



# **2011 ENTERPRISE GREEN COMMUNITIES** MULTIFAMILY REHABILITATION SPECIFICATIONS

**About Enterprise Green Communities**

Enterprise Green Communities is the first national green building program focused entirely on affordable housing. Launched by Enterprise in fall 2004, Green Communities is designed to help developers, investors, builders and policymakers make the transition to a greener future for affordable housing. Visit [www.greencommunitiesonline.org](http://www.greencommunitiesonline.org)

**About Enterprise**

Enterprise is a leading provider of the development capital and expertise it takes to create decent, affordable homes and rebuild communities. For nearly 30 years, Enterprise has introduced neighborhood solutions through public-private partnerships with financial institutions, governments, community organizations and others that share our vision. Enterprise has raised and invested more than \$10.6 billion in equity, grants and loans to help build or preserve more than 270,000 affordable rental and for-sale homes to create vital communities. Enterprise is currently investing in communities at a rate of \$1 billion a year. Visit [www.enterprisecommunity.org](http://www.enterprisecommunity.org) and [www.enterprisecommunity.com](http://www.enterprisecommunity.com) to learn more about Enterprise's efforts to build communities and opportunity.

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## Introduction

Thank you for your interest in creating a greener future for affordable housing. Enterprise has developed specification recommendations that meet the requirements of both mandatory and optional 2011 Enterprise Green Communities Criteria. These recommendations were created for multifamily projects of more than three stories undergoing moderate or substantial rehabilitation, and must be reviewed and adapted to your specific climate, housing stock, and targeted criteria. In no case are these recommendations to be incorporated if they are in conflict with the requirements of authorities having jurisdiction, including but not limited to state and local code officials, zoning requirements, OSHA standards, and the like.

The ideal integration of the Green Multifamily Rehabilitation Specifications would include:

- Customization of the specifications for your climate, housing stock and targeted Enterprise Green Communities Criteria
- Training for the project team on the use of these specifications, particularly for contractors, as they implement the specifications.

This document includes two sections: 1) specification masters for key Division 1 sections, and 2) specification edits for the remaining sections. The Division 1 masters include Sustainable Design Requirements, which provides an overview of the Criteria as related to the construction process. The Construction Waste Management section incorporates the requirements of Criteria 6.3 and 6.4. The Indoor Air Quality Management section incorporates criteria for low emitting materials along with recommendations for implementing an indoor air quality management program.

The specification edits incorporate recommendations for improving the environmental performance of multifamily projects of more than three stories undergoing moderate rehabilitation. The body of each section incorporates relevant mandatory and optional Criteria. It also includes recommended language for incorporating the ENERGY STAR Multifamily High Rise (MFHR) Program.

Many sections list cost-effective green building products. The pricing provided was established by gathering estimated material costs from the recommended manufacturers, and by using the 2010 RS Means Building Construction Cost Data to determine the estimated installed unit cost for the recommended materials and equipment. These estimated unit costs represent US national averages and have not been priced for a particular location. Other factors, such as labor costs, equipment cost, and overhead and profit, have been included in the final estimated unit cost. This pricing information is not intended to be used for estimating a project, but rather to provide a projected cost for the sustainable materials and energy-efficient equipment specified.

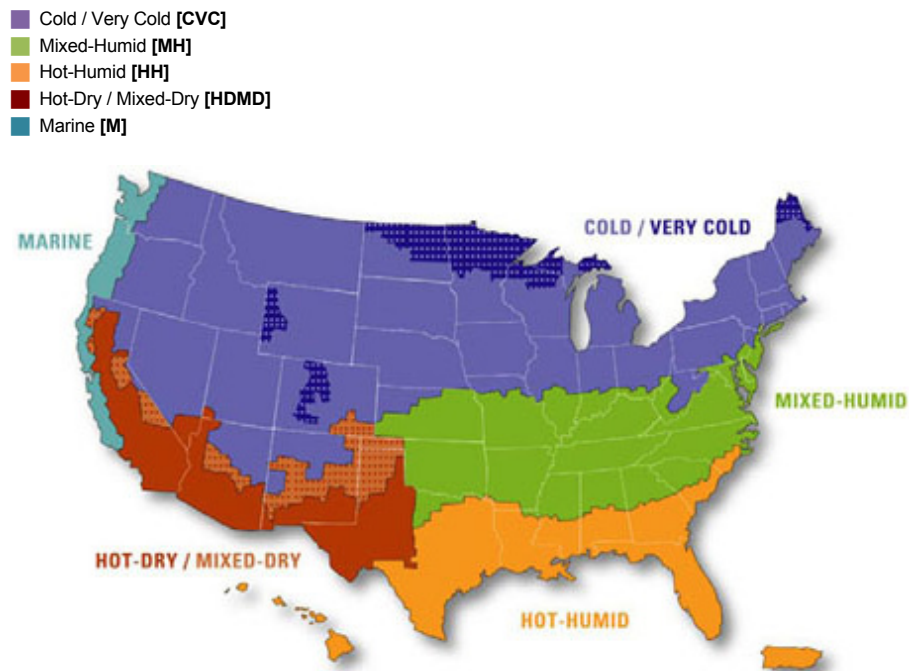
Moisture management, ventilation, and radon mitigation strategies will vary depending on project location. A separate text box lists appropriate strategies for each climate zone. These recommendations either follow Building America (BA), 2006 International Energy Conservation Code (IECC), ASHRAE 90.1-2007 (90.1), ENERGY STAR® Multifamily High-Rise National Prescriptive Path Requirements, or California Title 24, or reference the EPA Map of Radon Zones (EPA). See Figures 2–5 for the appropriate designations based on your project location.

If you have any questions or suggestions regarding these recommendations, please contact us at [greencommunities@enterprisecommunity.org](mailto:greencommunities@enterprisecommunity.org).

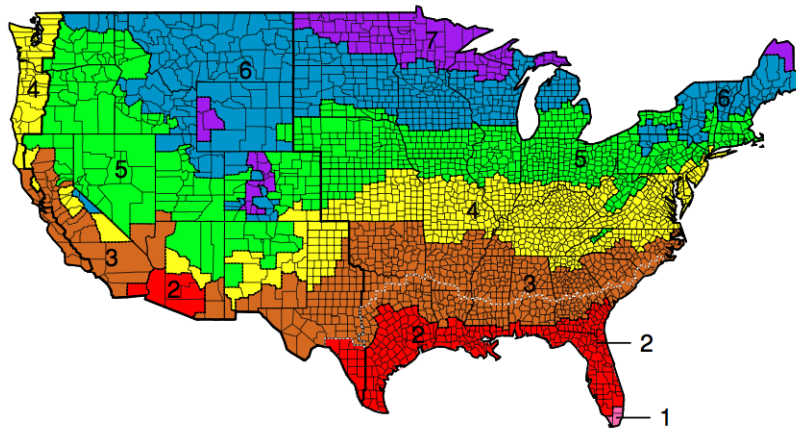
Figure 1. Legend for Specification Edits

	<p>GREEN MULTIFAMILY REHABILITATION SPECIFICATIONS</p> <p>DIVISION 22: PLUMBING 76</p> <p><b>Division Number &amp; Name</b> (1995 Division Number &amp; Name)</p> <p><b>2004 SECTION # / SECTION TITLE / 1995 SECTION #</b></p> <p>Materials Beneficial to the Environment 6.2: Low / No VOC Adhesives and Sealants <b>[Mandatory]</b>          Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde <b>[Mandatory]</b>          Energy Efficiency 5.7b: Photovoltaic (PV) / Solar Hot Water Ready <i>[Optional]</i></p> <p><b>PART 1 – GENERAL</b></p> <p><b>1.1 Informational Submittals</b></p> <p><b>A.</b> Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”</p> <p><b>B.</b> Pipe Insulation: Meet ENERGY STAR MFHR National Prescriptive Path Requirements.</p> <p><b>PART 2 – PRODUCTS</b> (Confirm that specified materials meet criteria)</p> <p><b>A.</b> Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:</p> <ol style="list-style-type: none"> <li>1. Multipurpose Construction Adhesives: 70 g/L</li> </ol> <p><b>B.</b> Pipe Insulation: Pipes carrying water or steam with temperatures under 55°F or over 105°F must provide the following:</p> <ol style="list-style-type: none"> <li>1. Pipes less than 1.5 inches in diameter: 1 inch insulation.</li> <li>2. Pipes greater than 1.5 inches in diameter: 1½ inch insulation.</li> </ol> <p><b>PART 3 – EXECUTION</b></p> <p><b>A.</b> Piping Design and Layout:</p> <ol style="list-style-type: none"> <li>1. <i>Locate piping within conditioned spaces or grouped and properly insulated to prevent freezing.</i></li> <li>2. Bathroom faucets, <b>1.5 GPM [0.5 GPM]</b> maximum.</li> </ol> <p><b>Recommendations:</b>          Insulate exposed hot and cold water mains with closed-cell polyethylene slip-on pipe insulation, sized to fit the pipe's diameter. Seal seams and butt joints with either 5 mil pipe insulation sealing tape or closure clips. Miter all angled junctions.</p> <p><b>Regional Considerations:</b>          [BA] CVC: Do not locate piping in exterior walls.</p>	<p>Enterprise Green Communities Criteria</p> <p>[Grey]: Note to spec editor</p> <p><b>[Tan]:</b> not required by Enterprise Green Communities Criteria, but recommended</p> <p><b>[Italics]:</b> Optional Criterion requirement</p> <p><b>[Orange]:</b> Select appropriate option</p> <p>See Figures 2–5 for climate zone references          [BA] = BUILDING AMERICA          [IECC] IECC 2006 CLIMATE ZONES          [EPA] = EPA RADON MAP</p>
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**Figure 2. Building America Climate Regions ([www1.eere.energy.gov](http://www1.eere.energy.gov))**

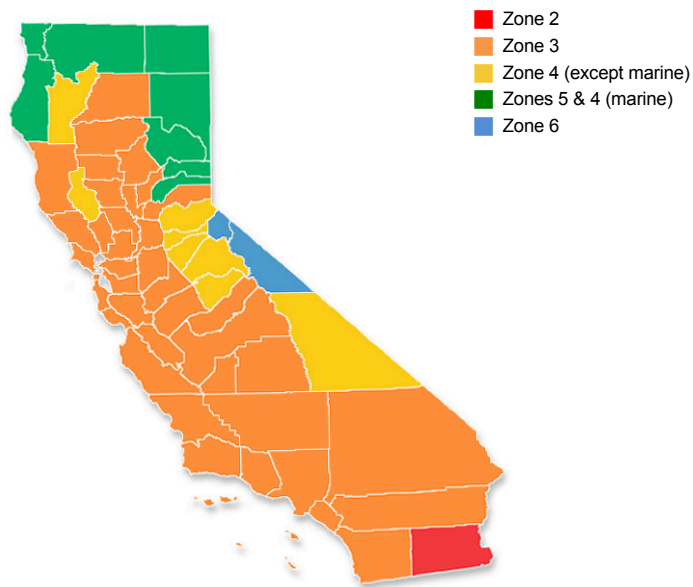


**Figure 3. Climate Zones for 2006 IECC, ASHRAE 90.1-2007 and ENERGY STAR ([resourcecenter.pnl.gov](http://resourcecenter.pnl.gov))**

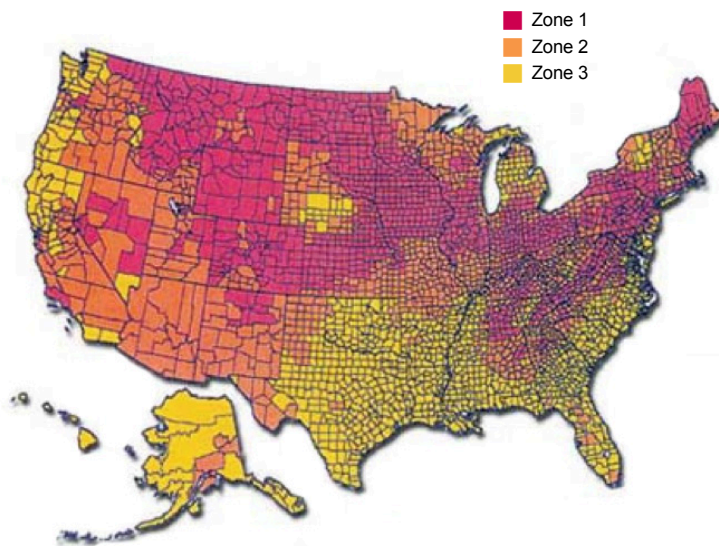


All of Alaska is Zone 7 except for the following Boroughs in Zone 8: Bethel, Dellingham, Fairbanks, N. Star, Nome North Slope, Northwest Arctic, Southeast Fairbanks, Wade Hampton, and Yukon-Koyukuk. Zone 1 includes Hawaii, Guam, Puerto Rico, and the Virgin Islands.

