Flat	12
Chinese Camp	12
Columbia	12
Groveland	12
Hetch Hetchy Junction	12
Jacksonville	12
Jamestown	12
Melones Reservoir	12
Mi-Wuk Village	12
Moccasin	12
New Don Pedro Reservoir	12
Sonora	12
Soulsbyville	12
Standard	12

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County & City/Town Area	CZ
Tuolumne County (cont.)	
Stent	12
Tuolumne	12
Tuttletown	12
Twain Harte	12
All other locations	16
Ventura County	
Santa Clara River	6/9
Bardsdale	9
Casitas Springs	9
Fillmore	9
Lake Casitas	9
Meiners Oaks	9
Moorpark	9
Newbury Park	9
Oak Ridge	9

County & City/Town Area	CZ
Oak View	9
Ojai	9
Piru	9
Santa Paula	9
Santa Susana	9
Sespe	9
Simi Valley	9
Sulphur Springs	9
Thousand Oaks	9
Apache Canyon	16
Cuddy Canyon	16
Dry Canyon	16
Frazier Mountain	16
Mount Pinos	16
Pine Mountain	16
Quatal Canyon	16

County & City/Town Area	CZ
Wheeler Springs	16
All other locations	6
Yolo County	
Berryessa Peak	2/12
All other locations	12
Yuba County	
Camptonville	16
Challenge	16
Middle Yuba River	16
New Bullards Bar Reservoir	16
North Yuba River	16
Oregon Peak	16
Strawberry Valley	16
Woodleaf	16
All other locations	11

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APPENDIX -D-

GROUNDING GUIDELINES
FOR
ELECTRIC MEASURES

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APPENDIX -D-

GROUNDING GUIDELINES FOR ELECTRIC MEASURES

1.0 INTRODUCTION

1.1 Purpose: This appendix provides guidelines for electrically protecting a receptacle or switch in a home with an ungrounded 2-wire system. Options addressed are installation of a:

1. Retrofit ground wire, or
2. GFCI receptacle or switch.

1.2 Caveat:

1. These are basic guidelines. Detailed criteria may be found in the California Electrical Code (CEC).
2. Each installer is responsible for adhering to program policies and all requirements of the local jurisdiction, including acquisition of a permit when required.

1.3 Definitions:

1. *Ground Wire* (also called the *Equipment Ground Wire):* The wire (typically 12 AWG) that provides grounding to a receptacle, switch, or metal box.
2. *Grounding Electrode Conductor **(GEC)**:* A wire (typically 6 AWG) that extends from the service entrance ground rod to:
   a. the main service panel grounding terminal bar, or
   b. another location where grounding is needed.

2.0 DWELLING ELECTRICAL HAZARDS

2.1 Identification: Homes will have a four-wire service entrance to the panel box to ensure a wiring system that is nominally rated at 120/240 volts and allows for proper grounding.

2.2 Safety Check: Evaluation of an electrical system is required of all field personnel before tools and equipment are used, electrical measures are installed, or the dwelling's electrical system will be affected by weatherization activities.

1. The electrical safety check shall conform to CSD WIS Section 1, Item 4.1.13.4 and CSD Field Guide Section 3 Assessor's Guide, Items 3.10.1 and 3.10.2.
2. Grounding at the service entrance will be checked to determine proper grounding of the home.

3.0 INSTALLATION OF A RETROFIT GROUND WIRE

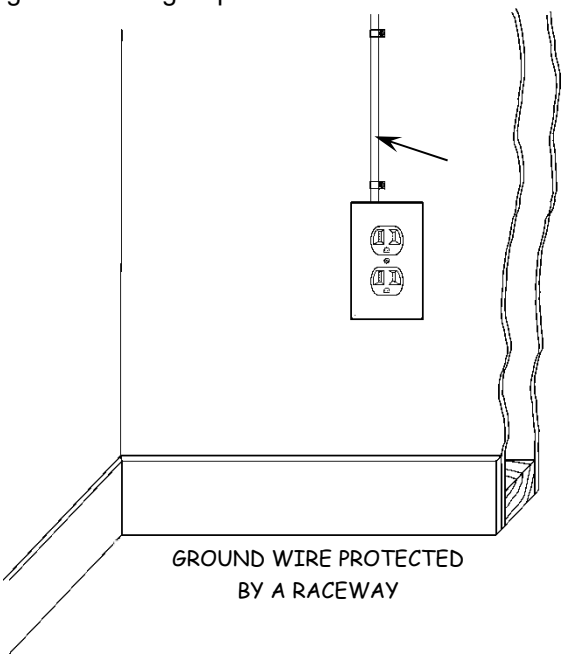
3.1 Purpose: To install a retrofit ground wire that provides electrical protection for an ungrounded receptacle or switch, in a home with a 2-wire ungrounded system.

3.2 Grounding Sources: Grounding can be provided to an ungrounded receptacle or switch by connecting a ground wire from it to either of the following:

1. Existing Ground: An existing 3-wire grounded receptacle elsewhere in the structure, or the main service grounding system.
2. Retrofit Electrode Conductor: A retrofit grounding electrode conductor (GEC) connected to the main service grounding system (e.g., the ground rod).

3.3 Ground Wire Requirements

1. Wire: Must be a copper conductor meeting the following requirements.
   a. Minimum 12 AWG for 20 amp circuits.
   b. When insulated, colored green or green with one or more yellow stripes.
2. Protection: Where exposed, the ground wire must be secured and protected as needed to avoid damage, and to safeguard the occupants.
   a. Indoors: Wires must be enclosed in a raceway.
   b. Outdoors: Wires must be enclosed in a conduit or cable armor.
   c. Attic or Crawlspace: Wires that run across the joists must be run either through bored holes in the joists or on running boards.



GROUND WIRE PROTECTED BY A RACEWAY

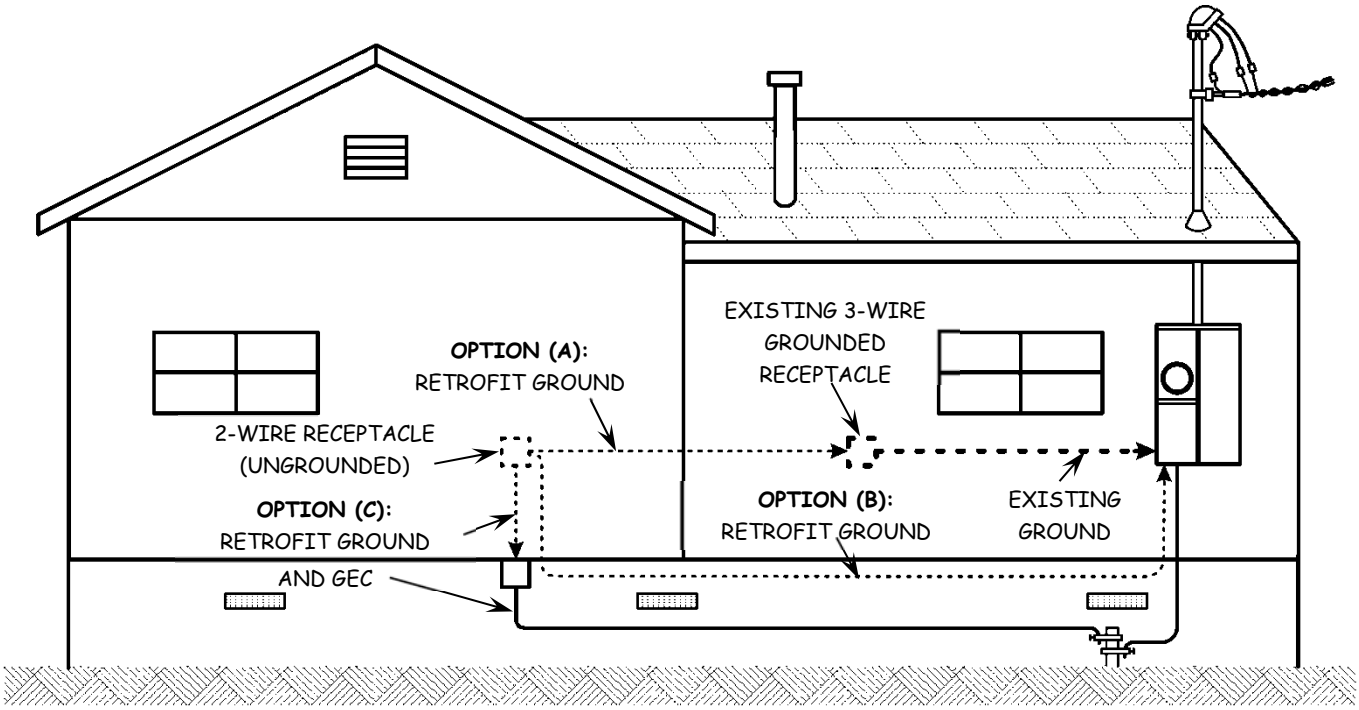
3.4 Grounding Electrode Conductor (GEC): When a GEC is installed, it must meet the following requirements:

1. Size: Minimum 6 AWG, or as required by local code, properly clamped/bonded to ground at the main service (e.g., clamped to the ground rod).
2. Splices: Any splices in the GEC must be secured with an irreversible compression-type connector or exothermic weld.
3. Protection: The GEC must be protected.
   a. Where physical damage is <u>not</u> likely, the GEC may be securely fastened to the building.
   b. Where physical damage <u>is</u> likely, the GEC must be enclosed in a rigid metal or nonmetallic conduit, or encased in cable armor.

3.5 Grounding Options: An ungrounded receptacle or switch may be grounded by connecting a ground wire (typically AWG 12) from it to a grounding source.[1] Options include the following:

1. Option A: Connect to an existing grounded receptacle in another part of the building:
   a. Applies when a 3-wire grounded receptacle is available elsewhere in the home.
   b. Run a ground wire from the ungrounded receptacle/switch to the existing 3-wire grounded receptacle.
2. Option B: Connect to the grounding system at the main service panel:
   a. Applies when a ground wire can be routed without direct exposure to occupants or outdoors (e.g., in the crawlspace, wall, or attic).
   b. Run a ground wire (conduit not required) from the ungrounded receptacle/switch to the main panel grounding system.
3. Option C: Connect to an existing ground rod in the home's grounding system:
   a. From the main service ground rod, run a retrofit GEC to a junction box near the ungrounded receptacle/switch.
   b. Run a ground wire from the ungrounded receptacle/switch to the GEC junction box, and connect it to the GEC inside.

[1] Ground wire exposed in the living space must be in a raceway. Ground wire in the crawlspace or attic does not need to be in a conduit, unless required by local code.



4.0 INSTALLATION OF A GFCI RECEPTACLE OR SWITCH

4.1 Purpose: To install a GFCI unit, rather than a ground wire, to provide electrical protection for an ungrounded receptacle or switch, in a home with a 2-wire ungrounded system.

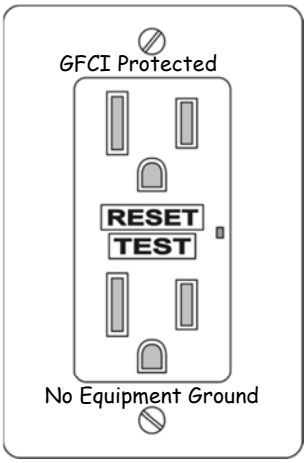
4.2 The GFCI Alternative

1. Installation of a GFCI unit is an acceptable alternative for protecting an ungrounded receptacle or switch.
2. This method may be used when installation of a retrofit ground wire is not a good option.