**Figure 4. California Building Climate Zone, Title 24 ([www.energy.ca.gov](http://www.energy.ca.gov))**



**Figure 5. EPA Map of Radon Zones ([www.epa.gov/radon/images/zonemapcolor\\_800.jpg](http://www.epa.gov/radon/images/zonemapcolor_800.jpg))**





## Division 01: General Requirements

### 01 42 00 / REFERENCES AND DEFINITIONS / 01420

#### PART 1 – GENERAL

##### 1.1 References

- A. 2009 ICC International Energy Conservation Code (IECC)
- B. Air Conditioning Contractors of America (ACCA) Manual D, Residential Duct Systems
- C. Air Conditioning Contractors of America (ACCA) Manual J, Residential Load Calculation
- D. Air Conditioning Contractors of America (ACCA) Manual S, Residential Equipment Selection
- E. ASHRAE 62.1-2010, Ventilation for Acceptable Indoor Air Quality (for common areas in mid- and high-rise buildings)
- F. ASHRAE 62.2-2010, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings
- G. ASHRAE 90.1-2007, Energy Standard for Buildings Except Low-Rise Residential Buildings
- H. 2009 ASHRAE Handbook—Fundamentals
- I. ASHRAE Handbook, Systems and Equipment
- J. ASME E17.1—Safety Code for Elevators and Escalators
- K. ASTM C1371-04—Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
- L. ASTM E1527-05—Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process
- M. ASTM C1549-04—Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
- N. ASTM E408-71(1996) e1—Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques
- O. ASTM E779-03—Standard Test Method for Determining Air Leakage Rate by Fan Pressurization
- P. ASTM E1918-97—Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field
- Q. ASTM E1980-01—Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces
- R. ASTM E2121-09—Standard Practice for Radon Mitigation Systems in Existing Low-Rise Residential Buildings
- S. Bay Area Air Quality Management District Regulation 8 Rule 51—Establishes VOC limits for sealants
- T. Building Performance Institute Home Energy Auditing Standard, Section 7, 2009

- U.** Building Performance Institute Technical Standards for the Building Analyst Professional
- V.** California Air Resources Board (CARB) 93120—Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products
- W.** California Department of Health Services—Standard Practice for The Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers, including 2004 Addenda
- X.** California Energy Efficiency Standards Residential Manual, Chapter 4, 2001.
- Y.** California Title 24 2008 Building Energy Efficiency Standards, Title 24, Part 6
- Z.** Carpet and Rug Institute (CRI) “Green Label” IAQ Testing Program for Carpet Cushion
- AA.** Carpet and Rug Institute (CRI) “Green Label Plus” IAQ Testing Program for Carpet
- BB.** ENERGY STAR Advanced Lighting Package
- CC.** ENERGY STAR Appliances and Lighting Fixtures
- DD.** ENERGY STAR for New Homes Version 2.5 or 3
- EE.** ENERGY STAR Multifamily High-Rise Program, National Performance and Prescriptive Path Requirements
- FF.** ENERGY STAR Roofing—Establishes criteria for sloped roofs to meet specific solar reflectance and emissivity values
- GG.** EPA “Compendium of Methods for the Determination of Air Pollutants in Indoor Air”
- HH.** EPA Indoor airPLUS Program
- II.** EPA Radon Zone Map.
- JJ.** EPA WaterSense Inspection and Verification Guidance for WaterSense Labeled New Homes, 2009
- KK.** EPA Renovation, Repair, and Painting (RRP) Regulation 40 CFR 745 Lead-Based Paint Poisoning Prevention in Certain Residential Structures
- LL.** EPA Stormwater Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices (EPA 832-R-92-005)
- MM.** EVFM by International Leak Detection
- NN.** Forest Stewardship Council (FSC) Guidelines
- OO.** Enterprise Green Communities Criteria 2011
- PP.** Green Seal (GC) Standard GC-03 “Anti-Corrosive Paints”
- QQ.** Green Seal (GS) Standard GS-11 “Paints”
- RR.** Green Seal (GS) Standard GS-36 “Commercial Adhesives”
- SS.** IESNA 90.1-2007 Space Type Lighting Power Density
- TT.** Housing and Urban Development (HUD) 24 CFR 35 Lead Safe Housing Rule
- UU.** Housing and Urban Development (HUD) 24 CFR 50 Protection and Enhancement of Environmental Quality
- VV.** Housing and Urban Development (HUD) 24 CFR 58 Environmental Review Procedures

- WW.** MaP Toilet Fixture Performance Testing Protocol, Version 3, July 2007
- XX.** MPI Green Performance Standard for Paints & Coatings GPS-2-08
- YY.** NSF/ANSI 332-2010, Sustainability Assessment for Resilient Floor Coverings
- ZZ.** TPI BCSI, “Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses”
- AAA.** Resilient Floor Covering Institute (RFCI) “FloorScore Program”
- BBB.** Sheet Metal and Air Conditioning Contractors’ National Association (SMACNA) 2008 Duct Construction Standards
- CCC.** South Coast Air Quality Management District (SCAQMD) Rule #1168 “Adhesive and Sealant Applications”
- DDD.** USDA 1940-G and 7 CFR Part 1794 Environmental Policies and Procedures
- EEE.** WaterSense, U.S. Environmental Protection Agency, Office of Wastewater Management (4204M)

## 1.2 Definitions

- A. Adaptive Plant Species:** Non-native plant species that performs similarly to a native species in a particular region, state, ecosystem, and habitat, and 1) can survive temperature or weather extremes in the microclimate; 2) requires little irrigation or fertilization, once established; 3) is resistant to local pests and diseases; and 4) does not displace other plants, as invasive species do.
- B. Air Barrier System:** A combination of air barrier assemblies and air barrier components, connected by air barrier accessories that are designed to provide a continuous barrier to the movement of air through an environmental separator.
- C. Carbon Monoxide:** A colorless, odorless, and tasteless gas that greatly affects indoor air quality. Because it is impossible to see, taste, or smell the toxic fumes, CO can kill before there is awareness that it is in the home. At lower levels of exposure, CO causes mild effects that are often mistaken for flu. These symptoms include headaches, dizziness, disorientation, nausea, and fatigue.
- D. Certified Wood:** Wood grown in a sustainably managed forest certified by a Forest Stewardship Council (FSC)–accredited certification agency. FSC-Certified wood products must have Chain of Custody from forest to manufacturer.
- E. Chain-of-Custody:** Tracking procedure documenting the status of wood products from the forest to the ultimate consumer. Used to verify compliance with FSC guidelines.
- F. Common Area:** An area available for use by more than one person, including rental or sales offices, entrances, hallways, shared leisure rooms, resident services areas, and laundry rooms.
- G. Composite Wood:** Products such as particleboard, medium-density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores that are a composite of wood or plant material pressed and adhered together by synthetic resin or binder.
- H. Construction Waste:** Solid wastes typically including building materials, packaging, trash, debris, and rubble that results from construction, remodeling, repair, and demolition.

- I. **Distribution Uniformity:** A measure of the evenness of irrigation water coverage over a given area.
- J. **Emissivity (or Infrared Emittance):** Indication of ability of a material to shed infrared radiation.
- K. **Engineered Wood Products:** Wood building materials manufactured by gluing particles, fibers, or veneers to increase strength.
- L. **Environmental Separator:** A part of a building that separates the controlled interior environment from the uncontrolled exterior environment, or that separates spaces within a building that have dissimilar environments.
- M. **Formaldehyde:** Chemical used widely to manufacture building materials and numerous household products. Also a by-product of combustion and certain other natural processes; thus, it may be present in substantial concentrations both indoors and outdoors. Health effects include eye, nose, and throat irritation; wheezing and coughing; fatigue; skin rash; and severe allergic reactions. May cause cancer.
- N. **Greywater:** Wastewater produced from baths and showers, clothes washers, and lavatories.
- O. **LED (Light-Emitting Diode):** Energy-efficient lights that produce less initial heat per lumen, consume less energy, and last longer than conventional incandescent and fluorescent lights.
- P. **Intermittent Ventilation:** A ventilation system that stops and starts at regular intervals.
- Q. **Maintained Solar Reflectance:** The measure of a material's ability to maintain its initially rated solar reflectance. Products are tested over a period of three years.
- R. **Material Cost:** The dollar value of materials being provided to the site, after any contractor mark-ups; separate from equipment or labor costs.
- S. **Non-Toxic:** Neither immediately poisonous to humans, nor poisonous after a long period of exposure.
- T. **Phenol-Formaldehyde:** Resin used in the manufacture of composite wood products primarily for outdoor use, including softwood plywood, flakeboard, or oriented strand board. Composite wood products that contain phenol-formaldehyde generally emit formaldehyde at lower rates than those containing urea-formaldehyde resin.
- U. **Photocell:** A light-sensitive device that detects ambient light and controls exterior fixtures accordingly.
- V. **Photovoltaics:** Composite materials that convert sunlight directly into electrical power.
- W. **Post-Consumer Waste:** Materials or finished products that have served their intended use and have been diverted or recovered from waste destined for disposal, having completed their lives as consumer items.
- X. **Post-Industrial Waste (or Pre-Consumer Waste):** Materials generated in manufacturing and converting processes, such as manufactured scrap and trimmings and cuttings.
- Y. **Potable Water:** Water suitable for drinking and supplied from wells or municipal water systems.
- Z. **Radon:** Colorless, odorless, and tasteless gas that greatly affects indoor air quality. According to the EPA, radon exposure is the second leading cause of lung cancer in the US.
- AA. **Reclaimed Wood:** Previously used wood that has been made available for reuse.
- BB. **Recycling:** Collection, reprocessing, marketing, and use of materials that were recovered or diverted from the solid waste stream.
- CC. **Regionally Extracted, Harvested, or Recovered:** Location where material was extracted, harvested or recovered. For products containing multiple materials, each material must be calculated separately.

- DD. Regionally Manufactured:** Location of final assembly of components into the building product furnished and installed by tradespeople.
- EE. Resilient Flooring:** Includes but is not limited to rubber, polymeric, vinyl composite tile (VCT), and linoleum flooring products in which the wearing surface is non-textile.
- FF. Salvage:** Removal of existing materials or assemblies for re-installation or other use as directed by Owner.
- GG. Sediment:** Soil and other debris that has been eroded and transported by storm or production runoff water.
- HH. Solar Hot Water System:** A means of capturing, converting, and transferring heat from direct and indirect sunlight to heat an auxiliary water tank and provide hot water for a building's occupants.
- II. Solar Reflectance (or Albedo):** The measure of a material's ability to reject solar heat, as shown by a small temperature rise. Calculated according to ASTM E1980 using the material's Emittance and Reflectivity values. Standard black has an SRI of 0 and standard white has an SRI of 100.
- JJ. Supportive Housing Dwelling Units:** Supportive housing is permanent housing with attached intensive services targeted to populations that have special needs, including people who are currently or formerly homeless; people with serious, chronic mental health issues; people in various stages of recovery from substance abuse; people with HIV/AIDS; people with physical or developmental disabilities; formerly incarcerated people; frail elderly; homeless or emancipated youth; victims of domestic violence; and others who would not be able to live independently and maintain housing without intensive support.
- KK. Sustainable Design:** Design that reduces negative effects on the environment by using sound ecological, social, and economic methods, while considering the health and comfort of a building's occupants.
- LL. Sustainable Forestry:** Practice of managing forest resources to meet the long-term product needs of humans while maintaining the biodiversity of forested landscapes. The primary goal is to restore, enhance, and sustain the full range of forest values, both economic and ecological.
- MM. Toxic:** Poisonous to humans, either immediately or after a long period of exposure.
- NN. Urea-Formaldehyde:** Toxic resin created from formaldehyde that causes health side effects. Composite wood products made for indoor use often contain this resin, including particleboard, hardwood plywood paneling, and medium density fiberboard.
- OO. Ventilation:** Process of supplying and removing air to and from interior spaces by natural or mechanical means.
- PP. Volatile Organic Compounds (VOCs):** Carbon compounds that participate in atmospheric photochemical reactions, (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates, and ammonium carbonate). Compounds vaporize (become a gas) at normal room temperatures. VOC content is calculated in grams/liter (g/L) according to 40 CFR 59, Subpart D (EPA Method 24).
- QQ. Waste:** Extra material or material that has reached the end of its useful life in terms of its intended use.

**01 74 19 / CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL / 01524**

Materials Beneficial to the Environment 6.3: Construction Waste Management [Mandatory]

*Materials Beneficial to the Environment 6.4: Construction Waste Management [Optional]*

**PART 1 – GENERAL****1.1 Summary**

- A.** Reduce construction and demolition waste on job site and minimize waste sent to landfills through implementation of Construction Waste Management Plan as required by Enterprise Green Communities Criteria 6.3 and 6.4 and as outlined within this Section and in the Sections referenced herein.
- B.** Related sections
  - 1. Division 01 Section “Sustainable Design Requirements” for Enterprise Green Communities Criteria compliance and documentation requirements and definitions.
  - 2. Division 02 Sections referring to demolition.
- C.** Divert a minimum of 25 [35, 45, 55, 65, 75] percent from landfill by weight or volume of total non-hazardous project construction, demolition, and site operations waste.

**1.2 Action Submittals**

- A. Construction and Demolition Waste Management (CWM) Plan:** Prior to any waste removal and within 30 days of Contract award, submit for approval a detailed CWM Plan in accordance with Criteria 6.3 and 6.4 as outlined in this Section:
  - 1. Analysis of estimated job-site waste to be generated, including types and quantities of compostable, recyclable, and salvageable materials.
  - 2. Description of means and methods to achieve 25 [35, 45, 55, 65, 75] percent diversion requirement for compostable, recyclable, and salvageable materials, including those that may be donated to charitable organizations.
  - 3. Identification of the carpet product’s composition as polymer, nylon, or polypropylene.
  - 4. Identification of recycling contractors and haulers proposed for use in the project and locations accepting construction waste materials or entities providing related services.

**For renovation projects where old carpet will be removed and the new carpet manufacturer has a carpet reclamation program available, consider including the following:**

- B. Carpet Reclamation Plan:** Provide directions for reclamation of recyclable carpet and carpet waste within 30 days of Contract award in compliance with Carpet Reclamation Program.
- C. Carpet Reclamation Certificate:** Provide verification of the carpet reclamation methods and amount (by weight or volume) diverted from landfill.

### 1.3 Information Submittals

- A. Waste Management Progress Reports:** Submit monthly, concurrent with each Application for Payment.
1. Project title, name of party completing report, and dates of period covered by the report.
  2. Amount (by weight or volume) of project waste material landfilled to date and identity of the landfill(s).
- B. Final Waste Management Report:** Submit at completion of construction and prior to contract close-out, in electronic format.
1. All information required in Waste Management Progress Reports.
  2. Legible copies of on-site logs, manifests, weight tickets, and receipts.
  3. Final calculations, including total amount (by weight or volume) of diverted construction and demolition waste, and the total amount (by weight or volume) of landfilled waste.

## PART 2 – PRODUCTS (NOT USED)

## PART 3 – EXECUTION

### 3.1 Waste Management Plan Implementation

- A. Training and Coordination:**
1. Provide copies of approved CWM Plan to all on-site supervisors, each subcontractor, Owner, and Architect.
    - a. Contractors, sub-contractors, and other entities responsible for implementing the CWM Plan must return a signed agreement stating that they will comply.
  2. Instruction: Provide on-site instruction of appropriate separation, handling, recycling, salvage, reuse, and return methods to be used by all entities at the appropriate stages of the project.
  3. Meetings: Include construction waste management on the agenda of all required regularly scheduled construction meetings.
- B. Facilities:** Provide designated facilities for co-mingling or separation and storage of materials for recycling, salvage, reuse, return, and waste disposal, per approved CWM Plan for use by all contractors and installers.
1. Provide signage in English (Spanish, Vietnamese, etc.) and graphics to indicate recycling procedure.
  2. Provide materials for barriers and enclosures that are non-hazardous, recyclable, or reusable to the maximum extent possible; reuse project construction waste materials if possible.
  3. Provide adequate space, convenient to subcontractors, for pickup and delivery.
  4. Keep recycling and waste bin areas neat and clean to avoid contamination of materials.
- C. Methods of waste disposal** that are not acceptable for meeting Enterprise Green Communities Criteria include:
1. Burning or incinerating on or off project site.
  2. Burying on project site, other than fill.
  3. Dumping or burying on other property, public or private, other than official landfill.
  4. Illegal dumping or burying.

**D. Recycling Procedures:**

1. Co-mingle or separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
2. Coordinate work of recycling, composting, and salvaging waste haulers with other trades.
3. Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor.

**For renovation projects where old carpet will be removed and the new carpet manufacturer has carpet reclamation program available, consider including the following:**

**E. Carpet Reclamation Procedures:** Remove approved carpet materials from the existing installation and prepare for pickup by carpet manufacturer.

1. Roll or palletize and secure for shipping with shrink wrap, banding or strapping.
  - a. *Pallets:* Minimum 40 inches by 40 inches. Palletize materials if less than a truckload.
  - b. *Rolls:* Minimum three-foot width. Maximum nine-foot width.
  - c. *Baled materials:* Not accepted.
2. Keep materials dry and free of moisture damage, mildew, or mold.
3. No materials containing asbestos accepted.
4. Prepare fiber or urethane carpet padding for reclamation. Attached cushion not accepted.
5. Storage containers: Clean and free of debris.
6. Determine approval for carpet donation at project site.

**F. Salvage of Materials:** Set aside, sort, and protect products to be salvaged for reuse off-site.**G. Hazardous Waste Handling:** Separate, store, and dispose of hazardous wastes separately and in accordance with local regulations. Do not handle, separate, store, salvage, or recycle hazardous materials with other materials.



**01 77 00 / CLOSEOUT PROCEDURES / 01770**

Operations and Maintenance 8.1: Building Maintenance Manual [Mandatory]

As a reminder, these recommendations should supplement, not replace, the section prepared by the design team.

**PART 1 – GENERAL****1.1 Final Completion Procedures:****A.** Submittals prior to final completion:

1. Enterprise Green Communities: Submit a Building Maintenance Manual that includes the following:
  - a. Operations and maintenance guidance for appliances and building systems
  - b. Operations and maintenance documentation for all the following water-using equipment or controls installed:
    - 1) Pressure regarding valve(s)
    - 2) Hot water delivery system(s)
    - 3) Toilets
    - 4) Faucets
    - 5) Showerheads
    - 6) Dishwasher(s)
    - 7) Clothes washer(s)
    - 8) Evaporative cooling system
    - 9) Water softener(s)
    - 10) Drinking water treatment system(s)
    - 11) Distribution pumps for central hydronic heat, domestic water, and domestic hot water
  - c. HVAC operation and maintenance schedule
  - d. Location water-system turnoffs
  - e. Lighting equipment
  - f. Paving materials and landscaping
  - g. Green cleaning products and schedule
  - h. Pest control
  - i. Occupancy turnover plan
  - j. Recycling procedures

**PART 2 – PRODUCTS (No Comments)****PART 3 – EXECUTION (No Comments)**

- A.** Contractor must demonstrate that all responsibilities to achieve Enterprise Green Communities Certification have been met prior to closeout.
- B.** Contractor must work with an energy services provider who will:
  1. Create an energy model with the building plans and specifications to show the building's projected energy performance in the design stages
  2. Conduct a mid-construction pre-drywall thermal enclosure inspection
  3. Verify the final performance of the building with performance testing

**01 81 13 / SUSTAINABLE DESIGN REQUIREMENTS / 01352****PART 1 – GENERAL****1.1 Summary**

- A.** This project is designed to achieve all mandatory requirements and no fewer than 30 optional points under the Enterprise Green Communities Criteria, including all current revisions.
  - 1. Certain Criteria are dependent on material selections. Compliance with the Criteria shall be a basis of evaluating substitution requests.
  - 2. Additional Criteria needed to obtain Enterprise Green Communities Certification are dependent on Architect's design and other aspects of the project that are not part of the Work of Contract.
- B.** The project will achieve Enterprise Green Communities Certification [see 1.2.A].
- C.** Contractor is responsible for all requirements of the Criteria that are contained throughout these Specifications, including successful compliance with and passage of visual inspections and performance tests by verifying party.
- D.** Contractor is not responsible for the application for Enterprise Green Communities Certification, nor for determination of methods of achieving the Criteria unless otherwise specifically indicated.
- E.** Related Sections
  - 1. Division 01 Section "Construction Waste Management and Disposal" for detailed Criteria requirements to be incorporated into construction process.
  - 2. Division 01 Section "Closeout Procedures" for requirements to be incorporated into Building Maintenance Manual.
  - 3. Division 01 Section "Indoor Air Quality Requirements" for detailed Criteria requirements to be incorporated into construction process.
  - 4. Divisions **03 through 10 and 31-33 [2-10]** Sections for Criteria specific to work of each of those Sections. These requirements may or may not include references to the Criteria.
  - 5. Appendix A: Incorporate Combustion Safety and Carbon Monoxide Inspection procedures before finalizing scope and starting work, as the results may inform the work scope.

**1.2 Action Submittals**

- A.** Enterprise Green Communities Certification submittals:
  - 1. Step 1 Submittals: To be submitted prior to the construction start date.
    - a. **Project Registration Form** – General information including but not limited to the location, developer, construction schedule, and building type and size.
    - b. **Project Overview Form** – A brief description of the development's mechanical systems and building envelope, as well as building code(s) and green building program(s) the development will meet.
    - c. **Intended Methods** – Indicates how a development plans to comply with the mandatory and optional points of the Criteria. It also requires that responsibility for meeting individual criteria is identified among the team and signatures are obtained from team members.
    - d. **Site Plan** – Demonstrates the development's proximity to existing infrastructure and its integration into the adjacent pedestrian grid.
    - e. **Context Map** – A map that demonstrates the development's proximity to community amenities and public transportation.
    - f. **Energy Performance Report Form** – Fill out an Energy Performance Report Form and submit the corresponding energy modeling report.

2. Step 2 Submittals: To be submitted within 60 days after the construction end date.
  - a. **Final Certification Form** – Basic project information to ensure proper listing in database.
  - b. **Compliance Report** – A revised version of the Intended Methods form from Step 1 requiring project teams to document any changes in their strategy to meet the Criteria.
  - c. **Cost Development Form** – Documents the incremental costs that project teams incurred when meeting the Enterprise Green Communities standard.
  - d. **Photos** – Teams upload before, during, and after photos from the development.
  - e. **Utility Release Form(s)** – A series of forms that authorize Enterprise to conduct energy data monitoring after the completion of the development.
- B. Low-Emitting Materials: Provide product data as described in Division 01 Section “Indoor Air Quality Requirements.”
- C. Recycled Content Materials: Provide product data indicating percentages of post-industrial and post-consumer recycled content. Include statement of material cost for each recycled content material.
- D. Regional Materials: Provide product data indicating location of extraction, processing, and manufacture. Include statement of material cost for each regional material.
- E. FSC Certified Wood Products: Provide Chain of Custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Include statement of material cost for each qualified material. Alternative compliance paths as follows:
  1. For Salvaged Wood: Documentation indicating percentage of wood product that is salvaged and the location of origin.
  2. For Engineered Wood Products: Documentation indicating no added urea-formaldehyde.
- F. Status Reports: Provide construction status reports and coordinate pre-drywall and final inspections with verifiers charged with inspecting and testing installed green building measures.

### 1.3 Project Meetings

- A. Agenda: Provide status of Criteria–related work on the agenda of all required regularly scheduled job-site meetings.

### 1.4 Contractor Green Communities Coordinator

- A. Designate one team member with Enterprise Green Communities experience as the General Contractor Coordinator for this project.
  1. This Coordinator shall be present for all relevant General Contractor meetings.

**PART 2 – PRODUCTS****2.1 General**

- A.** Where specifications state that products shall meet certain Criteria, these products shall be counted toward the minimum total materials required to meet the related Criteria.

**2.2 Recycled-Content Materials**

- A.** Recycled Content: Minimum 25% post-consumer or 50% post-industrial recycled content for each qualifying material.
- B.** Qualified Building Components: Provide minimum 90% of the building component by weight or volume for one to four of the following:
1. Framing: Wood, concrete, steel, aluminum.
  2. Siding or Masonry: Wood, metal, vinyl, masonry.
  3. Non-Structural Flooring: Linoleum, cork, bamboo, reclaimed wood, sealed concrete, carpet.
  4. Concrete: Cement, aggregate, urbanite.
  5. Roofing: Wood shingles, asphalt shingles, tile, metal.
  6. Insulation: Fiberglass batt, cellulose, rigid panel.
  7. Sheathing: Plywood, oriented strand board (OSB).

**2.3 Regional Materials**

- A.** Regional Materials: Qualifying building materials extracted, processed, and manufactured within 500 miles of project site.
- B.** Qualified Building Components: Provide minimum 50% of the building component based on cost of the project's total material value for one to five of the following:
1. Framing
  2. Exterior Materials: Siding, masonry, roofing
  3. Concrete: Cement and aggregate
  4. Drywall and Interior Sheathing
  5. Flooring Materials

**2.4 Certified, Salvaged, And Engineered Wood Products**

- A.** Qualified Building Materials: Minimum 25%, by cost or value, of the project's total wood products used as structural components. The following qualify:
1. FSC Certified Wood: Certified in accordance with the Forest Stewardship Council (FSC) guidelines
  2. Salvaged Wood
  3. Engineered Wood: No added urea-formaldehyde binders

**PART 3 – EXECUTION (No Comments)**

**01 81 19 / INDOOR AIR QUALITY REQUIREMENTS / 18119**

Materials Beneficial to the Environment 6.1: Low/No VOC Paints and Primers [Mandatory]

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde [Mandatory]

Healthy Living Environment 7.2: Environmentally Preferable Flooring [Mandatory, if project scope includes provision of flooring.]