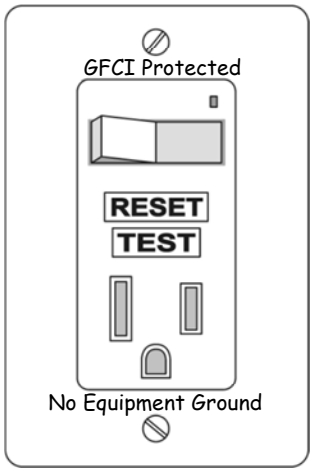
4.3 GFCI Installation

1. Receptacle—for a plug-in appliance (except refrigerator):
   a. A GFCI receptacle may be connected to an ungrounded 2-wire circuit.
   b. Wires bringing power to the receptacle must be connected to the “line” terminals.
   c. When present, wires leaving the GFCI receptacle to provide power down-line must be connected to the “load” terminals.
   d. No wire is connected to the ground lug on the GFCI receptacle.
2. Switch—for a switched fixture:
   a. A GFCI-protected switch may be connected to an ungrounded 2-wire circuit.
   b. Wires bringing power to the unit must be connected to the “line” terminals.
   c. When present, wires leaving the unit to provide power down-line must be connected to the “load” terminals.
   d. No wire is connected to the ground lug on the GFCI-protected switch.
3. All Units
   a. Installation shall be in conformance with manufacturer’s instructions and local code.
   b. When a GFCI receptacle or GFCI-protected switch is installed where a ground wire is not present, the cover plate shall be labeled “GFCI Protected” *and* “No Equipment Ground”.

4.4 GFCI Limitation: GFCI protection may not be used for a circuit powering a refrigerator.



GFCI RECEPTACLE



GFCI-PROTECTED
LIGHT SWITCH

5.0 EQUIPMENT GROUNDING AS A WORK PRACTICE TO AVOID STATIC SHOCK

5.1 Purpose: To minimize static shock that occurs from an insulation fill tube moving over the ground, follow instructions in CSD WIS Section 1, Item 4.1.13.5.

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APPENDIX -E-

ATTIC & CRAWLSPACE ACCESSIBILITY REQUIREMENTS

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APPENDIX -E-

ATTIC & CRAWLSPACE ACCESSIBILITY REQUIREMENTS

1.0 INTRODUCTION

1.1 Purpose: This appendix provides minimum accessibility guidelines for measures to be installed in attic or crawlspace locations.

1.2 Caveat:

1. These are basic guidelines. If a limited area in an attic or crawlspace is more restrictive than these guidelines, it does not make an entire measure unfeasible.
    a. Each assessor and installer is responsible for adhering to program policies and to all requirements of the local jurisdiction. If work cannot be performed due to accessibility issues, the assessor shall note existing measurements of the attic or crawlspace entry and provide photo documentation, to justify non-feasibility of measures located in the attic or crawlspace. If the local jurisdiction is more restrictive, the local policy must be documented and included in the client file or in a centralized file with the agency.

1.3 Working in a “Confined Space”:

1. On January 1, 2016, Cal/OSHA is implementing a “confined space” standard to protect employees from hazards related to confined spaces exposure in the construction industry (Section 5158).
2. The Cal/OSHA standard CCR, T8, 1950-1962 is in effect as of this date and will be enforced. A copy of the standard is provided at: http://www.dir.ca.gov/Title8/sb4a37.html
3. The “confined space” standard may apply to attics, chases, and crawlspaces; therefore, confined space safety practices must be observed.
4. Employers are required to: 1) determine if there is a confined space, and if so, 2) evaluate the associated hazards and implement specific procedures to protect workers. The level of action is dependent upon whether the space is a “permit-required confined space” or “confined space” only.
5. Planning and compliance with these confined space regulations is required for all agencies and subcontractors. Additional information may be obtained from Cal/OSHA and in CSD WIS Section 1 (Health and Safety Requirements).

2.0 ATTIC ACCESSIBILITY

2.1 Accessibility: Attics shall be accessible for assessment and inspection:

1. An existing attic access must have minimum dimensions of 14" x 20".
2. If an access is not present or is too small, adequate access shall be provided.
    a. Client permission must be obtained when an attic access is installed/enlarged.
    b. Minimum dimensions of the rough-framed opening shall be 22" x 30", or as required by local code. Wood trim shall have mitered corners.
3. When an attic access is painted shut or otherwise sealed, it must be opened to check the attic for insulation feasibility.
    a. If the only attic access is through a gable vent, the vent must be easily removable, or a standard access must be installed.

2.2 Attic Clearances: For measures to be feasible where presence in an attic is required, the following clearances shall apply:

1. Clearance shall be at least 24" from the top of the ceiling joists to the bottom of the roof rafters at the highest point.
2. Any obstruction in the attic, such as cross members of truss systems and ductwork, shall provide an opening with a minimum dimension of 18".

3.0 CRAWLSPACE ACCESSIBILITY

3.1 Accessibility: Crawlspaces must be accessible for assessment, installations, and inspection.

1. An existing crawlspace access must have minimum dimensions of 14" x 20".
2. When existing access is sealed, it must be opened to check for insulation feasibility.
3. If an access is not present or is too small, adequate access shall be provided.
    a. Client permission must be obtained when a crawlspace access is installed/enlarged.
    b. Minimum dimensions of the opening shall be 18" x 24", or as required by local code. Wood trim shall have mitered corners.

3.2 Crawlspace Clearances: For measures to be feasible where presence in a crawlspace is required, the following clearances shall apply:

1. Clearance shall be at least 18” from the ground to the bottom of the floor joist system (girders under a mobile home).
2. Any obstruction in the crawl area, such as an HVAC duct, shall provide a minimum clearance of 12” to crawl over or under it.

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APPENDIX -F-

KNOB-AND-TUBE REQUIREMENTS

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APPENDIX -F-

KNOB-AND-TUBE REQUIREMENTS

1.0 FEASIBILITY

1.1 Purpose: This appendix provides guidelines for measures when knob-and-tube (K&T) wiring is present in a home.

1.2 Feasibility:

Field personnel, including weatherization crews, shall NOT install insulation in attics or crawlspaces around/near functional knob-and-tube wiring that is energized, unless the wiring has been certified safe by an electrical (C-10) contractor through a "Notice of Survey" certification.

NOTE: Wall insulation shall NEVER be installed when K&T wiring is present in dwelling walls, even when a C-10 electrical contractor "Notice of Survey" is available.

1. Each assessor, installer, and quality control inspector is responsible for performing a safety evaluation of locations where knob-and-tube wiring may be present and adhering to program safety policies.

2. Prior to installation of any insulation in the ceiling or crawlspace of a dwelling where knob-and-tube wiring is present, a copy of a CSD 543 "Notice of Survey by Electrical Contractor" shall be completed by a C-10 electrical contractor licensed by the State of California.

3. The C-10 electrical contractor "Notice of Survey" is an allowed **Optional Measure** under the LIHEAP program. Costs to obtain "Notice of Survey by Electrical Contractor" and installation of simple overcurrent protection shall be billed to "Assessment and Diagnostics (Permits)".

4. When a C-10 "Notice of Survey" is available, each installer is responsible for adhering to all requirements of the local jurisdiction, if the local jurisdiction is more restrictive regarding K&T wiring, such as insulating over K&T wiring (live or abandoned). Confirm with the local jurisdiction; and if more restrictive, the local policy must be documented and included in the client file or on file with the agency administrative office.

5. If work cannot be performed due to K&T accessibility restrictions or unsafe K&T conditions, field personnel must note the existing conditions in the affected area (i.e., attic, walls, or crawlspace) and provide photo documentation (when possible), to justify non-feasibility of the insulation and/or other measure(s) in the identified location.

6. If an electrical K&T hazard exists, workers are expected to evaluate the feasibility of installing other measures in the same area without endangering staff or occupants. Potentially affected measures may be:

Air Conditioner—Central	Duct Insulation	Mechanical Ventilation
Air Conditioner—Wall	Duct Repair and Sealing	Minor Envelope Repair (sealing of thermal bypasses in the area)
Attic Ventilation	Evaporative Cooler	
Ceiling/Kneewall Insulation	Floor Furnace	Thermostats
Ceiling Fan	Floor Insulation	Wall Furnace
Compact Fluorescent Fixture	Forced Air Unit—Central	Wall Insulation
Crawlspace Ventilation	Kitchen Exhaust	Water Heater—Electric

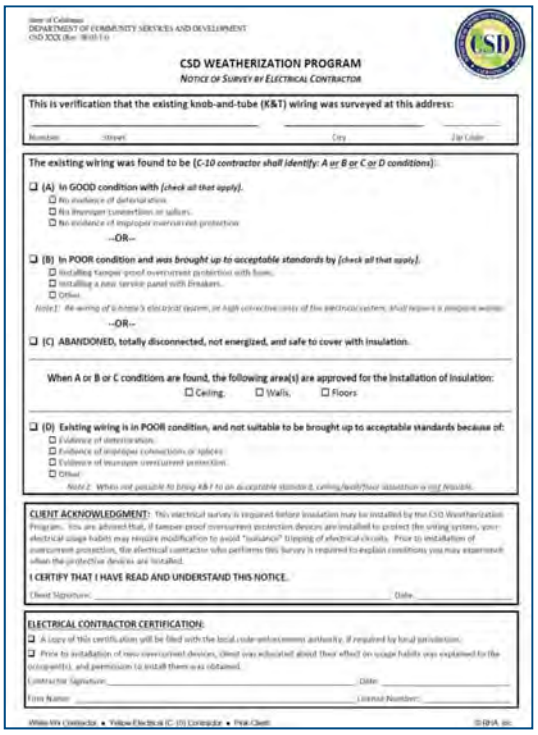
2.0 C-10 NOTICE OF SURVEY REQUIREMENTS

2.1 A survey shall include the C-10 contractor's personal inspection and observation, and verify that all existing K&T wiring in the area intended to be insulated/or other measures are to be installed:

1. Is in good condition with proper overcurrent protection; OR
2. Is in poor condition (unsafe), but will be brought up to acceptable standards and proper overcurrent protection is present; OR
3. Is in poor condition (unsafe), and is not suitable to be brought up to acceptable standards.
4. When batting/blocking is installed to protect K&T wiring, the wiring must still be certified safe with proper overcurrent protection in place. (Note: An overcurrent protection device, such as a circuit breaker or S-type fuse, is designed to break the circuit if current is over the designed amount.)

2.2 When K&T wiring has been **abandoned** (i.e., it is de-energized and a new wiring system has been installed with overcurrent protection), insulation is feasible when:

1. The C-10 contractor certifies that:
   a. K&T wiring is abandoned and not energized, and it is safe to cover with insulation; and
   b. Wiring cannot be energized by reconnecting abandoned feeder conductors to the service panel or other source.
2. The "Notice of Survey by Electrical Contractor" form defines the condition. A copy shall be:
   a. Kept in the client file with the Assessment Form; and
   b. Filed with the local jurisdiction.



DEPARTMENT OF COMMUNITY SERVICES AND DEVELOPMENT

CSD WEATHERIZATION PROGRAM

NOTICE OF SURVEY BY ELECTRICAL CONTRACTOR

This is verification that the existing knob-and-tube (K&T) wiring was surveyed at this address:

The existing wiring was found to be (*C-10 contractor shall identify: A or B or C or D conditions*):

☐ (A) In GOOD condition with *(check all that apply)*.
☐ No evidence of deterioration
☐ No improper connection or splices
☐ No evidence of improper overcurrent protection

--OR--

☐ (B) In POOR condition and *was brought up to acceptable standards by (check all that apply)*.
☐ Installing tamper proof overcurrent protection with fuses;
☐ Installing a new service panel with breakers.
☐ Other.

Note1: Re-wiring of a home's electrical system, or high corrective costs of the electrical system, shall not be a prerequisite when

--OR--

☐ (C) ABANDONED, totally disconnected, not energized, and safe to cover with insulation.

When A or B or C conditions are found, the following area(s) are approved for the installation of insulation:
☐ Ceiling. ☐ Walls. ☐ Floors

☐ (D) Existing wiring is in POOR condition, and not suitable to be brought up to acceptable standards because of:
☐ Evidence of deterioration.
☐ Evidence of improper connection or splices
☐ Evidence of improper overcurrent protection.
☐ Other.
Note2: When not possible to bring K&T to an acceptable standard, ceiling/wall/floor insulation is not feasible.

CLIENT ACKNOWLEDGMENT: This electrical survey is required before insulation may be installed by the CSD Weatherization Program. You are advised that, if tamper proof overcurrent protection devices are installed to protect the wiring system, your electrical usage habits may require modification to avoid "nuisance" tripping of electrical circuits. Prior to installation of overcurrent protection, the electrical contractor who performs this Survey is required to explain conditions you may experience when the protective devices are installed.