**PART 1 – GENERAL****1.1 Summary**

- A.** Implement the following procedures in an effort to improve indoor air quality during Owner's occupancy.
- B.** Construction Indoor Air Quality (IAQ) Management.
  - 1. Provide low-emitting products as required by Criteria 6.1, 6.2, 7.1, 7.2, and as specified.

**1.2 References**

- A.** Related Section
  - 1. Division 01 Section "Referenced and Definitions" for standards referenced herein.
- B.** Enterprise Green Communities Criteria
  - 1. 6.1, Low/No VOC Paints and Primers
  - 2. 6.2, Low/No VOC Adhesives and Sealants
  - 3. 7.1, Composite Wood Products that Emit Low or No Formaldehyde
  - 4. 7.2, Environmentally Preferable Flooring

**1.3 Informational Submittals**

- A.** Low-Emitting Materials: For each low-emitting product, provide the following product data:
  - 1. Carpet: Proof of Green Label Plus certification.
  - 2. Carpet Cushion: Proof of Green Label certification.
  - 3. Hard Surface Flooring (except ceramic tile or reclaimed or unfinished hardwood floors): Proof of FloorScore certification.
  - 4. Adhesives, Sealants, Paints, and Primers: VOC content as measured in grams per liter (g/L).
  - 5. Composite Wood Products: Manufacturer declaration that product complies with CARB 93120.
- B.** Construction Indoor Air Quality Management (IAQ) Plans: Within 30 days of Contract award, submit for approval:
  - 1. Detailed Construction Indoor Air Quality Management Plan, During Construction, as outlined in this Section.
    - a. Meet or exceed control measures of Sheet Metal and Air Conditioning Contractor's National Association Indoor Air Quality Guidelines and as described within this Section.
    - b. Detailed products and procedures for compliance with execution requirements outlined in Parts 2 and 3 of this Section.

2. Detailed Construction Indoor Air Quality Management Plan, Prior to Occupancy, as outlined in this Section. As directed by Owner, comply with one compliance path below:
  - a. Option 1: Building Flush-out Schedule describing procedures and dates and as described elsewhere in this Section. Include calculations to demonstrate that the required total air volumes and minimum ventilation volumes and rates will be delivered.
  - b. Option 2: IAQ Testing Schedule describing procedures and dates and as described elsewhere in this Section.
- C. Photographs demonstrating compliance with IAQ Plan. Provide at the following recommended construction milestones: 50%, 75%, and 95%.

#### **1.4 Informational Submittals**

- A. HVAC Filter Media: Manufacturer product data indicating MERV rating of temporary and permanent filtration media with statement of where and when each filter was installed.
- B. Cleaning Products: Manufacturer product data indicating chemical content and Green Seal certification of cleaning products.
- C. Final Construction Indoor Air Quality Management, During Construction: At completion of construction and prior to contract close-out, submit:
  1. Approved Construction Indoor Air Quality Management Plan.
  2. Construction Photographs: Six taken at three (3) separate times for a total of eighteen (18) digital photographs of required construction indoor air quality management measures.
    - a. HVAC Protection.
    - b. Source Control.
    - c. Pathway Interruption.
    - d. Housekeeping.
    - e. Scheduling.
    - f. Protection of absorptive or dry sink materials, including but not limited to carpet, gypsum board, acoustical ceiling tiles, and insulation.
    - g. Temporary Filtration Media, if HVAC is operated during construction.
    - h. Filtration Media installed prior to occupancy.
  3. Product data of filtration media used during construction and installed immediately prior to occupancy including MERV values, manufacturer's name, and model number.
  4. Meeting minutes, checklists, worksheets, notifications, and deficiency or resolution logs related to the project IAQ issues.
- D. Final Construction Indoor Air Quality Management Plan, Prior to Occupancy, Package: At completion of construction and prior to contract close-out, submit:
  1. Option 1: Approved Building Flush-out Schedule including a statement that space was not occupied until after delivery of minimum outside air requirements were met.
  2. Option 2: Baseline Indoor Air Quality Testing reports showing results and location of each test indicating that the maximum chemical contaminate concentration requirements are not exceeded, a summary of HVAC operating conditions, a listing of discrepancies, and recommendations for corrective actions, if needed.
    - a. Include certification of test equipment calibration with each test report.

- E.** Final Low Emitting Materials Package for Criteria 6.1, 6.2, 7.1, 7.2: Provide individual electronic folders for each credit containing:
1. Legible electronic copies of relevant material product data, with applicable criteria highlighted, for each product required to meet GCC.

### 1.5 Project Meetings

- A.** Construction indoor air quality management shall be discussed as required in Division 01 Section “Sustainable Design Requirements.”

## PART 2 – PRODUCTS

### 2.1 Low-Emitting Materials

- A. Adhesives:** Comply with VOC Content limits of South Coast Air Quality Management District (SCAQMD) Rule 1168 “Adhesive and Sealant Applications,” Bay Area Air Quality Management District (BAAQMD) Regulation 8 Rule 51, or more stringent levels, as follows (in grams/Liter):
1. Indoor Carpet & Pad Adhesives: 50
  2. Outdoor Carpet Adhesives: 150
  3. Wood Flooring Adhesives: 100
  4. Rubber Floor Adhesives: 60
  5. Subfloor Adhesives: 50
  6. Ceramic Tile Adhesives: 65
  7. VCT and Asphalt Tile (& Linoleum) Adhesives: 50
  8. Dry Wall and Panel Adhesives: 50
  9. Cove Base Adhesives: 50
  10. Multipurpose Construction Adhesives: 70
  11. Structural Glazing Adhesives: 100
  12. Single-Ply Roof Membrane Adhesives: 250
  13. Non-Membrane Roof Installation/Repair: 300
  14. Perimeter Bonded Sheet Vinyl Flooring Installation: 660
  15. PVC Welding: 510
  16. CPVC Welding: 490
  17. ABS Welding: 325
  18. Plastic Cement Welding: 250
  19. Adhesive Primer for Plastic: 550
  20. Contact Adhesive: 80
  21. Special Purpose Contact Adhesive: 250
  22. Structural Wood Member Adhesive: 140
  23. Metal to Metal Substrate: 30
  24. Plastic Foam Substrate: 50
  25. Porous Substrate Except Wood: 50
  26. Wood Substrate: 30
  27. Fiberglass Substrate: 80
  28. All Other Welding and Installation Adhesives: 250

- B. Exemption for VOC Content limits for adhesives and sealants:** Projects located in cold climates (Climate Zones 6 and 7 based on IECC 2006) may be exempted from the required VOC Content limits for adhesives and sealants if for application in temperatures below 40 degrees Fahrenheit.
1. Submittal Documentation: Contractor to identify non-compliant adhesives and sealants applied and stage of construction product was applied.
- C. Paints and coatings applied within building waterproofing envelope:** Comply with VOC Content limits (as noted in Criterion 6.1) of Green Seal Standard GS-11 “Paints,” First Edition; Standard GC-03 “Anti-Corrosive Paints,” and MPI GPS-2-08, as follows:
1. Flat: 50
  2. Non-flat: 50
  3. Anti-Corrosive and Anti-Rust: 250
  4. Floor Coatings: 100
  5. Grout Sealer: 200
  6. Clear Wood Finishes, Varnish: 350
  7. Clear Wood Finishes, Lacquer: 550
  8. Shellac, Clear: 730
  9. Shellac, Pigmented: 550
  10. Waterproofing Sealer: 250
  11. Sanding Sealer: 275
  12. Sealers, Other: 200
  13. Stains: 250
- D. Carpet:** Comply with testing and product requirements of the Carpet & Rug Institute Green Label Plus program.
- E. Carpet Cushion:** Comply with testing and product requirements of the Carpet & Rug Institute Green Label program.
- F. Hard Surface Flooring** (vinyl, linoleum, hardwood, cork, bamboo): Comply with testing and product requirements of the Resilient Floor Covering Institute’s FloorScore Program.
1. Exempt Materials: Reclaimed wood and ceramic tile
    - a. *Reclaimed Wood:* No lead-based paint
    - b. *Tile:* No asbestos
- G. Permanently installed composite wood products:** Comply with one of the following:
1. CARB 93120 certification
  2. Products not in compliance with CARB 93120: Seal all exposed edges and sides with low-VOC sealants that comply with Criterion 6.2.
- H. Laminating adhesives used in composite wood and agrifiber product assemblies, shop-applied and applied on-site, shall contain no added urea-formaldehyde.**



- I. Aerosol adhesives applied within building waterproofing envelope shall comply with the VOC Content limits, as expressed in percentage of VOCs by weight, of Green Seal (GS) Standard GS-36 “Commercial Adhesives,” October 19, 2000, as follows:
  - 1. General Purpose Mist Spray: 65% VOCs by weight
  - 2. General Purpose Web Spray: 55% VOCs by weight
  - 3. Special Purpose Aerosol Adhesives (all types): 70% VOCs by weight
- J. Sealants applied within building waterproofing envelope shall comply with VOC Content limits, as expressed in grams per liter, less water and exempt compounds, of SCAQMD Rule 1168 “Adhesive and Sealant Applications,” amended January 7, 2005, as follows:
  - 1. Architectural Sealants: 250
  - 2. Non-Membrane Roof: 300
  - 3. Single-Ply Roof Membrane: 450
  - 4. Other: 420
- K. Sealant primers applied within building waterproofing envelope shall comply with VOC Content limits, as expressed in grams per liter, less water and exempt compounds, of SCAQMD Rule 1168 “Adhesive and Sealant Applications,” amended January 7, 2005, as follows:
  - 1. Architectural, Nonporous: 250
  - 2. Architectural, Porous: 775
  - 3. Other: 750

## 2.2 Air Filtration Media

- A. *Filters:* Filtration media rated for minimum efficiency reporting value (MERV) when tested in accordance with ASHRAE 52.2.
  - 1. MERV of 8, minimum.

## 2.3 Cleaning Products and Equipment

- A. Green Seal: Qualified spot removers and cleaning agents shall be used for each given application.
- B. HEPA-filter: Equipped vacuum cleaners shall be used for the final cleaning.

# PART 3 – EXECUTION

## 3.1 General

- A. Incorporate procedures and processes during construction and prior to occupancy as described herein.

## 3.2 HVAC Protection

- A. If permanent HVAC is used during construction, filtration media shall be used at each return air grill. All HVAC systems, equipment, and pathways shall be dust and particulate free at time of substantial completion of that phase of construction, in accordance with SMACNA “IAQ Guidelines for Occupied Buildings Under Construction.”
  - 1. Begin construction ventilation when building is substantially enclosed.
  - 2. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.

- B.** HVAC system shall be kept clean and free of dust, debris, moisture, and gaseous and microbial contamination during storage, handling, installation, and punch-out. Inspect all air inlets, air outlets, grilles, diffusers, plenums, and ducts upon completion of work.
  - 1. Cover and protect (taped plastic or similar method) all exposed air inlet and outlet openings, grilles, ducts, and plenums to prevent water, moisture, dust, and other contaminant intrusion.
  - 2. Apply protection immediately after installation of equipment and ducting.
  - 3. Ducting runs that require more than a single day to install shall be protected at end of each day's work.
  - 4. Leaks in return ducts and air handlers shall be checked and repaired. Do not use mechanical rooms for construction storage.
  - 5. Inspect filtration monthly and replace as needed with new media throughout the HVAC system. Filtration media shall be minimum MERV 8.
  - 6. After final phase of construction, install new filtration media throughout the HVAC system. Filtration media shall be minimum MERV 8.
  - 7. Cleaning of ductwork is not part of this contract; however, Contractor shall bear cost of cleaning required by Owner due to failure of Contractor to protect ducts and equipment from construction pollutants as specified.

### 3.3 Source Control

- A.** Comply with Product specifications in [Specification 01 81 19 — Part 2.1]
- B.** Provide direct exhaust to the exterior during installation of strong emitting materials, including touch-up activities. Keep exhaust away from intakes and occupied spaces.
- C.** Protect “absorptive” or dry sink materials from exposure to dust, debris, and moisture contamination during product delivery, storage, and handling from construction/demolition and punch-out activities.
- D.** Provide adequate ventilation of packaged dry products prior to installations. Remove from package and place in a secure, dry, well-ventilated space, free from contaminant sources and residues. Provide a temperature range of 60 degrees F minimum to 90 degree maximum continuously during ventilation. Do not ventilate within limits of work unless otherwise approved by Architect.
- E.** “Bake-out” or “super-heating” of spaces to accelerate the release of gaseous emissions is not permitted.
- F.** Prohibit smoking and use of fossil-fueled temporary heating units inside the building and near building entrances, windows, and intakes, and within 25 feet of building perimeter.

### 3.4 Pathway Interruption

- A. Provide negative pressurization of spaces under construction and/or demolition and positive pressurization of occupied or finished spaces while construction work proceeds in adjacent areas.
- B. Relocate pollutant sources when project equipment or staging areas coincide with critical air flow pathways and place plastic barriers to contain construction areas.
- C. Temporarily seal building, including air intakes and exhaust vents, and any other building openings, when dust-generating or strong-emitting construction products or procedures are used on the exterior of the building.
- D. Once spaces within building become occupied, work areas must remain under negative pressure. Exhaust air at a rate at least 10% greater than the rate of supply. Do not exhaust air where it can be drawn back into occupied spaces, and place a continuous plastic barrier to create a seal between construction areas and occupied spaces.

### 3.5 Housekeeping

- A. Broom-clean and vacuum floors to keep dust from accumulating during construction and/or demolition. Remove debris from building on a daily basis and suppress dust during construction and/or demolition activities with wetting agents or sweeping compounds.
- B. Prior to use of return air ductwork without intake filters, clean up and remove dust and debris generated by construction activities.
  - 1. Inspect duct intakes, return air grilles, and terminal units for dust. Clean plenum spaces, including top sides of lay-in ceilings, outside of ducts, tops of pipes and conduit, and return plenums of air handling units.
  - 2. Clean tops of doors and frames.
  - 3. Clean mechanical and electrical rooms, including tops of pipes, ducts, conduit, equipment, and supports.
  - 4. Remove intake filters last, after cleaning is complete.
- C. Ensure that food and food packaging is not left on the job site.
- D. Use low-toxic pest control chemicals such as boron, if needed, unless otherwise directed.
- E. Final cleaning shall be detailed and shall use a HEPA-filter vacuum throughout.
- F. Remove spills or excess application of solvent-containing products as soon as possible. Use low-emitting cleaning agents described under Cleaning Products and Equipment.
- G. Keep work areas as dry as possible. Replace any absorptive (dry sink) material that is exposed to moisture.

### 3.6 Scheduling

- A. Coordinate construction activities to minimize or eliminate disruption of operations in occupied portions of building.
- B. Schedule for storage, installation, and protection of all components of air distribution systems.

- C.** Schedule for storage, installation, and protection of absorptive materials (woven, fibrous, or porous in nature, such as carpet, ceiling tiles, insulation, and fabrics) from exposure to emissions during and after installation of materials and finishes with potential for short-term release of off-gassing volatile organic compounds.
  - 1. Highlight critical methods used to protect absorptive materials from airborne pollutants such as dust, debris, moisture, and gaseous and microbial contamination.
  - 2. Sequence installation of absorptive materials after odor-emitting activities have occurred and have been mitigated by ventilation
- D.** Do not store absorptive materials on-site if protection measures as described above cannot be ensured.
- E.** Avoid building occupancy while construction-related pollutants are present.
- F.** Ensure proper and complete curing of concrete before covering.

### 3.7 Indoor Air Quality Management, Prior to Occupancy

- A.** Comply with one of the following as directed by Owner:
  - 1. Option 1 Building Flush-out: After construction ends and prior to occupancy with all interior finishes installed, install new filtration media. Supply a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60°F and, where mechanical cooling is operated, relative humidity no higher than 60%.
    - a. Space may be occupied following delivery of a minimum of 3,500 cu.ft. of outside air per sq.ft. of floor area to space, and provided the space is ventilated at minimum rate of 0.30 cfm/cu.ft. of outside air or the design minimum outside air rate, whichever is greater, a minimum of three hours prior to the occupancy and during occupancy, until the total of 14,000 cu.ft./sq.ft. of outside air has been delivered to the space.
    - b. Do not start flush-out in any area until:
      - 1) All construction is complete.
      - 2) HVAC systems have been tested, adjusted, and balanced for proper operation.
      - 3) Inspection of inside of return air ducts and terminal units confirms that cleaning is not necessary.
      - 4) New HVAC filtration media have been installed.
  - 2. Option 2 If schedule does not permit Building Flush-out, provide Air Quality Testing: After construction ends and prior to occupancy with all interior finishes installed, use testing protocols consistent with US EPA "Compendium of Methods for the Determination of Air Pollutants in Indoor Air."
    - a. Owner or Contractor shall provide the services of a qualified Indoor Air Quality Testing Services Firm.
    - b. Support the Indoor Air Quality Testing Services Firm by coordinating scheduling of required testing, and providing services during IAQ remediation if necessary.
    - c. Test for the following contaminant concentration levels:

Chemical Contaminant	Maximum Concentration
Carbon Monoxide (CO)	9 parts per million and no greater than 2 ppm above outdoor levels
Formaldehyde	50 parts per billion
Particulates (PM10)	50 micrograms per cubic meter
TVOC	500 micrograms per cubic meter
4-Phenylcyclohexene (4-PCH)*	6.5 micrograms per cubic meter

\*This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing material are installed as part of the base building systems.

- d. For each sampling point where maximum concentration limits are exceeded, conduct flush-out with outside air and re-test the specific parameter(s) that were exceeded to indicate that the requirements are achieved. Repeat procedure until all requirements have been met. When re-testing non-complying building areas, take samples from the same locations as the first test.
- e. All measurements shall be conducted prior to occupancy, but during normal occupied hours and with building ventilation system starting at regular daily start time and operated at minimum outside air flow rate for occupied mode throughout duration of the air testing.
- f. Building shall have all interior finishes installed.
- g. For each portion of project served by a separate ventilation system, the number of sampling points shall not be less than one per 25,000 or for each contiguous floor area, whichever is larger, and include areas with the least ventilation and greatest presumed source strength. In residential building areas, perform at least one test for each group of seven dwelling units.
  - 1) If a failure is encountered during sample testing, re-sampling shall be conducted to assess whether that failure is unique or the rest of the units are likely to have similar failings. One of the up to six untested units in the group shall be selected for re-sampling. If testing in units in the re-sample confirms that the requirements are met, then the dwelling unit with the failure shall not be considered an indication of failure in the other dwelling units in the group. Corrective action shall be taken for the unit with the failure, and that unit shall be re-tested. However, if field testing in the re-sample results in a second failure, then all units in the group must be tested for compliance.
- h. Air samples shall be collected between three (3) feet and six (6) feet from the floor over a period of no less than four hours.

## Division 02: Existing Conditions

### (Division 02: Site Work)

#### 02 24 00 / ENVIRONMENTAL ASSESSMENT / 02200

Site Improvements 3.1: Environmental Remediation [Mandatory]

##### **PART 1 – GENERAL**

###### **1.1 Informational Submittals**

- A.** For Criterion 3.1: Submit final mitigation report.

###### **1.2 Quality Assurance**

- A.** Environmental Remediation: Comply with mitigation steps as required in (Phase I Environmental Site Assessment, Tier II Environmental Review Assessment per HUD funding requirements, Environmental Site Assessment – HUD Part 50 or Part 58, Environmental Site Assessment – USDA 1940-G or 1794).

##### **PART 2 – PRODUCTS (No Comments)**

##### **PART 3 – EXECUTION**

- A.** Mitigation:
  - 1. Provide mitigation steps as determined by environmental site assessment.

**02 26 00 / HAZARDOUS MATERIAL ASSESSMENT / 02200**

Healthy Living Environment 7.15: Lead-Safe Work Practices [\[Mandatory\]](#)

**PART 1 – GENERAL****1.1 Quality Assurance**

- A.** Lead-Safe Work Practices: For properties built before 1978, comply with EPA’s Renovation, Repair, and Painting Regulation (RRP) (40 CFR 745) and HUD requirements at 24 CFR 35.
- B.** Training and Certification for in-house maintenance staff and construction team: Comply with EPA RRP requirements.

**PART 2 – PRODUCTS (No Comments)****PART 3 – EXECUTION (No Comments)****02 41 19 / DEMOLITION / 02222**

Materials Beneficial to the Environment 6.3: Construction Waste Management [\[Mandatory\]](#)

*Materials Beneficial to the Environment 6.4: Construction Waste Management [Optional]*

**PART 1 – GENERAL****1.1 Related Sections**

- A.** Division 01 Section [01 74 19 \[01524\]](#) “Construction Waste Management and Disposal” for diversion goals and methods.
- B.** Division 01 Section [01 81 19 \[18119\]](#) “Indoor Air Quality Requirements” for protection measures during demolition.

**PART 2 – PRODUCTS (No Comments)****PART 3 – EXECUTION (No Comments)**

- A.** Formulate a waste management plan specifically and exclusively for the demolition phase of the project.

## Division 03: Concrete

### 03 30 00 / CONCRETE / 03300

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

*Healthy Living Environment 7.3: Environmentally Preferable Flooring Coverings: Alternative Sources [Optional]*

*Healthy Living Environment 7.10: Vapor Barrier Strategies [Mandatory, if foundation work in scope.]*

As a reminder, these recommendations should supplement, not replace, the section prepared by the design team.

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. *Product data for Criterion 6.6: For products having recycled content, documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- B. *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processing, and manufacture.*
- C. *Product data for Criterion 7.10: For vapor barrier system, documentation and samples of underslab vapor barrier to be used.*

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Concrete
  - 1. *Recycled Content: Provide cement with minimum 50% post-industrial recycled content or 25% post-consumer recycled content; Structural Engineer's approval.*
  - 2. *Regional Materials: Provide aggregate manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*
  - 3. *Basement Floors: Seal and stain with low-VOC material rather than providing any floor treatments.*
- B. Steel Reinforcement
  - 1. *Recycled Content: Provide steel with minimum 90% recycled content of which 60% shall be post-consumer.*
  - 2. *Regional Materials: Provide steel manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*
- C. Vapor Barrier
  - 1. *Provide vapor barrier under all concrete slabs.*



**PART 3 – EXECUTION****A. Vapor Barrier**

1. Install a capillary break in direct contact with concrete slab according to one of the following:
  - a. Install 4-inch layer of half-inch diameter or greater clean aggregate, covered with 6 mm (or thicker) polyethylene sheeting, overlapped 6 to 12 inches at the seams, and in direct contact with the concrete slab above.
  - b. Install 4-inch uniform layer of sand, overlain with a layer or strips of geotextile drainage matting installed according to the manufacturer's instructions, and cover with polyethylene sheeting overlapped 6 inches to 12 inches at the seams.
2. Install beneath crawl spaces:
  - a. Install 8 mm minimum thickness cross-laminated polyethylene on the crawl floor, extended at least 12 inches up on piers and foundation walls, and overlap joints at least 12 inches minimum.
  - b. Line "high-traffic" areas of the crawl space with foam board to avoid disturbing polyethylene.

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**Recommendations: Consider using fly ash, ground blast-furnace slag, and/or rice-hull ash to replace Portland cement in concrete.**

- Up to 20% of cement can be replaced with minimal impact to schedule and finish.
- Up to 60% replacement is possible, but may impact final color.
- Coordinate with structural engineer on final percentages of replacement material.

*Unit Cost: Same as standard concrete*

Radiant heating in the garage or sidewalks may be used to prevent ice formation as a safety feature only and must comply with ASHRAE 90.1-2007 Section 6.4.3.8.

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**Regional Considerations:**

[BA] MH, CVC, MC: 8-mm polyethylene sheeting or rigid foam insulation for below grade use under slab

[BA] HH, HDMD: 8-mm polyethylene directly under slab

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## Division 04: Masonry

### 04 20 00 / UNIT MASONRY / 04810

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- B. *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*

##### 1.2 Masonry

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills exposed to weather with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
  - 1. Extend cover a minimum of 24 inches (600 mm) down both sides of walls and hold cover securely in place.
  - 2. Where one wythe of multiwythe masonry walls is completed in advance of other wythes, secure cover a minimum of 24 inches (600 mm) down face next to unconstructed wythe and hold cover in place.

#### PART 2 – PRODUCTS

Confirm that specified materials meet Criteria. Many fire-resistive masonry products do not contain recycled content.

- A. *Recycled Content: Provide unit masonry with minimum 25% post-consumer or 50% post-industrial recycled content; Structural Engineer's approval.*
- B. *Regional Materials: Provide unit masonry manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*

**PART 3 – EXECUTION (No Comments)**


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**Recommendations:** Consider using fly ash, ground blast-furnace slag, and/or rice-hull ash to replace Portland cement in concrete; coordinate with structural engineer.

Autoclaved Aerated Concrete (AAC) Masonry Units (protect from moisture with claddings or coatings)

E-Crete (AZ) [www.e-crete.com](http://www.e-crete.com)

Unit Cost: AAC = \$7.05/sf (8" x 8" x 24")

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**Regional Considerations:**

[BA] CVC, MH: Install insulation and air barriers to avoid ice dams; install roof membranes in roof valleys and at eaves.