I CERTIFY THAT I HAVE READ AND UNDERSTAND THIS NOTICE.

Client Signature: _____ Date: _____

ELECTRICAL CONTRACTOR CERTIFICATION:

☐ A copy of this certification will be filed with the local code-enforcement authority, if required by local jurisdiction.
☐ Prior to installation of new overcurrent devices, client was educated about their effect on usage habits and explained to the occupant(s), and permission to install them was obtained.

Contractor Signature: _____ Date: _____

Firm Name: _____ License Number: _____

White-Mr Contractor • Yellow-Electrical (C-10) Contractor • Pink-Client ©RHA, Inc.

3.0 CLIENT AND CREW NOTIFICATIONS

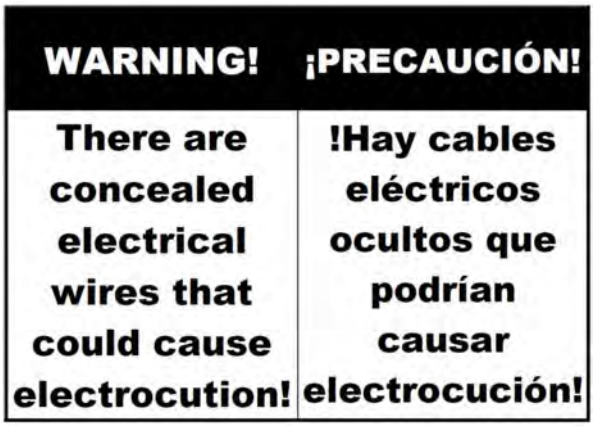
3.1 Pre-Installation Requirements: Before *any* measures are installed in the K&T wiring locations (attic or crawlspace):

1. Warning placards shall be posted as described in Section 3.2 below.
2. Required overcurrent protection(s) shall be installed by the C-10 contractor, and
3. A CSD 543 "Notice of Survey" by Electrical Contractor" shall be completed by the C-10 contractor.

4. "Notice of Survey" also must be signed by the client and a copy retained in the client file.
5. The signed "Notice of Survey" must be posted next to the Warning Placard (see below) at the entrance to the work site.
6. The agency shall ensure that a copy of the completed "Notice of Survey" has been given to the client after it is signed.
7. When obtained as part of the CSD Weatherization Program, the CSD 543 "Notice of Survey" from the CSD Providers' website shall be used (see above). When obtained by the client, the "Notice of Survey" may look slightly different, but all components must be present and addressed.

3.2 Posting of Warning Placards

1. Assessors and Crews shall ensure that a "Warning Placard(s)" is posted in the attic/crawlspace entry where it will be observed by persons entering the area stating that caution is required when entering insulated areas because covered electrical wiring is present. The warning placard must be printed in *both English and Spanish*.



2. A separate warning placard shall be posted:
   a. Near each openable entrance (accessed from inside or outside the living space); and
   b. Any openable entrance that is temporarily unused or obstructed by furniture, stored items, etc., but can be opened and used at any time.

3.3 Posting of "Notice of Survey"

1. A photocopy of the "Notice of Survey" shall be posted in the attic next to the Warning Placard.
2. If there is more than one entrance to the area, the "Notice of Survey" shall be posted at the primary entrance.
3. C-10 inspection, certification, and installation procedures for attic insulation also applies to floor insulation, except that for floor insulation, a "Notice of Survey" shall be posted near each crawlspace access.

3.4 Installation of Measures

1. After the K&T wiring has been certified safe by a C-10 contractor and documented, measures may be installed in the ceiling and floor locations as long as great care is taken and safety precautions are practiced by all workers. (Note: Copies of documentation are also required when the Notice of Survey was obtained by the client outside of the Weatherization Program).
2. Ceiling/floor insulation may cover the K&T wiring as long as it is allowed by the local jurisdiction and is performed in conformance with CSD WIS Section 20A (Ceiling Insulation for Conventional Homes).
3. Insulating materials used by the contractor for ceiling and floor insulation shall ALWAYS be:
   a. Non-combustible insulation only.
   b. Non-combustible barriers/blocking only.

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NOTES

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ABBREVIATIONS AND ACRONYMS

°C	Degrees Centigrade
°F	Degrees Fahrenheit
AAMA	American Architectural Manufacturers Association
ACCA	Air Conditioning Contractors of America
ACDD	Annual Cooling Degree Days
ACH	Air Changes per Hour (at natural pressure)
AFUE	Annual Fuel Utilization Efficiency
AGA	American Gas Association
AHDD	Annual Heating Degree Days
AHRI (ARI)	Air Conditioning, Heating, and Refrigeration Institute (formerly ARI)
ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWG, awg	American Wire Gage
BEAR	Bureau of Electronic and Appliance Repair
BEF	Ballast Efficacy Factor
BOCA	Building Officials and Code Administrators
Btu	British Thermal Unit
Btuh, Btu/hr	Btu per Hour
CABO	Council of American Building Officials
CalOSHA	California Occupational Safety and Health Administration
CAS	Combustion Appliance Safety
CASIF	Combustion Appliance Safety Inspection Form
CAZ	Combustion Appliance Zone
CBC	California Building Code
CBM	Certified Ballast Manufacturers
CBO	Community Based Organization
CCR	California Code of Regulations
CDD	Cooling Degree Days (also see ACDD)
CEC	California Electrical Code and California Energy Commission

ABBREVIATIONS AND ACRONYMS

CFL	Compact Fluorescent Lamp
CFM, cfm	Cubic Feet per Minute
CFM_{25}	Cubic Feet per Minute of Air Flow at 25 Pascals of Pressure
CFM_{50}	Cubic Feet per Minute of Air Flow at 50 Pascals of Pressure
CFR	Code of Federal Regulations
CMC	California Mechanical Code
CO	Carbon Monoxide
COP	Coefficient of Performance
CPC	California Plumbing Code
CPSC	Consumer Products Safety Commission
CSD	California Department of Community Services and Development
CVA	Combustion and Ventilation Air (vents)
DOE	(United States) Department of Energy
DV	Direct Vent (appliances)
EER	Energy Efficiency Ratio
EPA	Environmental Protection Agency
ESP	Economic Stop Parameters/Economic Stop Policy
F.S.	Federal Specifications
FAU	Forced Air Unit
fpm	Feet per Minute
FVIR	Flammable Vapor Ignition Resistant
GFCI	Ground Fault Circuit Interrupter
HCD	(California Department of) Housing and Community Development
HDD	Heating Degree Days
HDL	House Depressurization Limit
HPD	Heat Producing Device
HSPF	Heating Seasonal Performance Factor
HUD	(U.S. Department of) Housing and Urban Development
HUD MHCSS	HUD Manufactured Home Construction and Safety Standards ("HUD Code" for mobile homes)
HVAC	Heating Ventilation and Air Conditioning
HVACR	Heating, Ventilation, Air Conditioning, and Refrigeration

ABBREVIATIONS AND ACRONYMS

Hz	Hertz (equivalent to cycles per second)
ICBO	International Conference of Building Officials
ICC	International Code Council
ID	Inside Diameter
IGU	Insulated Glazing Unit
IRM	Infiltration-Reduction Measures
IWC, iwc	Inches of Water Column (same as IWG, Inches of Water Gauge)
IWG, iwg	Inches of Water Gauge (same as IWC, Inches of Water Column)
kHz	Kilohertz (see Hertz)
MHCSS	See “HUD MHCSS”
MVR	Minimum Ventilation Requirement
NEC	National Electrical Code
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NFRC	National Fenestration Rating Council
NFVA	Net Free Ventilation Area
NIM	**N**on **I**nfiltration **M**easures only (may be installed)
NOx	Generic term for mono-nitrogen oxides NO and NO_2 (nitric oxide and nitrogen dioxide)
OC	On Center
OD	Outside Diameter
OSHA	Occupational Safety and Health Administration
P&P	Policies & Procedures
Pa	Pascal (see Definitions)
PPM, ppm	Parts per Million
psf	Pounds per Square Foot
psi	Pounds per Square Inch
PTAC	Packaged Terminal Air Conditioner
RTV	Room Temperature Vulcanization (e.g., RTV silicone)
SEER	Seasonal Energy Efficiency Ratio
T&P Valve TPV	Temperature and Pressure Relief Valve

ABBREVIATIONS AND ACRONYMS

TPE	Thermoplastic Elastomer
UBC	Uniform Building Code (CBC in California)
UL	Underwriters Laboratories
UMC	Uniform Mechanical Code (CMC in California)
UPC	Uniform Plumbing Code (CPC in California)
UV	Ultraviolet
WC, wc	Water Column (same as Water Gauge)
WG, wg	Water Gauge (same as Water Column)
WIS	Weatherization Installation Standards
Wx	Weatherization

DEFINITIONS

Abandoned Appliance	An appliance that has been removed from client use by doing the following: • Remove the flexible gas connector ("gas flex"), and • Cap the appliance line (shutoff) valve, or remove the valve and cap the gas supply line, and • Disconnect electricity to the unit, if applicable and feasible (e.g., power switched off or the cord unplugged).
Adapters, Plumbing type	Threaded fittings designed to fit specialized plumbing threads and diameters associated with some styles of showerheads and faucet aerators. Adapters convert from the specialized connections to standard connections commonly used.
Air Changes per Hour (ACH)	ACH is the air infiltration rate of a building at natural (atmospheric) pressure. • ACH is the number of times per hour an amount of air equivalent to the entire volume of a building will pass through the shell as infiltration. • If a 4,000–cu. ft. dwelling had infiltration at natural pressure equivalent to 1,000 cu. ft. per hour, the air infiltration rate would be 0.25 ACH (1,000 ÷ 4,000 = 0.25). In other words, during each hour, one-fourth of the air in the dwelling would be replaced (changed) by fresh outdoor air.
Air-Free (CO)	A CO measurement taken with a test instrument that calculates the amount of CO ppm without the presence of excess air. The amount of oxygen in the combustion gas is taken into account by adjusting the as-measured CO ppm value to simulate oxygen-free conditions in the combustion gases.
Appliance Line Valve (Appliance Shutoff Valve)	A manual gas shutoff valve installed between the gas supply pipe and the flexible gas connector. It must be located within 6' of the appliance it serves. The flexible gas connector must be completely in the same room as the appliance to which it is connected.
Appliance Repairs	Cleaning and replacement of fuel nozzles and jets, replacement of thermocouples, refrigerant, or other component repairs or replacements necessary for safe and efficient operation. Must be accomplished by a person licensed to perform such work. Also see "Appliance Service."
Appliance Service	Minor corrective work performed by utility gas or electrical service personnel or qualified technicians, intended to make an appliance operate properly without repair or replacement. Includes cleaning burners and orifices, adjusting air/gas

	mixture, adjusting manifold gas pressure, or correcting of electrical hazards.
As-Measured (CO)	The measured CO ppm from a sample of combustion gases with no regard for the amount of excess air diluting the CO concentration. The test instrument does not perform a calculation to account for oxygen in the combustion gases.
Assessment	The process used to evaluate an eligible dwelling unit for weatherization services offered under the DOE and LIHEAP weatherization programs. The purpose is to determine if the dwelling qualifies for weatherization and, if so, what labor and materials are necessary to weatherize the unit. An assessment shall only be performed by qualified individuals possessing the required skill and training needed to perform assessment activities.
Astragal	The vertical strip that spans the gap between the two meeting edges of double doors (e.g., “French” doors). The astragal attaches to a stile on one of the doors and provides a surface against which the other door closes and seals.
Attic Venting	Screened and/or louvered vents installed to provide attic ventilation (airflow though the attic) in a dwelling. • Low vents typically are eave and soffit vents, but they can also be a roof jack/eyebrow installed low on the roof, or a gable vent installed low on the gable wall. • High vents typically are roof jacks, eyebrow vents, dormer vents, and wind turbines. Minimum NFVA venting requirements are described in CSD WIS Section 21.
Audit	See “Energy Audit.”
Audit-Driven Measure (ADM)	A subset of energy conservation measures determined to be cost-effective by energy audit. In order for these measures to be allowed, the ADM must be proven to have a savings-to-investment ratio (SIR) value of 1.0 or greater.
Automatic Door Bottom	An air-sealing device installed at the bottom of a door on the interior. A carrier with pliable gasket on the bottom slides down to contact the floor or threshold when the door is closed, and it slides up to clear the floor/covering when the door is opened. It may be used when a shoe-and-saddle combination is not feasible. (Different from a “flip sweep” that pivots to move up and down, which is not an approved material.)
Automatic Gas Shutoff Valve	An automatic safety device that is installed on some gas water heaters to protect against overheating by shutting off the gas