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**04 70 00 / MANUFACTURED MASONRY / 04700**

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- B.** *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** *Recycled Content: Provide masonry with minimum 25% post-consumer or 50% post-industrial recycled content; Structural Engineer's approval.*
- B.** *Regional Materials: Provide masonry products manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*

**PART 3 – EXECUTION (No Comments)****Recommendations:**

Lodestone (TX) [www.lodestoneproducts.com](http://www.lodestoneproducts.com)

Unit Cost: LodeStone blocks \$6.25/sf

Standard LodeStone trim \$6.50/LF

Larger copings \$8.25/LF

Nichiha Fiber-Cement Rainscreen Siding (GA) 50% post-industrial [www.nichiha.com](http://www.nichiha.com)

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**Regional Considerations:**

[BA] CVC, MH: Install insulation and air barriers to avoid ice dams; install roof membranes in roof valleys and at eaves.

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## Division 05: Metals

### 05 10 00 / STRUCTURAL METAL FRAMING / 05120

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- B. *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. *Recycled Content: Provide steel with minimum 25% post-consumer or 50% post-industrial recycled content.*
- B. *Regional Materials: Provide steel products manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*

#### PART 3 - EXECUTION (No Comments)

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##### Recommendations:

Consider specifying 90% recycled content, 60% being post-consumer recycled content.

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## Division 06: Wood, Plastics, & Composites

### (Division 06: Woods & Plastics)

#### 06 10 00 / ROUGH CARPENTRY / 06100

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Section [Optional]*

*Materials Beneficial to the Environment 6.8: Certified Salvaged and Engineered Wood Products [Optional]*

Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde [Mandatory]

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B. *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- C. *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*
- D. *Product data for Criterion 6.8: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Alternative compliance paths as follows:*
  - 1. *Salvaged wood products*
  - 2. *Engineered products not containing urea-formaldehyde-based binders*
- E. Product data for Criterion 7.1: For composite wood products, documentation indicating compliance with CARB 93120 standard

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Adhesives and Sealants: VOC content not to exceed the following (g/L; less water and less exempt compounds):
  - 1. Subfloor Adhesives: 50 g/L
- B. *Recycled Content: Provide wood with minimum 25% post-consumer or 50% post-industrial recycled content.*
- C. *Regional Materials: Provide wood manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*
- D. *Section 6.8: Provide wood products complying with Forest Stewardship Council program. Alternative compliance paths as follows:*
  - 1. *Reclaimed wood products*
  - 2. *Engineered products not containing urea-formaldehyde-based binders*
- E. Composite Wood: Provide wood products that comply with CARB 93120 standard.

**PART 3 – EXECUTION (No Comments)****Recommendations:**

Allard Lumber Company (VT) [www.allardlumber.com](http://www.allardlumber.com)

AltruWood (OR) [www.altruwood.com](http://www.altruwood.com)

Big Creek Lumber Company (CA) [www.big-creek.com](http://www.big-creek.com)

McDowell, Lumber Company (PA) [www.mcdowelllumber.com](http://www.mcdowelllumber.com)

F.D. Sterritt Lumber (MA) [www.sterrittlumber.com](http://www.sterrittlumber.com)

Menominee Tribal Enterprises (WI) <http://mtewood.com/>

ROMEX World Trade Company (LA) [www.royomartin.com](http://www.royomartin.com)

Unit Cost: FSC, CA 93120 wood products add 5%–25% to final installed price.

**06 16 00 / SHEATHING / 06160**

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [\[Mandatory\]](#)

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Section [Optional]*

*Materials Beneficial to the Environment 6.8: Certified Salvaged and Engineered Wood Products [Optional]*

Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde [\[Mandatory\]](#)

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B.** *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- C.** *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*
- D.** *Product data for Criterion 6.8: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Alternative compliance paths as follows:*
  - 1. *Salvaged wood products*
  - 2. *Engineered products not containing urea-formaldehyde-based binders*
- E.** Product data for Criterion 7.1: For composite wood products, documentation indicating CARB 93120 compliance.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** *Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:*
1. *Subfloor Adhesives: 50 g/L*
- B.** *Recycled Content: Provide wood products with minimum 25% post-consumer or 50% post-industrial recycled content.*
- C.** *Regional Materials: Provide wood products manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*
- D.** *Section 6.8: Provide wood products complying with Forest Stewardship Council program. Alternative compliance paths as follows:*
1. *Reclaimed wood products*
  2. *Engineered products not containing urea-formaldehyde-based binders*
- E.** *Composite Wood: Provide wood products that comply with CARB 93120 standard.*

**PART 3 – EXECUTION (No Comments)****Recommendations:**

Allard Lumber Company (VT) [www.allardlumber.com](http://www.allardlumber.com)

AltruWood (OR) [www.altruwood.com](http://www.altruwood.com)

Big Creek Lumber Company (CA) [www.big-creek.com](http://www.big-creek.com)

McDowell, Lumber Company (PA) [www.mcdowelllumber.com](http://www.mcdowelllumber.com)

F.D. Sterritt Lumber (MA) [www.sterrittlumber.com](http://www.sterrittlumber.com)

Menominee Tribal Enterprises (WI) <http://mtewood.com/>

ROMEX World Trade Company (LA) [www.royomartin.com](http://www.royomartin.com)

Unit Cost: FSC, CA 93120 wood products add 5%–25% to final installed price

**06 17 00 / SHOP-FABRICATED STRUCTURAL WOOD / 06176**

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Section [Optional]*

*Materials Beneficial to the Environment 6.8: Certified Salvaged and Engineered Wood Products [Optional]*

Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B.** *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- C.** *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*
- D.** *Product data for Criterion 6.8: Chain-of-custody certificates certifying that products specified to be made from certified wood comply with forest certification requirements. Alternative compliance paths as follows:*
  - 1. *Salvaged wood products*
  - 2. *Engineered products not containing urea-formaldehyde-based binders*
- E.** Product data for Criterion 7.1: For composite wood products, documentation indicating CARB 93120 compliance.

**1.2 Delivery, Storage, and Handling**

- A.** Delivery, Storage, and Handling: Handle and store structural wood components to comply with recommendations in TPI BCSI, “Building Component Safety Information: Guide to Good Practice for Handling, Installing, Restraining, & Bracing Metal Plate Connected Wood Trusses.”

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Subfloor Adhesives: 50 g/L
- B.** *Recycled Content: Provide wood with minimum 25% post-consumer or 50% post-industrial recycled content.*
- C.** *Regional Materials: Provide wood products manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*
- D.** *Section 6.8: Provide wood products complying with Forest Stewardship Council program. Alternative compliance paths as follows:*
  - 1. *Reclaimed wood products*
  - 2. *Engineered products not containing urea-formaldehyde-based binders*
- E.** Composite Wood: Provide wood products that comply with CARB 93120 standard.

**PART 3 – EXECUTION (No Comments)**



**06 20 00 / FINISH CARPENTRY / 06201**

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

*Materials Beneficial to the Environment 6.8: Certified, Salvaged, or Engineered Wood Products [Optional]*

Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 7.1: For composite wood products, documentation indicating CARB 93120 compliance.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Composite Wood: Provide wood products that comply with CARB 93120 standard.

**PART 3 – EXECUTION (No Comments)****Recommendations:**

Evergreen Particleboard (ID) [www.bc.com](http://www.bc.com)

Columbia Forest Products (OR) [www.columbiaforestproducts.com](http://www.columbiaforestproducts.com)

F.W. Honerkamp Co (NY) [www.honerkamp.com](http://www.honerkamp.com)

Flakeboard (SC) [www.flakeboard.com](http://www.flakeboard.com)

Kirei USA (CA) [www.kireiusa.com](http://www.kireiusa.com)

Temple-Inland Forest Products (TX) [www.templeinland.com](http://www.templeinland.com)

*Unit Cost: CA 93120 wood products add a premium of 5%–25% to final installed price*

**06 40 00 / ARCHITECTURAL WOODWORK / 06400**

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

*Materials Beneficial to the Environment 6.8: Certified, Salvaged, or Engineered Wood Products [Optional]*

Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 7.1: For composite wood products, documentation indicating CARB 93120 compliance

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Composite Wood: Provide wood products that comply with CARB 93120 standard.

**PART 3 – EXECUTION (No Comments)**

## Division 07: Thermal & Moisture Protection

### 07 21 00 / THERMAL INSULATION / 07210

Energy Efficiency 5.1d: Building Performance Standard [\[Mandatory\]](#)

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [\[Mandatory\]](#)

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

**As a reminder, these recommendations should supplement, not replace, the section prepared by the design team.**

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B. *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*

##### 1.2 Related Sections

- A. Coordinate with Division 07, Section [07 27 00 \[07270\]](#) Air Barrier Systems.

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Multipurpose Construction Adhesives: 70 g/L
- B. *Recycled Content: Provide insulation with 25% post-consumer or at least 50% post-industrial recycled content.*
- C. Air Conditioning Units: Sleeves for future installation of through-wall AC units shall be insulated to achieve a minimum of R-7. Insulated covers for these sleeves must be provided by the building for use during heating season and when AC units are not installed.
- D. Inaccessible Locations: Use unfaced insulation or high-density fiberglass insulation.
- E. Light Tubes: Insulate with a minimum of R-8 duct insulation.
- F. Whole-House Fan Cover: Insulate with minimum R-5 insulated cover gasketed to framing assembly.

**BEST PRACTICE:**

For ASHRAE 90.1 2007 Climate Zones 1,2,3, and 4, select insulation based on the ENERGY STAR MFHR National Prescriptive Path requirements.

	Nominal R Value (minimum)	Assembly U-Value (maximum)	Nominal R Value (minimum)	Nominal U-Value (maximum)	Assembly R Value (minimum)	Nominal U-Value (maximum)	Nominal R Value (minimum)	Assembly U-Value (maximum)
	CLIMATE ZONE 1		CLIMATE ZONE 2		CLIMATE ZONE 3		CLIMATE ZONE 4	
ROOF INSULATION								
Insulation entirely above deck	R-25.0 continuous	U-0.039	R-25.0 continuous	U-0.039	R-30.0 continuous	U-0.032	R-35.0 continuous	U-0.028
Metal building	R-19.0	U-0.065	R-19.0 + R-5 c.i	U-0.049	R-19.0 + R-5 c.i	U-0.049	R-19.0 + R-5 c.i	U-0.049
Attic and other	R-38.0	U-0.027	R-38.0	U-0.027	R-38.0	U-0.027	R-49.0	U-0.021
ABOVE GRADE WALL INSULATION								
Mass	R-5.7 continuous	U-0.139	R-10.0 continuous	U-0.085	R-10.0 continuous	U-0.085	R-15.0 continuous	U-0.060
Steel-framed	R-13.0 + R-5.0 c.i.	U-0.077	R-13.0 + R-7.5 c.i.	U-0.064	R-13.0 + R-7.5 c.i.	U-0.064	R-13.0 + R-10 c.i.	U-0.055
Wood-framed and other	R-13	U-0.089	R-13	U-0.089	R-13.0 + R-5.0 c.i	U-0.059	R-13.0 + R-5 c.i.	U-0.059
BELOW GRADE WALL INSULATION								
Conditioned space	None	None	None	None	R-5.0 continuous or R-13.0 cavity	U-0.149	R-10.0 continuous or R-13.0 cavity	U-0.085
Unconditioned space	None	None	None	None	None	None	None	None
FLOOR INSULATION								
Mass	R-8.3 continuous	U-0.087	R-8.3 continuous	U-0.087	R-8.3 continuous	U-0.087	R-10.4 continuous	U-0.074
Steel joist	R-13.0	U-0.069	R-19.0	U-0.052	R-19.0	U-0.052	R-30.0	U-0.038
Wood-framed and other	R-13.0	U-0.066	R-30.0	U-0.033	R-30.0	U-0.033	R-30.0	U-0.033
SLAB INSULATION								
Unheated (non-radiant) and on-grade	None		None		None		R-10.0 for 24 in. vertical or horizontal	
Heated (radiant)	R-7.5 for 12 in. vertical or horizontal		R-7.5 for 12 in. vertical or horizontal		R-10.0 for 24 in. vertical or horizontal		R-15.0 for 24 in. vertical or horizontal	

**BEST PRACTICE:**

For ASHRAE 90.1 2007 Climate Zones 5,6,7, and 8, select doors based on the ENERGY STAR MFHR National Prescriptive Path requirements.