	supply when water in the tank reaches a preset level, typically 210°F. It shuts off gas to the water heater and prevents the burner from lighting. Code requires that a separate pressure relief valve also be installed somewhere in the cold water supply line. An automatic gas shutoff valve (such as a "Watts-210") may be used on water heaters instead of a temperature and pressure (T&P) relief valve. This is done in locations where a gravity drain line to outdoors cannot be installed (e.g., interior locations in multi-family units and in basements). Also see "T&P Valve (Temperature and Pressure Relief Valve)."
Backdrafting	The reverse flow of combustion gases down the vent pipe and out the draft hood of a natural draft open combustion gas appliance. Intermittent backdrafting can be caused by wind gusts. Ongoing backdrafting can be the result of a negative pressure in the combustion appliance zone (CAZ) caused by: • Duct system return leaks in the vicinity of the appliance, • Blockage of the vent pipe, and/or • The excessive interference of mechanical systems exhausting air from the structure (e.g., bathroom and utility room exhaust fans, kitchen exhaust fans, clothes dryer, built-in vacuum system, etc.).
BB Hole	A hole in a window pane that is less than 1/4" in diameter, similar in size to a "BB."
Belly Cavity Return	Because belly cavity returns are considered a source of catastrophic duct leakage in a mobile home, whenever feasible, an un-ducted belly-cavity return, shall be: • Abandoned, by removing floor registers and filling/sealing the holes, and • Replaced by a ducted central return. Regular duct testing shall be performed after the belly-cavity return has been replaced with a ducted central return. Note: If it is unfeasible to abandon a belly cavity return, modified duct testing shall be performed. • Isolate the return system from the FAU (e.g., with cardboard and tape at the bottom of the FAU). • Perform a duct test on the supply side of the system, with the Duct Blaster connected to a supply register or attached to the FAU at the supply plenum.
Bellyboard	See "Rodent Barrier."
Btuh, Btu/hr	Btu-per-hour input rating of a combustion appliance. Btuh (also

	abbreviated Btu/hr) is the unit of power most commonly associated with the Btu (British thermal unit). It is a measure of the quantity of energy from fuel that is consumed by the burner. • For simplicity, large Btu ratings can be referred to as "kBtuh," which is "thousand Btuh" (1,000 Btuh = 1 kBtuh). Thus, the rating of a 90,000 Btuh input furnace can be expressed as "90 kBtuh."
Built-up Roof (Low-Slope)	A low-slope roof that is "built up" with roofing felt laminated in overlapping layers to form a membrane that is 2-4 plies thick. To protect the membrane from sunlight and physical wear, a layer of aggregate (crushed stone or other mineral granules) is embedded in the surface.
Call-Back	A "call-back" is when a measure fails (either during inspection, or later within the warranty period) that is required to be corrected by an agency. The required warranty periods are defined in CSD WIS Appendix B. Also see "Go-Back."
Carbon Monoxide (CO)	A gas produced as a byproduct of the combustion process. CO is toxic to humans and animals because it "steals" oxygen atoms in the bloodstream and "starves" the body of oxygen. That can cause a variety of health problems and even death.
CAS Hazard	See "Combustion Appliance Safety (CAS) Hazard."
Catastrophic Leakage	A large amount of duct or shell leakage that must be documented by photographs, measurements of the gap, calculations, and a written description of the leakage. a. In ducts, catastrophic leakage is defined as a condition identified when: • The duct tester is in "open mode" and speed control is at maximum, and • Duct pressure no greater than 24 pascals is achieved. Examples include crushed or disconnected ducts, incomplete duct systems, or visible holes through the duct material that allow the escape of conditioned air. "Duct leak" repairs must be made in accordance with CSD Field Guide Appendix B, as long as no unresolvable CAS or Indoor Air Quality fails are present. a. In the shell (envelope), catastrophic leakage is defined as a physical gap(s), measuring at least 5 sq. in. of leakage calculated for a single measure location (e.g., a door, a window, etc.). "Shell leak" repairs must be made as long as no unresolvable CAS or Indoor Air Quality fails are present in accordance with

DEFINITIONS

	CSD Field Guide Appendix C.
Chandelier	A suspended luminaire (e.g., hanging from ceiling or attached to bottom of a ceiling fan) that incorporates exposed lamps as a decorative element. Sometimes referred to in the WIS as "cluster lighting."
Child or Children	Member(s) of a household who have not attained their 19th birthday.
Client Education	Includes, but is not limited to, providing client with written information describing energy-saving behavioral adjustments to decrease the energy consumption of the household; providing client with resource information, local agency referral; providing client with mold, radon, and lead-safe education, advising client of the benefits of weatherization; and showing client how to properly operate and maintain the installed weatherization measures.
Climate Zone (CZ)	The California Energy Commission established 16 climate zones that represent a geographic area and that have a particular weather pattern. These climate zones are based on energy use, temperature, weather, and other factors that determine the types of building standards that are subject to the Title 24 Energy Efficiency Standards and that determine the energy conservation measures that must be installed in a weatherized dwelling.
Closure System (Duct Closure System)	The sum total of components utilized to secure and seal a duct system joint or seam against air leakage (e.g., pressure sensitive tape, or heat activated tape, or mastic with fiberglass mesh reinforcement). Closure systems for non-metallic flexible ducts also include one or more drawbands.
CO	See "Carbon Monoxide."
Combustion Appliance	Combustion appliances that burn fuel. They include those using natural gas, propane (LP gas), fuel oil, wood, wood pellets, coal, or any other flammable liquid (e.g., kerosene) or combustible material.
Combustion Appliance Zone (CAZ)	The room or area of a home in which one or more open combustion appliances are located. The area is subject to pressurization or depressurization that can affect proper operation of the appliance(s). • Depressurization (negative pressure) in the CAZ is of greatest concern for natural draft appliances—typically a furnace, water heater, wood burning stove, or fireplace drawing combustion air from the living space. • The CAZ could be a living room containing a wood

	burning stove, a kitchen or utility porch containing a water heater, or an appliance enclosure containing a furnace and/or water heater. • Excessive depressurization of the CAZ can cause backdrafting and spillage of CO out of the draft hood and into the living space.
Combustion Appliance Safety (CAS) Client Advisory Condition	Client Advisory Conditions are nonconforming conditions that do not need to be corrected in order to weatherize or to install infiltration-reduction measures. They are reported to the clients (so they are made aware of the conditions), and are recorded in CASIF Section (D).
Combustion Appliance Safety (CAS) Fail	CAS Fails are conditions that must be corrected within 20 business days, but do not require immediate service (are not "Hazards"). They are recorded in CASIF Section (D). Infiltration-reduction measures must not be installed until all CAS Fails are corrected.
Combustion Appliance Safety (CAS) Hazard	A health-threatening condition associated with the operation of a gas or oil burning combustion appliance, which requires "immediate service" within 18 hours of identification. No weatherization measures shall be installed until all CAS Hazards are corrected.
Combustion Ventilation Air (CVA)	Adequate CVA is a room or space that has a volume of at least 50 cu. ft. per 1,000 Btuh of aggregated input rating of all fuel-burning space and water heating appliances installed in that space. In homes built in 2008 and later, cooking appliances and gas dryers must be added to the CVA calculation. There is insufficient CVA when there is *less than* 50 cu. ft. per 1,000 Btuh, and additional venting must be added or it is considered a CAS Fail.
Conditioned Space	An area, room, or space normally occupied and being heated or cooled by any equipment for human habitation. (CMC, §205.0.)
Conventional Home	A site-built dwelling unit (in contrast with a factory-built "manufactured" or "mobile" home). Note: Single-family dwellings must have a minimum living area of 330 sq. ft. to qualify for weatherization services.
Cover Plate Gasket	A pre-cut thin foam insulation material designed to fit behind the cover plate of an electrical box (switch or receptacle) to reduce infiltration.
Crawlspace Venting	Screened and/or louvered vents installed to provide crawlspace or foundation ventilation (airflow though the crawlspace) in a dwelling.

	Minimum NFVA venting requirements are described in CSD WIS Section 21.
CSD	The State of California Department of Community Services and Development.
Diagnostic Testing	A series of testing protocols performed under the weatherization program that uses specialized tools to assess: • The operating condition of combustion appliances for general safety and carbon monoxide emission levels. • Pressurized testing procedure to assess the integrity of building envelope and specific points of air infiltration. • Pressurized testing procedure that checks duct systems for leakage and outside air infiltration. Diagnostic tests shall only be performed by qualified individuals possessing the required skill and training needed to perform diagnostic testing activities.
DOE, DOE WAP separate	DOE is an abbreviation for the U.S. Department of Energy, which provides funds for the Weatherization Assistance Program (known as the "DOE WAP"). This program is authorized by Title IV of the Energy Conservation and Production Act (P. L. 94 385). The federal regulations for this program are in 10 CFR Part 440. The intent of this program is to increase the energy efficiency of low-income dwellings, reduce the occupant's total residential energy expenditures, and improve their health and safety.
Door Bottoms	Includes the door shoe, sweep, and threshold (which are door repair items, not "Weatherstripping").
Door Shoe	A rigid metal attachment to the bottom of a door that holds a pliable gasket material, which prevents air leakage under the door.
Drawband	A device which encircles a duct and mechanically secures the core-to-fitting attachment—i.e., a synthetic duct tie ("zip tie") or a worm-drive stainless steel clamp. Duct ties are also used to secure/seal flexible duct jackets (vapor barrier) and to secure fiberglass duct wrap.
Dual-Use Duct System	A duct system that is used to deliver air from both an evaporative cooler (in summer) and a forced air heating unit (in winter). Vent covers shall not be installed on such a system because the ducts are used to deliver heat and must not be blocked off.
Duct Closure System	See "Closure System (Duct Closure System)"

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Duct Insulation	Insulation material (faced or unfaced) applied to ducting to prevent transfer of heat through the duct walls. Retrofit duct insulation in weatherization programs is usually fiberglass “duct wrap” (1" to 2" thick) applied to the outside of rigid metal ducting located in an unconditioned space.
Duct System	All ducts, fittings, plenums, and fans assembled to form a continuous passageway for distribution of air. (CMC, §206.0.)
Dwelling Unit	A house, stationary mobile or manufactured home, apartment, group of rooms, or single room occupied as separate living quarters.
Elderly	An individual 60 years of age or older.
Electric Baseload Measure	A subset of weatherization measures designed specifically to reduce energy consumption in the areas of lighting and electrical appliances. Allowable electric base load measures include compact and torchiere fluorescent lamps, microwave ovens, refrigerator repairs/replacements, and electric water heater timers.
Elevators/Shims	See “Threshold Risers and Elevators/Shims.”
Energy Audit	An analysis tool for assessing a dwelling unit’s energy consumption and determining a list of cost-effective measures for a specific dwelling.
Energy Conservation Measures	Energy Conservation Measures (also known as weatherization measures) include a wide variety of measures installed in or applied to the dwelling to increase the energy efficiency or to reduce the total energy expenditures of the dwelling. For the DOE WAP, allowable measures and materials are defined in the Department of Energy Regulations, 10 CFR Part 440.
Essential Appliance	By CSD definition, an essential combustion appliance is a primary gas heater or primary gas water heater.
Evaporative Cooler	A device (appliance) that cools air through the simple evaporation of water. Evaporative cooling is especially well suited for climates where the air is hot and humidity is low. • The cabinet of an evaporative cooler has one or more sides equipped with a “pad” (a permeable material, also referred to as “media”) through which water will move and air can be pulled. The pad is wetted with water, and the fan inside pulls outside air through the pad. Evaporation of water in the pad lowers the temperature of the moving air, which is then pushed into the building. • The evaporation process adds moisture to the incoming

	air, which can cause air inside the building to become humid ("sticky") at higher temperatures outside. • Clients must be instructed to leave one or more doors, windows, and/or pressure relief passages open whenever the unit is operating, day or night.
Evaporative Cooler Repairs	Repair or replacement of filter pads, water pump, belt, motor, or other components that will promote efficient operation of the unit.
Factory-Built Housing	See "Modular Home."
Family Unit	All persons living together in a single dwelling unit.
FAU (Forced Air Unit)	That portion of a central heating and/or air conditioning system which contains the air handler (blower section). In a "split system," it is the furnace. In a "package unit," the combination heating or air conditioning unit may be referred to as the FAU.
Fluorescent Torchiere	A torchiere is a tall (5' to 6'), free-standing floor lamp with a weighted base. The word "torchiere" indicates a "torch-style" lamp with an upward-facing bowl-shaped reflector on top. A fluorescent torchiere uses a fluorescent lamp of any type or configuration (D-lamp, PL-lamp, etc.). In the CSD Weatherization Program, fluorescent torchieres are installed to replace existing halogen and other incandescent and floor lamps, which consume much more electricity than the fluorescent alternatives. If fluorescent light sources are not available, agencies may submit a waiver request to submit a LED torchiere lamp (LIHEAP only. This option is not available as a DOE measure.)
Gas Shutoff Valve	See "Automatic Gas Shutoff Valve" and "Appliance Line (Shutoff) Valve."
General Heat Waste (GHW) Measures	A subset of weatherization measures designed specifically to improve energy efficiency by reducing general heat and cooling waste within the dwelling. GHW Measures are listed in the CSD Field Guide, Section 7.1.
Go-Back	See "Call-Back."
Halogen	See "Quartz Halogen."
Hard-Wired Fixture	A fixture that is not plugged into an outlet, but rather is: • Mechanically attached to an electrical box with screws, and • Electrically connected directly to conductors extending from the electrical box. The term "hard-wired" is used because the conductors from the

	box are attached directly to the fixture's terminals with screws or "wire nuts." In contrast, a "plug-in" fixture has an electrical cord with a plug on the end, which is plugged into a receptacle.
Hazard, Hazardous Condition	Any condition posing an immediate health and safety threat to the client and/or persons working in the dwelling unit. Hazardous conditions include, but are not limited to: CAS hazards, appliance-related hazards, and electrical hazards as defined in the CSD Inspection Policies and Procedures. See also "Combustion Appliance Safety (CAS) Hazard"
Health and Safety Measures	A subset of weatherization measures installed to correct health and safety hazards generated by combustion or electrical appliances and to preserve or improve indoor air quality. These measures include carbon monoxide alarms, smoke alarms, kitchen exhausts, heating/cooling and water heater repairs and replacements, lead-safe weatherization and cooking appliance repair and replacements (LIHEAP only).
Heat-Activated Tape	Metallic duct-sealing tape with an adhesive coating that is activated and cured by the application of heat and pressure. Heat-activated tape is used only to seal joints in rigid fiberglass duct systems.
Heat Waste Measures	See "General Heat Waste Measures."
Heating/Air Conditioning Appliance Repairs	See "Appliance Repairs."
HEPA	HEPA stands for "High Efficiency Particulate Air." This is a filter that collects 99.97% of all particles greater than 0.3 microns in size. • Micron, a micrometer, is a unit of length in the metric system equal to one millionth of a meter (a meter is 39.37 inches). • One micron is 0.00003937 inches. A strand of human hair is about 100 microns wide.
HERS Rater	A HERS Rater, also referred to as a Home Energy Rating System (HERS) Provider, is an entity or individual recognized by the California Energy Commission with certification in necessary field and diagnostic testing verifications for demonstrating compliance with the Building Energy Efficiency Standards.
High-Efficacy, High-Efficacy Lighting	Title 24 specifies that new and replacement lights in bathrooms, garages, laundry rooms and outside on the front porch generally must provide high-efficacy lighting.

	"High-efficacy" generally means LEDs or pin-based fluorescent lighting—because the amount of light produced per watt of electricity is much higher than with incandescent bulbs. High-efficacy CFL fixtures must be "pin-based" rather than "thread-based;" however, LED fixtures may be thread-based to meet the high-efficacy definition.
High-Efficiency Toilet (HET)	A HET is a WaterSense labeled toilet that is rated at 1.28 GPF or less and has a MaP rating of 350 grams or greater.
House Depressurization Limit (HDL)	The maximum depressurization (negative pressure) acceptable in a given CAZ as explained in CSD Field Guide Appendix A. HDL is important with open combustion appliances, especially natural draft (with a draft hood) because they can back-draft and spill CO when negative pressure in the CAZ is too great.
Inaccessible Appliance	A combustion appliance that cannot be accessed for CAS testing due to a locked entry or a physical impediment. Examples include: • Appliance in locked room/enclosure with key not available. • Attic-mount furnace in a MUD apartment that requires entry through an inaccessible unit. • Floor furnace in a crawlspace with inadequate crawl clearance. • Floor furnace that has been covered over by plywood or attached floor covering (e.g., wall-to-wall carpet or vinyl). • Floor or wall furnace that has been turned off and blocked by heavy furniture (e.g., a hutch or cabinet).
Indoor Air Quality (IAQ) Fail	Infiltration-reduction measures shall not be installed when sources of air pollution are present that cannot be corrected. The following air quality contaminants are described in CSD WIS Section 1. They may cause serious health issues for clients and their families and would be considered an IAQ Fail unless correctable within the program scope: • Un-vented moisture sources, • Significant pet waste and odors, • Fumes from stored chemicals/volatile organic compounds, • Radon • Asbestos-Containing Materials, • Methane gas, • Biological hazards, • Combustion byproducts, etc.

	Any IAQ Fail must be corrected *before* infiltration-reduction measures may be installed. If a combustion appliance is creating an IAQ or CAS Hazard, the appliance shall be checked/serviced by a qualified technician or properly abandoned.
Infiltration-Reduction Measure (IRM)	Measure(s) installed in or applied to dwellings to reduce or stop infiltration—which is the uncontrolled flow of conditioned air out of the dwelling and outside air into the living space. Infiltration-reduction measures are primarily shell sealing measures, but duct sealing is also included (and completed before shell sealing). Additional IRM are: caulking, door repair/replacement, glass replacement, Minor Envelope Repairs, sliding glass door repair/replacement, interior vent covers, exterior door weatherstripping, other weatherstripping (access doors, windows, etc.), and window and sliding glass door repair/replacement.
Inoperable Appliance	An appliance that does not operate and therefore cannot be CAS tested until checked/serviced by a qualified technician. Most commonly applied to a gas-burning appliance in which the main burner(s) will not light.
Intake	Includes, but is not limited to, the process of completing an intake form and reviewing applicant documentation in order to verify eligibility.
Interim CAS Test	A minimum CAS test that must be performed on open combustion appliances when installation of infiltration-reduction measures has begun but is not completed at the end of a work day. • Applies to appliances that draw combustion air from the living space. This is especially important for natural draft units (which have a draft hood), because they can "spill" CO into the home.
kBtuh, kBtu/hr	See "Btuh, Btu/hr."
Labeled	See "Listed, Listing."
Lapped Seam	The seam (joint) formed where two pieces of material (usually sheet metal) are overlapped.
Lead De Minimis (DPH)	California Department of Public Health (DPH) requires: • In homes built before 1978, Lead Safe Weatherization (LSW) practices are required by CSD in any home where paint will be disturbed (most strict policy). • Agencies, field personnel and their supervisors, and all

	subcontractors are required to know and follow lead-safe practices for containment, clean-up, and certification. • Requirements for dealing with lead-based paint are outlined in CSD WIS Section 2.
Lead De Minimis (EPA RRP)	Environmental Protection Agency Renovation, Repair and Painting (RRP) Rule: a. Applies to any housing constructed prior to 1978, except housing type inhabited by the elderly or persons with disabilities (unless any child who is less than six years of age resides or is expected to reside in such housing) or any 0-bedroom dwelling. b. De minimis (minimum action) levels are: • Activities that will disturb more than 6 sq. ft. of painted surfaces on the interior of a building (per room), or more than 20 sq. ft. total on the exterior.
Lead De Minimis (HUD)	HUD Lead-Safe Housing Rule is required for all HUD public housing and Section 8 “Rental Assistance” clients when: a. HUD’s de minimis (minimum action) levels are exceeded, which are: • 2 sq. ft. of paint disturbance per interior room; or, • 20 sq. ft. on exterior surfaces. • 10% of the surface area of small building components (i.e., trim, window sill, baseboard) is disturbed. When calculating the de minimis level, the entire surface of the component must be included in the computation. See WIS Section 2 for additional guidance.
Lead-Free, Certified	Residential property that has been determined by a California Certified Inspector/Risk Assessor Contractor to be absent from the presence of lead-based paint
Lead-Safe, Certified	Residential property in which lead-painted surfaces are intact and/or have been treated with measures to stabilize and eliminate lead-paint hazards and that, as such, poses no immediate threat to the occupants as determined by a California Certified Inspector/Risk Assessor Contractor.
LED Bulb	An LED light bulb is a solid-state lighting device that uses light-emitting diodes (LED) to produce light. An LED is a semiconductor device that emits visible light when an electric current passes through it. LED bulbs with a standard threaded base may replace existing screw-in incandescent bulbs and CFLs. LED bulbs with a pin base are installed in pin-based sockets.

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LED Night-Light	A LED night-light is a night-light equipped with an LED light source rather than an incandescent bulb.
Limited Home Repair (LHR)	Those repairs that have a direct association with weatherization measures being installed, and are necessary for the effective performance or preservation of weatherization materials. LHR shall include: • Kitchen cabinet repairs and retrofits that are associated with the replacement of a range, cook top, or existing microwave oven. No other cabinet repair or retrofit shall be allowed without a program waiver. • Repairs necessary to restore building integrity and limited to the following repairs: o Floor/platform repair for heating, cooling, or water heating appliances. o Cover plate replacement. o Minor roof repairs and materials. o Mobile home skirting repairs to prevent animal infiltration. o Minor exterior appliance access. o Limited rehabilitation to replace deteriorated wooden window or door frames, to make possible the proper installation of a replacement door or window. o Extension of exhaust fan vents or dryer venting to the outdoors. (It is not acceptable to vent to the attic or crawlspace.) o Repair/installation of an exterior appliance enclosure door that does not close properly or is missing, only when appliance services will be provided under the program. LHR shall *not* include: • Any other measure or associated incidental repair that has a chargeable line item, including Minor Envelope Repair items. • Repairs to the dwelling that are outside of the program scope, including but not limited to, handicap ramps, major roof repairs, or correction to structural issues that are a mandatory deferral condition.
Listed, Listing	Equipment or materials included in a list published by a nationally recognized testing agency (e.g., UL, CSA, ITS, ETL, Warnock Hersey, etc.) that maintains periodic inspection of the production of listed equipment or materials. Listing indicates compliance with nationally recognized standards. Listed appliances and components must be installed in a manner that complies with the “terms of the listing”

	(i.e., in accordance with manufacturer's instructions). Also known as "Labeled" and "UL Classified."
Longitudinal Joint	Lengthwise joint along a piece of rigid metal duct (e.g., the joint running the full length of a snap-together sheet metal duct). (Note: *longitudinal* means "lengthwise" ... in contrast to *transverse,* which means "across.")
Low-Flow Showerhead	Low-Flow Showerheads have a flow rate less than or equal to 2.0 gallons per minute.
Luminaire	A complete lighting fixture. A luminaire includes the light source/lamp, the reflector for directing the light, an aperture/opening (with or without a lens/diffuser), the outer shell/housing, an electrical ballast (if required), and connection to a power source.
Mandatory Measures	Weatherization measures required by a program to be performed, where applicable and feasible. In other words, if a Mandatory Measure is feasible, it must be installed (installation is *not* optional).
Manufactured Housing	See "Mobile Home."
Materials	Materials are those allowable items that are installed in or on the dwelling to promote energy conservation. All materials must be in conformance with the CSD WIS Appendix A (Material Specifications).
Measure in Place	A weatherization measure that (a) already exists, (b) is in serviceable condition, and (c) functions properly—even if not installed in accordance with current installation standards. This makes replacement not feasible unless specifically allowed by CSD.
Mini-Split Air Conditioner or Heat Pump	Mini-split units condition air like a central HVAC system, but they are much smaller and there are no ducts. They are easily installed and their energy consumption is low compared to central systems. Installation of any mini-split system requires a program waiver. • The outdoor condenser unit is relatively small, and the refrigerant lines and wiring come through the wall in a small-diameter conduit. • The indoor air-handling unit is mounted on a wall in front of the conduit. The indoor unit looks like a wall-mount air conditioner or a PTAC, but it is surface-mounted rather than extending through the wall, and it does not contain a condensing unit. Some mini-split systems have several indoor units to condition multiple rooms (zones) in the home.