	Nominal R Value (minimum)	Assembly U-Value (maximum)	Nominal R Value (minimum)	Nominal U-Value (maximum)	Assembly R Value (minimum)	Nominal U-Value (maximum)	Nominal R Value (minimum)	Assembly U-Value (maximum)
	CLIMATE ZONE 5		CLIMATE ZONE 6		CLIMATE ZONE 7		CLIMATE ZONE 8	
ROOF INSULATION								
Insulation entirely above deck	R-35.0 continuous	U-0.028	R-35.0 continuous	U-0.028	R-40.0 continuous	U-0.025	R-40.0 continuous	U-0.025
Metal building	R-19.0 + R-5 c.i	U-0.049	R-19.0 + R-5 c.i	U-0.049	R-19.0 + R-5 c.i	U-0.049	R-19.0 + R-5 c.i	U-0.049
Attic and other	R-49.0	U-0.021	R-60.0	U-0.017	R-60.0	U-0.017	R-60.0	U-0.017
ABOVE GRADE WALL INSULATION								
Mass	R-17.0 continuous	U-0.053	R-19.0 continuous	U-0.048	R-20.0 continuous	U-0.046	R-25.0 continuous	U-0.037
Steel-framed	R-13.0 + R-10 c.i.	U-0.055	R-13.0 + R-10 c.i.	U-0.055	R-13.0 + R-15.6 c.i.	U-0.042	R-13.0 + R-18.8 c.i.	U-0.037
Wood-framed and other	R-19.0 + R-5 c.i.	U-0.048	R-19.0 + R-5 c.i.	U-0.048	R-21.0 + R-5 c.i.	U-0.045	R-21.0 + R-10 c.i.	U-0.035
BELOW GRADE WALL INSULATION								
Conditioned space	R-10.0 continuous or R-13.0 cavity	U-0.085	R-15.0 continuous or R-19.0 cavity	U-0.060	R-15.0 continuous or R-19.0 cavity	U-0.060	R-15.0 continuous or R-19.0 cavity	U-0.060
Unconditioned space	None	None	None	None	None	None	None	None
FLOOR INSULATION								
Mass	R-12.5 continuous	U-0.064	R-14.6 continuous	U-0.057	R-16.7 continuous	U-0.051	R-16.7 continuous	U-0.051
Steel joist	R-30.0	U-0.038	R-38.0	U-0.032	R-38.0	U-0.032	R-38.0	U-0.032
Wood-framed and other	R-30.0	U-0.033	R-30.0	U-0.033	R-30.0	U-0.033	R-30.0	U-0.033
SLAB INSULATION								
Unheated (non-radiant) and on-grade	R-10 for 24 in. vertical or horizontal		R-15.0 for 24 in. vertical or horizontal		R-15.0 for 24 in. vertical or horizontal		R-20.0 for 24 in. vertical or horizontal	
Heated (radiant)	R-15.0 for 24 in. vertical or horizontal		R-20.0 for 48 in. vertical or horizontal		R-20.0 for 48 in. vertical or horizontal		R-20.0 for 48 in. vertical or horizontal	

**PART 3 – EXECUTION****A. Insulation:**

1. Install on all sides of the exterior envelope.
  - a. Avoid: gaps, voids, compression, and wind intrusion.
2. Cut and fit insulation lightly around piping, electrical wiring, and any other penetrations.
3. Do not obstruct ventilation spaces.
4. Fill gaps and voids with insulation and mastic.
5. In vertical installations where framing members are set out from substrate wall structure, provide insulation support strips attached to backs of studs to hold insulation in place.
6. Install insulation where dropped ceilings or soffits adjoin exterior walls.
7. No foil-faced insulation is to be used in basement insulation cavities.

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**Recommendations:**

Thermafiber (70% Standard recycled content, up to 90% with longer lead time) [www.thermafiber.com](http://www.thermafiber.com)

Unit Cost: Blanket Insulation for Walls: R-19 = \$.92 sf / R-30 = \$1.29 sf

Blanket Insulations for Floors/Ceilings: R30 = \$1.78 sf / R38 = \$2.18 sf

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**Regional Considerations:**

[BA] MH: Basements—Install insulation exterior foundation wall. If on interior, insulation must extend down the wall to a depth at least 2 feet below grade.

[BA] CVC: Extend the underslab insulation for the entire surface area of the slab.

[IECC] Zones 4–8: Provide a thermal barrier by installing contiguous and continuous insulation over the entire building envelope. Insulation should be perfectly aligned with the air barrier. Provide continuous slab insulation to avoid thermal bypass at exposed concrete slabs.

[IECC] Zones 5–8: Install insulation with a vapor retarder on the warm side to prevent moisture paths through the insulation.

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**07 27 00 / AIR BARRIER SYSTEMS / 07270**

Energy Efficiency 5.1: Building Performance Standard [Mandatory]

*Energy Efficiency 5.2: Additional Reductions in Energy Use [Optional]*

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

Healthy Living Environment 7.10: Vapor Barrier Strategies [Mandatory]

Healthy Living Environment 7.12: Water Drainage [Mandatory, when replacing particular assemblies called out in Criterion.]

Healthy Living Environment 7.13: Garage Isolation [Mandatory]

Healthy Living Environment 7.14: Integrated Pest Management [Mandatory]

**As a reminder, these recommendations should supplement, not replace, the section prepared by the design team.**

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B.** Product data for Criterion 7.10: For vapor barrier system, provide product data of underslab vapor barrier to be used.
- C.** Per Criterion 7.12: Water Drainage System: When replacing impacted assemblies, provide waterproofing that prevents water passage for the following areas:
  - 1. Walls, Exterior Windows, and Doors
  - 2. Roof Systems
  - 3. Thermal Barrier
- D.** Per Criterion 7.13: Provide the following sealing measures:
  - 1. Garage containment isolation measures with ASHRAE 62.2
  - 2. Air sealing per EPA Indoor airPLUS program 5.5
- E.** Per Criterion 7.14: Provide pest management measures.

**1.2 Related Sections**

- A.** Coordinate with Division 07 Section **07 21 00 [07210]** Thermal Insulation.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Multipurpose Construction Adhesives: 70 g/L
- B.** Applications: Water Management:
  - 1. Walls, Exterior Windows, and Doors
    - a. Provide weather-resistive barrier/housewrap.
    - b. Provide pathway for liquid water to exit exterior wall assembly.
  - 2. Roof Systems
    - a. Provide 2-inch clearance between wall cladding and roofing materials.
  - 3. Thermal Barrier
    - a. Provide properly sealed drainage plane.

**PART 3 – EXECUTION****A. Installation**

1. Provide continuous air barriers.
  - a. Install continuous interior air barrier around each dwelling unit to compartmentalize from adjoining spaces/units.
  - b. Install continuous external air barrier between all conditioned space and unconditioned space.
2. Compartmentalization of individual dwelling units:
  - a. Walls
    - 1) Seal exterior wall corners with joint sealant [and/or foam].
    - 2) Seal vertical walls at all penetrations with joint sealant [and/or foam].
    - 3) Seal window frame with low expanding foam.
    - 4) Weatherstrip doors to common spaces with joint sealant [and/or foam].
    - 5) Staircase walls: Where staircases are located on an exterior wall, extend structural sheathing above and below stringers to allow for taping with joint compound. Fully align air barrier with insulation and seal any gaps with joint sealant [and/or foam].
    - 6) Seal between drywall and framed common walls using expanded foam [and/or fire-rated blocking, caulk].
    - 7) Seal bottom plates on exterior walls with a foam gasket [and/or caulk, foam].
  - b. Floors
    - 1) Provide complete seal at joists supporting conditioned space with joint sealant [and/or foam].
  - c. Ceilings
    - 1) Install continuous top and bottom plates, and sheathing to create a six-sided air barrier on all attic knee walls and seal with foam [and/or caulk].
    - 2) Install blocking at exposed edges of insulation at joists and rafters
    - 3) Truss framing: Install blocking at the top and bottom of each framing bay.
    - 4) Seal attic hatches with joint sealant [and/or foam].
    - 5) Provide sealing around skylight shaft with joint sealant [and/or foam].
    - 6) Seal dropped ceiling soffit at the top and sides bordering exterior ceiling and wall assemblies with foam [and/or blocking, caulk].
    - 7) Install baffles between all rafters or trusses to direct the flow of air over and above the attic insulation.
    - 8) Recessed lighting when below unconditioned attic: Install insulation contact, airtight rated (ICAT) and seal to drywall with gasket [and/or caulk, foam]
  - d. Garage Isolation Air Barrier when attached to dwelling units:
    - 1) Install continuous air barrier between the conditioned living space and any garage space and seal with foam [and/or caulk].
    - 2) Seal between all walls separating conditioned and garage spaces with foam [and/or caulk].
    - 3) All pipe and conduit penetrations shall be sealed with material compatible with the adjacent materials and resilient to temperature fluctuations and providing fire-resistive characteristics if required by authorities having jurisdictions.
    - 4) Floor trusses: Seal and block floor trusses and joists between conditioned space and garage with foam [and/or caulk].

- e. Bathtub and Shower enclosures
  - 1) Use mold-resistant material [plywood, oriented strand board (OSB), sheathing boards, moisture-resistant gypsum] behind bathtub or shower enclosures, and extend the mold-resistant material the full length and width of the wall(s) on which the bathtub or shower enclosure abuts. Seal at all joints.
  - 2) Install spray foam at framing behind bathtub or shower enclosures prior to setting tub or shower.
- 3. Continuity of external air barrier.
  - f. Roof
    - 1) Install 4-inch to 6-inch “peel and seal” self-adhering waterproofing strips over joints in roof decking before installing the roof underlayment and cover.
  - g. Mechanical Work
    - 1) Seal holes from penetrations from unconditioned spaces with joint sealant [and/or foam] and provide flashing.
    - 2) Seal flue openings with flashing and fire-rated joint sealant [and/or foam]
  - h. Building Envelope
    - 1) Air barrier must be continuous around building, including all components that act together as the exterior air barrier (sheet or liquid membrane with compatible tapes, caulks, flashing). Foam or caulk all exterior sheathing joints and intersections.
    - 2) Install weatherstripping hard-fastened to the door or frame at entranceways
    - 3) Seal the roof curb at ductwork penetrations.
    - 4) Install continuous air barrier at the intersection of the porch roof and conditioned space.
    - 5) Air seal and insulate exterior sheathing on bottom of cantilevered floor.
    - 6) Lap and foam or caulk exterior rigid insulation over the seams of the exterior wall sheathing.
  - i. Bathtub and Shower Enclosures
    - 1) Use mold-resistant material [plywood, oriented strand board (OSB), sheathing boards, moisture-resistant gypsum] behind bathtub or shower enclosures, and extend the mold-resistant material the full length and width of the wall(s) on which the bathtub or shower enclosure abuts. Seal at all joints.
    - 2) Install spray foam at framing behind bathtub or shower enclosures, prior to setting tub or shower.
  - j. Fireplace enclosures
    - 1) Seal fireplace flue and wall penetrations with fire-rated caulking along with flashing or UL-rated collars.
  - k. Garage Isolation Air Barrier:
    - 1) Install continuous air barrier between the conditioned living space and any garage space.
    - 2) Seal between all walls separating conditioned and garage spaces.
    - 3) All pipe and conduit penetrations shall be sealed with material compatible with the adjacent materials and resilient to temperature fluctuations and providing fire-resistive characteristics if required by authorities having jurisdictions.
    - 4) Floor trusses: Seal and block floor trusses and joists between conditioned space and garage.
  - l. Use air sealing with polyurethane caulk for following areas:
    - 1) Slab openings
    - 2) Slab penetrations
    - 3) Control or expansion joints
    - 4) Sump cover



3. Install permeable coverings on exterior walls.
4. Pest Management measures:
  - a. For openings in the building envelope less than 1/4 inch, including pipe and electrical penetrations:
    - 1) Completely seal to avoid pest entry.
  - b. Install rodent- and corrosion-proof screens for openings greater than 1/4 inch.

**B. Building Envelope and Unit Compartmentalization Leakage Testing and Inspections**

1. Residential units have been designed to have airtight air barriers between units; inspect air barrier at the following locations and repair as required.
  - a. Between party walls and floor structure.
  - b. Between party walls and roof structure.
  - c. Around pipes, conduits, ducts, and fixtures penetrating the air barrier surface.
  - d. At exterior walls or surfaces adjoining unconditioned space.
2. The following requirements apply to locations as defined in A.1, 2, and 3: Comply with Reference Standard: ASTM E779-03 – Standard Test Method for Determining Air Leakage Rate by Fan Pressurization.
  - a. Air barriers have been designed to limit leakage area to less than 1.75 square inches (806 square mm) per 100 square feet (square meter) (ELA at 4 Pa) of wall, ceiling, and floor area.
  - b. Perform inspection and testing prior to covering up air seals in walls and floors.
    - 1) Alternate: Perform testing after completion of construction but before occupancy.
    - 2) Inspections may include the following:
      - a) Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
      - b) Continuous support of air barrier system has been provided.
      - c) Substrate surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
      - d) Site conditions for application temperature and dryness of substrates have been maintained.
      - e) Maximum exposure time of materials to UV deterioration has not been exceeded.
      - f) Surfaces have been primed, if applicable.
      - g) Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
      - h) Termination mastic has been applied on cut edges.
      - i) Strips and transition strips have been firmly adhered to substrate.
      - j) Compatible materials have been used.
      - k) Transitions at changes in direction and support at gaps have been provided.
      - l) Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, support, integrity, and continuity of seal.
      - m) All penetrations have been sealed.
  - c. Test air barrier in accordance with ASTM E 779, using the progressive sampling method defined in 2001 California Energy Efficiency Standards Residential Manual, Chapter 4.
    - 1) If test results show excess leakage area, re-inspect, repair, and re-test.