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Minor Envelope Repairs (MER)	MER are those repairs that have a direct association with weatherization measures being installed, and are necessary for the: 1) effective performance or preservation of weatherization materials, or 2) to stop infiltration and general heat waste. MERs shall be limited to the following: • Identified infiltration repairs, including the patching of holes in the building envelope (ceiling, floor, or walls) to the exterior that are too big to caulk; • Sealing of thermal bypasses when no insulation will be installed; • Replacement of missing or broken attic/crawl space access covers, installation of an access where one does not exist, or enlargement of an existing access; • Fireplace chimney damper repair or installation, or installation of glass fireplace doors when a replacement damper is not feasible. MERs shall NOT include: • Any other measure or associated incidental repair that has a chargeable line item, including Limited Home Repair (LHR) items. • Repairs to the dwelling that are outside of the program scope, including but not limited to, handicap ramps, major roof repairs, or correction to structural issues that are a mandatory deferral condition.
Mobile Home (Manufactured Housing)	A mobile or "manufactured home" is regulated by HUD and is built on a trailer chassis and designed for highway delivery to a permanent location. It can be a single-, double- or triple-wide home. To receive weatherization services under a CSD program, a mobile home must be a permanent, full-time residential dwelling, with a floor area of at least 320 sq. ft., it must be more than 8' in width, and more than 40' in length. A "modular home" is not the same as a mobile home.
Modular Home (Factory-Built Housing)	In California, "modular homes" are called "factory-built housing" and are subject to Title 24 and the CA Residential Code—not the HUD code. Alteration permits are issued/inspected by the local building department, not HCD. A modular home has framing characteristics similar to a conventional home and is built for permanent installation on a foundation. It is not built on a trailer chassis, it does not have axles, wheels or license plate, and it is transported in one or more sections on a dolly or trailer. To receive weatherization services in CSD programs, a modular home must be a permanent, full-time residential dwelling with a

	floor area of at least 330 sq. ft.
Multi-Family	See "Multiple Unit Dwelling (MUD)"
Multi-Family Central Water Heating System	A water heating system that provides hot water for more than one residential unit of a multi-family complex.
Multiple Unit Dwelling (MUD)	Within local code, a MUD is defined as residential dwelling structures containing more than one residential unit within a single building or complex. Within CSD's programs, a MUD (also known as Multi-Family Building (MFB) or multi-unit apartment complex) is defined as residential dwelling structures containing two or more attached residential units within a single building, including duplexes, triplexes, fourplexes, and multi-unit apartments. For purposes of travel reimbursement to contractors and shell leakage testing, MUDs are defined as multi-unit dwellings, e.g., apartments, with five or more attached residential units.
NFPA 90B	Standards governing installation of "Warm Air Heating and Air Conditioning Systems" in one- or two-family dwellings and structures not exceeding 25,000 cu. ft. (NFPA 90A applies to larger structures). It provides specifications for the manufacture and installation of rigid metal ductwork and references UL 181 regarding factory-made air ducts (e.g., flexible ducts and rigid fiberglass ducts).
NFV Area	See "NFVA."
NFVA, Net Free Venting Area	NFVA is "net free ventilation area" (sometimes written "NFV Area"). • It is the net amount of venting (open) area provided by a vent, after the blocking effect of mesh and/or louvers has been subtracted from the gross area of the vent opening. • NFVA = [total area of the opening] *minus* [space occupied by screen and/or louvers present in the vent opening].
NIM	NIM means "**N**o **I**nfiltration **M**easures" shall be installed. When a home is NIM, only non-infiltration reduction measures are installed. The most common cause is the presence of a combustion appliance safety (CAS) or indoor air quality fail that cannot be resolved within the weatherization program.
Nonconforming	Usually used in reference to an appliance or component that does not meet code, such as an unlisted or improperly-vented

	gas appliance, or a vent pipe with improper termination or inadequate clearance to combustibles.
Non-essential Appliance	By CSD definition, a non-essential gas appliance is a gas appliance that does not qualify for repair or replacement under the CSD weatherization programs, such as a gas clothes dryer, secondary gas heat source, or portable heater. Also see “Essential Appliance”
Non-operable (Non-op) Appliance	See “Inoperable Appliance”
Occupancy Sensor	An Occupancy Sensor is an electronic device that detects the presence of a person in the room/area where a light fixture is located and operates the fixture circuit. These are not permitted under the program. Also see “Vacancy Sensor.”
Operable	Applies to a component (e.g., window or door) or an appliance. The item is considered “operable” when it properly operates (opens/closes, runs, functions, etc.). Also see “Non-op Appliance.”
Operable Appliance	A heating or cooling appliance that operates when started and provides conditioned air below the ambient air temperature.
Opportunity (Sealing)	See “Duct Sealing ‘Opportunity’ (Start CFM_{25})” and “Shell Sealing ‘Opportunity’ (Start CFM_{50})
Overcurrent Protection	An electrical protection device (circuit breaker or fuse) designed to break (disconnect) the circuit if current exceeds the amount for which the wiring and other components are designed. Tamper-proof overcurrent protection (required when insulating over Knob-and-Tube wiring), is a circuit breaker or a special “S-type Fuse.” An S-type Fuse fits into a special threaded adapter permanently installed in the fuse socket. The adapter will accept *only* a fuse with the correct amperage rating—which prevents a fuse with too high a rating from being installed and possibly causing a fire from over-heated wiring.
Package Terminal Air Conditioner (PTAC)	A self-contained, non-ducted air conditioning/heating unit that is normally mounted through an outside wall. It is usually larger than a typical wall-mount air conditioner and is most commonly seen in motel rooms and apartments. Installation of a PTAC will require a program waiver because it provides heating and cooling and may conflict with the CSD policy to only provide repair/replacement to a “primary” source.
Package Unit	An air conditioner, or a combination heating and air conditioning

	system, contained within one housing unit that is installed outdoors (on the roof or on a slab next to the house). A combination heating and air conditioning unit may also be called a "Dual Pack." (Also see "Split System.")
Pascal (Pa)	A small unit of pressure equal to 0.004 IWC. • 1 Pa = 0.004 IWC, and 1 IWC = 250 Pa. • 25 Pa, the pressure typically used for Duct Leakage Testing, is equivalent to 0.1 IWC. • 50 Pa, the pressure typically used Shell Leakage Testing, is equivalent to 0.2 IWC. • Conversion formulas are: [Pa = IWC ÷ 0.004] and [IWC = Pa x 0.004].
Perm	A unit of permeance, which refers to how permeable a material is (i.e., how well moisture will pass though it). Vapor barriers are rated in perms.
Pin-Based CFL	Pin-based CFLs *plug* in, rather than *screw* in CSD requires that replacement light fixtures provide "high-efficacy" lighting fixtures. That requires installation of ENERGY STAR® certified pin-based CFL fixtures—and means thread-based (screw-in) lamps cannot be used. • This requirement prevents thread-based CFLs from being installed and later being replaced with screw-in incandescent bulbs that fit the same size socket (but use four times the energy). Also see "High-Efficacy" and "Thread-Based CFL."
Plenum	An air compartment or chamber or building cavity to which one or more ducts are connected. (CMC, §218). • The plenum forms part of either the supply-air or return-air system. • Typically on residential HVAC systems, the supply and return plenums are the large rectangular boxes/chambers that connect the FAU to the supply-air duct system and the return-air system. • FAUs in garages and hallway closets often rest on a "platform" building cavity that constitutes the return plenum, referred to as a "platform return." Unlined platform returns are considered catastrophic leakage.
Pressure Sensitive Tape	Duct tape with a tacky adhesive coating (butyl, acrylic, etc.), which will adhere to a surface with the application of pressure (heat not required). Duct tapes used in CSD programs must be listed and marked per UL 181A and 181B standards.

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Primary Heating/Cooling	Where identified through standard measure diagnostics and assessment protocols, malfunctioning, "red tagged," inoperable, or nonexistent heating (or cooling) system replacement, repair, or installation is allowed under the CSD Weatherization Program where climatic conditions warrant, unless prevented by other program policy. When a home has *more than one* heating or cooling source, one of the following shall be considered the primary unit: • The appliance that provides conditioned air for the dwelling's primary common living area (i.e., occupied during waking hours), or • The unit providing conditioned air to the largest volume of living space, or • The unit with the largest heating/cooling capacity/output (Btuh or tons). Portable heaters shall not be considered a primary heat source. Only the primary heating and/or cooling source (one unit per dwelling) shall be repaired or replaced. It may be the one that provides: • Heating only, or • Cooling only, or • Heating and cooling. Note: An operable secondary system does not preclude repair/replacement of a defective primary heating and/or cooling system. In a two-story home that has a separate heating and/or cooling source on each floor, the unit on the ground floor is considered the primary heating and/or cooling source, with the following *exceptions*: • If the larger capacity/output unit is upstairs, it may be considered the primary unit. • A multi-story home may be constructed with a synchronized system, i.e., one FAU and duct system per story, designed to run concurrently. Repair or replacement of components to the synchronized system may be allowed through approval of a CSD programmatic waiver only.
Priority List	The subset of energy conservation measures determined to be cost effective by a measure evaluation process. In the DOE WAP, these measures may be installed in a dwelling in the specified climate zone without performing an energy audit.
Programmable Thermostat	A thermostat with a clock and internal program that

	automatically lowers (sets back) or raises (sets up) the room temperature control, so the HVAC unit will turn on only when needed and turn off when not needed for occupant comfort. • A programmable thermostat is usually programmed to lower the room temperature setting by about 10°F in winter (raise it in summer) when the home is unoccupied and during sleeping hours. • It then brings the HVAC unit back on a short time before occupants return home or get up in the morning.
PTAC	See "Package Terminal Air Conditioner (PTAC)."
Qualified Technician (for Appliance Service/ Repair/Replacement)	Qualified persons to work on electric or gas combustion appliances include: • C-20 (HVAC) contractors for furnaces and air conditioners • C-36 (Plumbing) contractor for water heater repair or replacement • C-10 (Electrical) contractor for electrical repairs • D-34 (Specialty) major gas appliance installations (including gas cooking appliances) and ventilating hoods in connection *with existing fuel and energy lines that were installed by others*. • Utility and propane company gas service technicians for gas appliances.
Quartz Halogen	A type of incandescent lamp that is very compact and puts out high intensity light and heat. • Quartz halogen torchiere lamps are very hot and can ignite flammable materials that come close to the lamp (bulb). • They also consume much more energy than fluorescent lamps, which is why existing quartz halogen torchiere lamps are exchanged for replacement compact fluorescent models in the CSD Weatherization Program.
Recreational Vehicle	A travel trailer, motor home, bus, truck camper or camping trailer that was originally designed as a temporary living quarters and could be self-propelled or mounted on or drawn by another vehicle. It also does not fit the definition of a "Mobile or Manufactured Home." This type of unit is excluded from weatherization services.
Re-weatherization	Once a dwelling has been submitted to CSD as a completed unit, any subsequent weatherization services provided to the dwelling are considered "Re-weatherization." Policies for re-weatherization are determined by funding type, and are

	described in the Field Guide, section 3.7.
Ride-Along	A representative of the agency who accompanies a designated third-party or CSD inspector who is performing on-site inspections. CSD requires that, to the extent possible, a ride-along be sufficiently trained to make necessary corrections during inspections, thereby minimizing or eliminating the need for return trips that may inconvenience the client and/or require re-inspection in accordance with the CSD Inspection Policies and Procedures.
Risers	See “Threshold Risers and Elevators/Shims.”
Rodent Barrier	A thin rigid or flexible material attached to the bottom of the floor supports (joists) of a mobile home to keep rodents out of the insulation and underfloor area. (Also known as “Bellyboard.”)
Room Air Conditioner or Cooler	A wall- or window-mount unit (without ducts) that serves a limited portion of the living space, usually just one room or area. The front of the unit is indoors, and the rear of the unit is outdoors. Wall mount units require a hole through the wall the size of the appliance body. Also see “PTAC,” which is physically similar (it extends through the wall) but is usually larger, and “mini-split,” which has an air-handling unit mounted entirely indoors and only a small conduit (with refrigerant lines and wires) extending through the wall to an outdoor unit.
R-value	R-value is a measure of a material’s resistance to the movement of heat through it. • Insulation is rated by R-value, and the higher the number, the better its ability to resist heat flow. See CSD Field Guide Feasibility Criteria for Ceiling, Floor, and Wall Insulations.
Sconce	A type of light fixture attached to a wall in such a way that it uses only the wall for support, and the light is usually directed upward. It can be a single- or multi-lamp luminaire.
Secondary Appliance	When a client has more than one type of appliance served by the program (i.e., heaters, cooling sources, water heaters, refrigerators, or cooking appliances), Assessors shall identify the secondary appliance. (See “Primary Heating/Cooling” definition.) All repair and replacement services are limited to a dwelling’s primary appliance only. Secondary appliances shall not qualify for the Weatherization Program.
Separate Living Quarters	Living quarters in which the occupant(s) do not live and eat with

	any other person(s) in the structure and which have either: (1) direct access from the outside of the building or through a common hall; or (2) complete kitchen facilities for the exclusive use of the occupant(s). The occupant(s) may be a single-family, one person living alone, two or more families living together, or any other group of related or unrelated persons who share living arrangements.
Service—Appliance	See "Appliance Service."
Shade Screen, Solar Shade Screen	Shade screens utilize a mesh fabric that blocks some of the sun's rays from coming in through the windows, while allowing occupants to see out. The screen's ability to block sunlight is called "shading coefficient," and the smaller the number, the less sunlight (and heat) allowed into the home. Shade Screens installed in the CSD programs must have a shading coefficient in accordance with CSD WIS Appendix A.
Shower Arm	The curved pipe extending from the shower wall onto which the showerhead is attached (sometimes also called a "neck").
Single-Family Dwelling	A single-family dwelling is defined as a detached dwelling structure containing no more than one dwelling unit. In contrast to this definition, see "Multiple Unit Dwelling (MUD)."
Site-Built Dwelling	A conventional single-family dwelling unit built on location, differentiated from manufactured (mobile) homes. Also known as "stick-built."
Smoke Test	See "Visual Draft Test."
Solid Fuel Heating Appliance	A combustion appliance that burns solid fuel—wood, wood pellets, or coal. It can be a free-standing stove, fireplace insert, or fireplace.
Solid-State Timer	A timer that utilizes an electronic-based timing mechanism, as opposed to a mechanical or wind-up timer.
Spillage	In an open combustion *natural draft* appliance (which has a draft hood), spillage is the unwanted outflow of combustion gases through the draft hood and into the room/space containing the appliance. Spillage occurs when the vent system draft is not adequate to carry combustion gasses up through the vent pipe and outdoors. • Brief spillage occurs when combustion first begins in a cold appliance, because cold air in the vent pipe impedes exhaust flow, until the system warms up. • Occasional spillage may be caused by wind gusts creating pressure at the vent termination.

	• Continuous spillage (a CAS Hazard) may result when (a) the vent pipe is blocked by an obstruction or is improperly constructed (too short, too many elbows, improper slope or diameter, etc.), or (b) when there is excessive negative pressure in the appliance location (the CAZ). This is a CAS Hazard.
Spillage Test	A test for spillage performed all along the entire draft hood opening. A mirror or the sense of touch (e.g., back of the hand) is used to detect hot moisture—which will be present if combustion gases are "spilling" out through the draft hood opening. • The mirror will "fog up" when it comes into contact with hot moisture from spillage. • Spillage will feel hot and moist on the back of the hand.
Split System	A heating and cooling system in which: • The air conditioning evaporator coil (the "inside" coil) is attached to the furnace, which is located indoors (typically in the garage, attic, basement, or interior closet), and • The condenser unit (with "outside" coil, compressor, and fan) is installed outdoors, usually on a slab next to the house. Also see "Mini-Split Air Conditioner or Heat Pump" and "Package Unit."
Storm Windows	A fixed or operable window installed on the exterior of a framed-in window to reduce infiltration and heat loss/gain.
Structural/Engineering Issues	During assessment, or once weatherization work has begun in a home, if these structural or engineering issues are identified or environmental/health and safety hazards are discovered, the issue shall be documented and work must stop until the agency re-obtains property owner permission for the revised scope of work. Examples of these issues include but are not limited to: • Need to relocate an appliance such as a furnace, water heater, or air conditioner. • Feasibility of windows or wall insulation (which may change the appearance of the building exterior). • Need to add an enclosure to house an appliance. • Need to re-size window or door to meet egress requirements, when required by local jurisdiction. • Need to add ventilation/venting in an unusual location or

	with an unusual appearance. • Rehabilitation of framing materials around a door or window, that would change the dwelling appearance. • Addition of a whole-house mechanical ventilation system. • HPO measure replacement, which might change the historic value of a dwelling measure. • Notification of the presence (or potential) for a hazardous material (such as vermiculite, asbestos, raw sewage, etc.) which would require clean-up by the landlord's certified contractor for weatherization work to continue.
Substandard (Construction)	A feature that does not comply with current code or the WIS, or is unsafe or creates an unsafe (or hazardous) condition. Examples include the following: • An unsound ceiling structure that will not support the weight of the installer plus added insulation—such as 2" x 4" joists 48" OC, bowed and sagging joists, or 1/4" drywall ceiling. • A sagging roof with improperly sized or spaced rafters. • Wall sheathing that is too thin and is weak or bowed.
T&P Valve (TPV)	A safety valve required on water heaters that releases water (and thus relieves pressure) if either the temperature or pressure in the tank gets too high. Temperature relief is typically set at 210°F, and pressure relief at 125 to 150 psi. T&P valves are very important because an overheated water heater can explode and cause considerable injury and/or property damage. T&P valves must have a gravity drain line to the outdoors. Also see "Automatic Gas Shutoff Valve."
Thermal Shutters	Insulated devices that are designed to cover windows to prevent heat flow through the window. They can keep summer heat out and winter warmth in.
Thermostatic Shower Valve, Thermostatic Showerhead	A valve installed in a shower that reduces water flow to a trickle when water temperature reaches a preset level. Manual activation restores water flow. A thermostatic shower valve reduces energy waste when a person turns on the shower to warm up and leaves it unattended beyond the time required for hot water to reach the showerhead. It can be a separate component or built into the showerhead.
Thread-Based CFL	A CFL with a standard E27 "Edison" thread (screw) base. Thread-based CFLs are installed in energy efficiency programs

	to replace standard incandescent bulbs—because, for the equivalent amount of light, CFLs use about 25% of the electricity consumed by the incandescent bulbs they replace. Also see “Pin-Based CFL” and “High-Efficacy.”
Threshold Risers and Elevators/Shims	Threshold Risers are installed on top of the threshold to increase its total height (profile). Elevators and shims are placed underneath the threshold to raise it up, so its top surface is higher above the floor. Note: The topmost surface of the threshold or riser must not exceed the maximum height specified in the WIS.
Tier 2 Audio-Visual Advanced Power Strip	A Tier 2 Audio-Visual Advanced Power Strip is a “smart” power strip, equipped with an infrared sensor and/or a motion detector, that automatically turns off “switched” outlets when any of the following conditions occurs during a preset period of time: • An infrared remote control signal has not been received, or • Motion has not been detected within the vicinity of the sensor, or • The controlling device has been turned off by the user.
Torchiere	See “Fluorescent Torchiere.”
Transverse Joint	The joint formed when two pieces of duct are spliced together (e.g., the joint around the circumference where two round ducts are joined together, and the joint around the perimeter where two rectangular ducts are joined together). Note: *transverse* means “across,” in contrast with *longitudinal*, which means “lengthwise.”
UL Class 0 Duct	Air duct materials having a fire hazard classification of zero (flame spread and smoke developed).
UL Class 1 Duct	Air duct materials having a flame-spread rating of not over 25 without evidence of continued progressive combustion and a smoke-developed rating of not over 50.
UL Classified, UL Labeled, UL Listed, UL Recognized	• **UL Classified** means that UL testing was limited to examination of one potential hazard. • **UL Labeled** means that a product is either UL Listed or UL Classified. Note that a product can be certified and “listed” without involving UL. Other accredited laboratories (e.g., CSA International, ITS Intertek Services, ETL SEMKO, Warnock Hersey, etc.) can test products and certify conformance with established standards. Such products can thus be “listed and labeled” without reference to UL. (See “Listed.”)

DEFINITIONS

	• **UL Listed** means that UL testing included examination of all foreseeable hazards. • **UL Recognized** means that a component (such as a motor) is approved for use in a UL Listed product (such as an evaporative cooler). The complete cooler is UL Listed, but the tested and approved components used in it are "UL Recognized components." Each UL Recognized component is tested to a UL standard applicable to that component, and it is "recognized" for use in a UL Listed product.
Unusually Tight Construction	Homes with the following construction features: • Walls and ceilings exposed to the outside atmosphere have a continuous water vapor retarder rated 1 perm or less, with all openings sealed; • Weatherstripping on openable windows and doors; and • Caulking or sealants applied to areas such as joints around window and door frames, between sole plates and floors, between wall-ceiling joints, between wall panels, and at plumbing and wiring penetrations and other openings. (CMC, §223.0.)
Useful Life	Useful life means the length of time a weatherization program measure is expected to be useable. Useful life terms are defined in the CSD contracts.
Vacancy Sensor	A Vacancy Sensor is turned on *manually* (does not come on automatically when a person enters the room). It keeps the light on when occupancy is detected, and it automatically turns off the circuit after occupancy is no longer detected.
Vanity Light (Wall-Mounted) or "Hollywood Light"	A multi-lamp fixture made up of a strip of globe lamps, usually mounted next to, above, or around a mirror.
Visual Draft Test	A draft test performed on an open combustion *natural draft* appliance utilizing "smoke" from a smoke pencil, smoke puffer, incense stick, extinguished match, etc. Smoke is applied all along the draft hood opening. • If smoke is drawn inward, draft is considered adequate, and the appliance "passes." • If smoke floats around the draft hood or is pushed away, the appliance "fails" the draft test. Backdrafting and spillage will cause that to happen.
Vulnerable Populations	Young children (ages 5 years or younger), disabled, and elderly persons (ages 60 or older).
Wall- or Window-Mount	See "Room Air Conditioner or Cooler."

DEFINITIONS

Air Conditioner or Cooler	
Weatherization Program	Weatherization services provided under the CSD-administered DOE, LIHEAP, and ECIP federal contracts. Additional short-term contracts/programs such as LIWP and HET programs may be added upon CSD decision.
Whole-House Mechanical Ventilation Fan	In the ASHRAE 62.2 Standard, mechanical ventilation is defined as "the active process of supplying air to or removing air from an indoor space by powered equipment such as motor-driven, ducted fans and blowers (exhaust, supply, or balanced [heat recovery ventilators or HRVs and energy recovery ventilators or ERVs], but not by devices such as wind-driven turbine ventilators and mechanically operated windows."
Window Film	A thin, flexible, plastic vinyl material with UV-, infrared-, and/or light-blocking components. It is applied to the interior side of window glass to block some of the sun's rays from coming into the home. The film's ability to block sunlight is called "shading coefficient," and the smaller the number, the less sunlight (and heat) allowed indoors. Window film installed in the CSD programs must have a shading coefficient in accordance with CSD WIS Appendix A.

REFERENCED STANDARDS

AAMA 1701.2	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors
AAMA 1704	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors
AAMA/NWWDA 101/I.S. 2-97	Voluntary Specifications for Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors
ANSI Z21.10.1	Gas Water Heaters, Volume I, Water Heaters with Input Ratings of 75,000 Btu per Hour or Less
ANSI Z21.10.1-Addendums 1a-1991	Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less
ANSI Z21.10.1-Addendums 1b-192	Gas Water Heaters, Volume I, Storage Water Heaters with Input Ratings of 75,000 Btu per Hour or Less
ANSI Z21.11.1	Heaters, Vented Room, Volume 1
ANSI Z21.1-2005	Household Gas Cooking Appliances
ANSI Z21.15	Manually Operated Gas Valves
ANSI Z21.22	Relief Valves for Hot Water Supply Systems
ANSI Z21.24	Connectors for Gas Appliances [UMC 1312.1(3)]
ANSI Z97.1	Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Testing
ANSI/AAMA 1002.10. 0	Voluntary Specifications for Insulating Storm Products for Windows and Sliding Glass Doors
ANSI/AAMA 101-93	Aluminum and Polyvinyl Chloride (PVC) Prime Windows and Glass Doors
ANSI/ACCI 1 Manual D	Residential Duct Systems
ANSI/ASME A112.18.1M	Plumbing Fixture Fittings
ANSI/BHMA A156.1	Butts and Hinges
ANSI/NWWDA I.S.6	Wood Site and Rail Doors
ANSI/SDI 100	Steel Doors and Frames

REFERENCED STANDARDS

ANSI/UL 2034-09	Single & Multiple Station Carbon Monoxide Detectors
ANSI/UL Standard 935 Class-P	Fluorescent Lamp Ballasts
ARI Standard 680	Residential Air Filter Equipment
ASHRAE	Equipment, Applications and Fundamentals Volumes
ASHRAE 62.2	Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
ASHRAE 90.1b	Addendum B, Energy Standard for Buildings Except Low-Rise Residential Buildings
ASTM D2665	Standard Specification for Polyvinyl Chloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM A164	Specification for Electrodeposited Coatings of Zinc on Steel
ASTM A165	Specification for Electrodeposited Coatings of Cadmium on Steel
ASTM A361/361M	Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process for Roofing and Siding (Withdrawn 1995) [This code is used in Section 20-B of the WIS]
ASTM B117	Standard Practice for Operating Salt Spray (Fog) Apparatus
ASTM C1289	Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
ASTM C1311	Specification for Solvent Release Sealants
ASTM C509	Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
ASTM C516	Specification for Vermiculite Loose Fill Thermal Insulation
ASTM C534	Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form
ASTM C549	Specifications for Perlite Loose Fill Insulation

REFERENCED STANDARDS

ASTM C578	Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation
ASTM C612	Standard Specification for Mineral Fiber Block and Board Thermal Insulation
ASTM C665	Specifications for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
ASTM C669	Specifications for Glazing Compounds for Back Bedding and Face Glazing of Metal Sash
ASTM C726	Specifications for Mineral Fiber Roof Insulation Board
ASTM C739	Specification for Cellulosic Fiber (Wood-Base) Loose Fill Thermal Insulation
ASTM C764	Specification for Mineral Fiber Loose Fill Thermal Insulation
ASTM C834-95	Specification for Latex Sealants
ASTM C920-98	Specification for Elastomeric Joint Sealants
ASTM D1044	Standard Test Method for Resistance of Transparent Plastics to Surface Abrasion
ASTM D1785	Standard Specification for Polyvinyl Chloride (PVC) Plastic Pipe, Schedules 40, 80, and 120
ASTM D2564	Standard Specification for Solvent Cements for Polyvinyl Chloride (PVC) Plastic Piping Systems
ASTM D2665	Standard Specification for Polyvinyl Chloride (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
ASTM D2794	Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation
ASTM D3359	Standard Test Methods for Measuring Adhesion by Tape Test
ASTM D3363	Standard Test Method for Film Hardness by Pencil Test

REFERENCED STANDARDS

ASTM D4028	Standard Specification for Solar Screening Woven from Vinyl-Coated Fiber Glass Yarn
ASTM D4637	Standard Specification for EPDM Sheet Used in Single-Ply Roof Membrane
ASTM D522	Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings
ASTM D756	Practice for Determination of Weight and Shape Changes of Plastics Under Accelerated Service Conditions (Withdrawn 1998) [This code is used in Section 29 of the WIS]
ASTM D870	Standard Practice for Testing Water Resistance of Coatings Using Water Immersion
ASTM E84	Test method for Surface Burning Characteristics of Building Materials
California Building Code-Chapter 24	Glass and Glazing
California Building Code-Section 215	Noncombustible (definition)
California Electrical Code-Sections 110-14	Electrical Connections (Code requirements addressing conductors of dissimilar materials, terminals, splices, and temperature limitations)
CBC, Article 2406.3	Safety Glazing
CBC, Article 2602.4	Identification of Light Transmitting Plastics
CBC, Section 1026	Emergency Escape and Rescue
CBC, Section 1026.2	Minimum Size of Emergency Escapes and Openings
CBC, Section 2406	Safety Glazing
CEC Article 240	Overcurrent Protection
CEC Article 394, Sect. 394-12	Concealed Knob-and-Tube Wiring—Uses Not Permitted
CEC Article 394-4	Concealed Knob-and-Tube Wiring
CEC Article 440, Part B	Air Conditioning and Refrigeration Equipment—Disconnecting Means

REFERENCED STANDARDS

CEC Article 440, Part C	Air Conditioning and Refrigeration Equipment—Branch Circuit and Ground Fault
CEC Article 440, Part III	Air Conditioning and Refrigeration Equipment—Not Incorporating a Hermetic Refrigerant Motor Compressor
CEC, Section 430-11	Motors, Motor Circuits, and Controllers
CEC/BES 2013, Subchapter 7 §150(h) & §151(b)	Building Efficiency Standards
CEC/RCM, Section 8.4	Residential Compliance Manual— Mixed Occupancy Buildings
CEC/RCM, Section 8.4.2	Residential Compliance Manual—Mixed Occupancy Buildings
CMC §701.2.1	Combustion Air—Pressure Difference
CMC §701.2.2	Combustion Air—Pressure Difference
CMC §701.3	Combustion Air—Indoor Size and Location
CMC §701.4	Combustion Air—Outdoor Combustion Air
CMC §907.2(3)	Installation of Decorative Appliances in Vented Fireplaces.
CMC §912.0	Floor Furnaces
CMC §912.9	Floor Furnaces—Seepage Pan
CMC §928.0	Wall Furnaces
CMC Article 802.6	Chimneys and Vents—Marking
CMC Article 803.0	Sizing of Category I Venting Systems
CMC Chapter 7	Combustion Air
CMC Chapter 8	Chimneys and Vents
CMC Section 1106.0	Refrigeration—Prohibited Locations

REFERENCED STANDARDS

CMC Section 1106.3	Refrigeration—General Requirements
CMC Section 308	General Requirements—Location
CMC Section 916.0	Household Cooking Appliances
CMC, Chapter 13	Fuel Gas Piping
CMC, Section 305	General Requirements—Access
CMC, Section 912.1	Floor Furnaces—Installation
CPC Chapter 5, Part II	Water Heaters—Definitions
CPC Section 507.0	Water Heaters—Combustion Air
CPC Section 509	Water Heaters—Prohibited Locations
CPSC 16 CFR Part 1209	Interim Safety Standard for Cellulose Insulation
CPSC 16 CFR Part 1404	Cellulose Insulation
CRC 2013	California Residential Code
CRC 2013, §308	Glazing
CRC 2013, §308.1	Glazing—Identification
CRC 2013, §308.4	Glazing—Hazardous Locations
CRC 2013, §310.1	Emergency Escape and Rescue Openings
CSA 6.10	Connectors for Gas Appliances
F.S. A-A-1556A	Duct Installation and Sealing Standards
F.S. A-A-272A	Caulking Compounds
F.S. HH-I-1972/1	Insulation Board, Thermal, Polyurethane or Polyisocyanurate, Faced with Aluminum Foil on Both Sides of the Foam
HUD MHCSS Section 3280.703	Heating, Cooling and Fuel-burning Systems—Minimum Standards
HUD MHCSS Section 3280.705	Heating, Cooling and Fuel-burning Systems—Gas Piping Systems
IBC Section 2406	Safety Glazing

REFERENCED STANDARDS

IRC Section R308	Safety Glazing
NEC 2013	National Electrical Code—Table 310.16
NFPA 101	Life Safety Code
NFPA 255	Surface Burning Characteristics of Building Materials
NFPA 72 §17.7.3.2.4	Spot-type Smoke Detectors—Spacing
NFPA 80	Fire Doors & Other Opening Protectives
NFPA 90B	Installation of Warm Air Heating & Air Conditioning Systems
NFPA-501A	Fire Safety Criteria for Manufactured Home Installations, Sites & Communities
NWWDA I.S. 2-93	Industry Standard for Wood Window Units
NWWDA I.S. 3-95	Industry Standard for Wood Sliding Patio Doors
NWWDA I.S. 8-95	Industry Standard for Wood Swinging Patio Doors
NWWDA I.S.2	Industry Standard for Wood Window Units
SMACNA	Residential Comfort Systems Installation Standards Manual
Title 17, St.CA Regs.	Lead Safe Practices Standard
Title 24 2013 RCM (Subsection 4.6)	Indoor Air Quality and Mechanical Ventilation
Title 24 CFR Part 3280.204 (HUDMHCSS)	Manufactured Home Construction and Safety Standards—Kitchen Cabinet Protection
Title 24 CFR Part 3280.709(a) (HUDMHCSS)	Manufactured Home Construction and Safety Standards—Installation of Appliances
Title 24 CFR Part 3280.710(e) (HUDMHCSS)	Manufactured Home Construction and Safety Standards—Appliance Ventilation Location
Title 24 CFR, Part 3280	Manufactured Home Construction and Safety Standards
Title 24 CFR, Part 3280, Subpart 1 (HUDMHCSS)	Manufactured Home Construction and Safety Standards—Scope

REFERENCED STANDARDS

Title 8 CCR, Section 1532.1	CAL/OSHA Lead In Construction Standard
UBC, Article 2406.4	Specific Hazardous Locations for the Purposes of Safety Glazing
UBC, Article 2602.4	Foam Plastic Insulation—Thermal Barrier Installation Requirements
UBC, Chapter 24	Glass and Glazing Requirements
UBC, Section 2406	General Compliance Listings for the Identification, Human Impact Load and Hazardous Locations for Safety Glazing
UBC, Section 310.4	Requirements for Group R Occupancies in Regard to Access and Means of Egress Facilities and Emergency Escapes
UL 10B/UL 10C	Fire Tests of Door Assemblies/Positive-pressure Fire Tests of Door Assemblies
UL 174	Standard for Household Electric Storage Tank Water Heaters
UL 181	Standard for Factory-Made Air Ducts and Air Connectors. Factory-made air ducts are manufactured in a factory and are insulated and ready to install. They can be rigid fiberglass ducts (made of insulating material) or flexible ducts (with insulation and vapor barrier factory-installed on the outside).
UL 181A	Standard for Closure Systems for Use with Rigid Air Ducts. This standard is for pressure-sensitive aluminum tapes, heat-activated aluminum tapes, and mastic closure systems for use with rigid fiberglass air ducts.
UL 181A-P	Standards for safety for closure systems for use with rigid air ducts and air connectors.
UL 181B	Standard for Closure Systems for Use with Flexible Air Ducts and Air Connectors. This standard is for pressure-sensitive tapes and mastic closure systems for use with flexible air ducts.
UL 181B-C	Standards for pressure-sensitive tapes and mastic closure systems for use with flexible air ducts, sub-item specifically with reference to “drawbands.”

REFERENCED STANDARDS

UL 181B-FX	Standards for safety for closure systems for use with flexible air ducts and air connectors.
UL 723	Standard for Test for Surface Burning Characteristics of Building Materials
UL 746C	Standard for Polymeric Materials—Use in Electrical Equipment Evaluations
UL 900	Standard for Air Filter Units
UL 94	Standard for Tests for Flammability of Plastic Materials for Parts in Devices & Appliances
UL-507	Standard for Electric Fans

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NOTES