- d. Test differential pressure between residential unit and pressurized hallway:
  - 1) Entrance door closed. Operate the ventilation system in normal manner.
  - 2) Take pressure readings for 15 minutes, with minimum of one measurement every 10 seconds.
  - 3) Test will be considered a failure if the lowest pressure differential between residential unit and hallway is less than 0.004 inches water gauge (1 Pa), or if average pressure differential is less than 0.02 inches water gauge (5 Pa).
3. The following requirements apply to locations as defined in A.
4. Comply with Reference Standard ASTM E1186 Standard Test Method for Air Permeance of Building Materials
  - a. Inspections may include the following:
    - 1) Continuity of air barrier system has been achieved throughout the building envelope with no gaps or holes.
    - 2) Continuous structural support of air barrier system has been provided.
    - 3) Masonry and concrete surfaces are smooth, clean, and free of cavities, protrusions, and mortar droppings.
    - 4) Site conditions for application temperature and dryness of substrates have been maintained.
    - 5) Maximum exposure time of materials to UV deterioration has not been exceeded.
    - 6) Surfaces have been primed, if applicable.
    - 7) Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
    - 8) Termination mastic has been applied on cut edges.
    - 9) Strips and transition strips have been firmly adhered to substrate.
    - 10) Compatible materials have been used.
    - 11) Transitions at changes in direction and structural support at gaps have been provided.
    - 12) Connections between assemblies (membrane and sealants) have complied with requirements for cleanliness, preparation and priming of surfaces, structural support, integrity, and continuity of seal.
    - 13) All penetrations have been sealed.
  - b. Testing: Air barrier assemblies will be tested for evidence of air leakage according to one or more of the following:
    - 1) ASTM E1186, smoke pencil with pressurization or depressurization.
    - 2) ASTM E1186, chamber pressurization or depressurization with smoke tracers.
    - 3) ASTM E1186, chamber depressurization using detection liquids.
  - c. Submit written weekly reports.
  - d. Remove and replace deficient air barrier components and re-test as specified above.

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**Regional Considerations:**

[BA] HH: Do not cover interior partitions with plastic vapor retarders or vinyl wallpaper.

[BA] MH, CVC: Install felt half lapped and housewrap lapped shingle-style. Install insulation and air barriers to avoid ice dams and roof membranes in roof valleys and at eaves.

[BA] HH, HDMD, MC: Install two layers of building felt; install housewrap lapped, shingle-style, especially over and around windows, doors, and other penetrations.

[IECC] Zones 4–6: Provide interior air barrier to prevent air flow from inside to outside the building envelope.

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**07 46 00 / SIDING / 07460**

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Section [Optional]*

Healthy Living Environment 7.12: Water Drainage [Mandatory, when replacing particular assemblies called out in Criterion.]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- B.** *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*

**1.2 Related Sections**

- A.** Comply with general requirements in **07 27 00 [07270]** Air Barrier Systems.
- B.** Comply with general requirements in **07 60 00 [07600]** Metal Flashing.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** *Recycled Content: Provide material with minimum 25% post-consumer or 50% post-industrial recycled content.*
- B.** *Regional Materials: Provide material products manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*

**PART 3 – EXECUTION**

- A.** Water Drainage: Coordinate with installation requirements in **07 27 00 [07270]** Air Barrier Systems and **07 60 00 [07600]** Metal Flashing.

**Recommendations: Unit Cost: \$3.91 sf**

Cemplank (CA) [www.cemplank.com](http://www.cemplank.com)

CertainTeed Corporation (PA) 50% post-industrial [www.certainteed.com](http://www.certainteed.com)

GAF Materials (NJ) [www.gaf.com](http://www.gaf.com)

James Hardie Building Products (CA) [www.jameshardie.com](http://www.jameshardie.com)

Nichiha USA (GA) 55% post-industrial [www.nichiha.com](http://www.nichiha.com)

**Regional Considerations:**

[BA] HH: Backprime all wood cladding

**07 50 00 / ROOFING / 07550**

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Section [Optional]*

*Materials Beneficial to the Environment 6.9a: Reduced Heat-Island Effect: Roofing [Optional]*

Healthy Living Environment 7.12: Water Drainage [Mandatory, when replacing particular assemblies called out in Criterion.]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B.** *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- C.** *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*
- D.** *Product data for Criterion 6.9a: Comply with ENERGY STAR and ASTM E408-71.*

**1.2 Related Sections**

- A.** Comply with general requirements in 07 60 00 [07600] Metal Flashing.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Single-ply Roof Membrane Adhesives: 250 g/L
  - 2. Nonmembrane Roof Installation/Repair: 300 g/L
  - 3. Single-Ply Roof Material Installation/Repair: 250 g/L
- B.** *Recycled Content: Provide roofing material with minimum 25% post-consumer or 50% post-industrial recycled content.*
- C.** *Regional Materials: Provide roofing products manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*
- D.** *Surface Emissivity: Provide 100% [75% when combined with vegetated roof] of roofing with at least 0.8 emissivity when tested in accordance with ASTM 408.*

**PART 3 – EXECUTION**

- A.** Water Drainage: Coordinate with installation requirements in 07 27 00 [07270] Air Barrier Systems and 07 60 00 [07600] Metal Flashing.

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**Recommendations: Avoid PVC membrane roofing, which is manufactured using phthalates.**

Standing Seam Metal Roofing: ATAS—Eco Seam 68: 48% post-consumer, 22.57% post-industrial

Energy Star certified (PA, AZ, TN) [www.atas.com](http://www.atas.com)

Unit Cost: \$1,500 sf

JM GlasKap® CR Cool Roof (CO) [www.specjm.com](http://www.specjm.com)

Derbigum (KS) [www.derbigum.com](http://www.derbigum.com)

Unit Cost: \$15.60 sf; Cap sheet: \$1.65 sf

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**Regional Considerations:**

[BA] CVC, MH: Carefully install insulation and air barriers to avoid ice dams; install roof membranes in roof valleys and at eaves.

[IECC] Zones 6 and 7 may be exempted from the required low-VOC adhesives and sealants if they are not capable of adhering at temperatures below 40F. Identify what other adhesives and/or sealants were required and at what phase of construction the installation of non-low VOC products was required.

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**07 55 63 / VEGETATED ROOF / 07500**

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Section [Optional]*

*Materials Beneficial to the Environment 6.9a: Reduced Heat-Island Effect: Roofing [Optional]*

Healthy Living Environment 7.12: Water Drainage [Mandatory, when replacing particular assemblies called out in Criterion.]

**As a reminder, these recommendations should supplement, not replace, the section prepared by the design team.**

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B.** *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- C.** *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*
- D.** Product data for Criterion 6.9a: For vegetated roof, documentation indicating plants installed on at least 50% [75% when combined with ENERGY STAR-compliant roof] of roof area.

## 1.2 Related Sections

- A. Comply with general requirements in 07 60 00 [07600] Metal Flashing.

### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
1. Single-Ply Roof Membrane Adhesives: 250 g/L
  2. Non-Membrane Roof Installation/Repair: 300 g/L
  3. Single-Ply Roof Material Installation/Repair: 250 g/L
- B. *Recycled Content: Provide roofing material with minimum 25% post-consumer or 50% post-industrial recycled content.*
- C. *Regional Materials: Provide roofing products manufactured of primary raw materials extracted or recovered within 500-mile radius of project site.*
- D. Vegetation: Provide native/adapted plants.

### PART 3 – EXECUTION

- A. Water Drainage: Comply with product requirements in 07 60 00 [07600] Metal Flashing.
- B. Electric Field Vector Mapping (EFVM) Testing, recommended for determining leaks in all types of flat roofs:
1. After membrane installation, provide low-voltage method that creates an electrical potential difference between a non-conductive membrane surface and a conductive structural deck or substrate, which is earthed or grounded.
  2. Apply water on the membrane surface and use water as a conductive medium to create an electric field. A breach in the membrane creates a vector (ground fault connection), which can then be measured.
  3. Provide CAD drawings, picture documentation and a written report detailing the location and nature of all breaches and defects found.
  4. Provide a second test one year after the entire system has been installed.
  5. Acceptable testing: Equivalent to EFVM by International Leak Detection.

**Recommendations: Avoid PVC membrane roofing, which is manufactured using phthalates**

LiveRoof (VA) Modules are 100% post-consumer [www.liveroof.com](http://www.liveroof.com)

Unit Cost: Live Roof \$13–20 sf

American Hydrotech (IL) [www.hydrotechusa.com](http://www.hydrotechusa.com)

American Wick Drain Corporation (NC) [www.americanwick.com](http://www.americanwick.com)

Barrett Company (NJ) [www.barrettroofs.com](http://www.barrettroofs.com)

Building Logics (VA) ([www.buildinglogics.com](http://www.buildinglogics.com))

Carlisle SynTec Incorporated (PA) [www.carlisle-syntec.com](http://www.carlisle-syntec.com)

GreenGrid (IL) [www.greengridroofs.com](http://www.greengridroofs.com)

Roofscapes (PA) [www.roofmeadow.com](http://www.roofmeadow.com)

**Regional Considerations:**

[BA] CVC, MH: Carefully install insulation and air barriers to avoid ice dams; install roof membranes in roof valleys and at eaves.

[IECC] Zones 6 and 7 may be exempted from the required low-VOC adhesives and sealants if they are not capable of adhering at temperatures below 40F. Identify what other adhesives and/or sealants were required and at what phase of construction the installation of non-low VOC products was required.

**07 60 00 / METAL FLASHING / 07600**

Healthy Living Environment 7.12: Water Drainage [Mandatory, when replacing particular assemblies called out in Criterion.]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Per Criterion 7.12 Water Drainage System: When replacing impacted assemblies, provide waterproofing that prevents water passage for the following areas:
  1. Walls, Exterior Windows, and Doors
  2. Roof Systems

**PART 2 – PRODUCTS**

- A.** Applications: Water Management:
  1. Walls, Exterior Windows, and Doors
    - a. Provide pan flashing, side flashing, and head flashing.
    - b. Provide flashings at roof/wall intersections and at penetrations through the wall.
  2. Roof Systems
    - a. Provide drip edge on roof perimeter.
    - b. Provide flashing where sloped roofs meet gable wall end.
    - c. Provide kick-out flashings at all wall eaves.
    - d. Provide 2-inch clearance between wall cladding and roofing materials.
    - e. Provide in valleys.

**PART 3 – EXECUTION****A. Installation: Water Management:**

1. Walls, Exterior Windows, and Doors
  - a. Install flashing barriers in rough window and door openings integrating with window and door unit flashings at sill and head. Alternative compliance path as follows:
    - 1) Install pan flashing, with side flashing with extending over pan flashing and head flashing extending over side flashing on windows and exterior door openings. Apply window pan flashing over building paper at sill and corner patches.
  - b. Install flashings at roof and wall intersections and at wall penetrations. Coordinate with other trades to integrate drainage plane, keeping water from entering wall assembly.
2. Roof Systems
  - a. Install drip edge at perimeter of roof
  - b. Install flashing where sloped roofs meet gable wall and integrate vertical wall into building drainage plane
  - c. Install kick-out flashings at wall eave intersections integrated into drainage plane.
  - d. Maintain  $\geq$  2-inch clearance at wall/roof intersections between wall cladding and roofing materials.



## Division 08: Doors & Windows

### 08 10 00 / DOORS AND FRAMES / 08110

Energy Efficiency 5.1d: Building Performance Standard [Mandatory]

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde [Mandatory]

Healthy Living Environment 7.12: Water Drainage [Mandatory, when replacing particular assemblies called out in Criterion.]

Healthy Living Environment 7.13: Garage Isolation [Mandatory]

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B. Product data for Criterion 7.1: For composite wood products, documentation indicating CARB 93120 compliance.
- C. Per Criterion 7.12: Water Drainage System: When replacing imported assemblies, provide waterproofing that prevents water passage for the following areas:
  - 1. Walls
  - 2. Roof Systems
  - 3. Thermal Barrier
- D. Product data for Criterion 7.13: For doors connecting to the garage, documentation indicating air-tight capability in accordance with ASHRAE 62.2-2007.

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Multipurpose Construction Adhesives: 70 g/L
- B. Garage Isolation: Provide doors between living spaces and garages with the following:
  - 1. Automatic Closer
  - 2. Spring Hinges with Fixed Gaskets
  - 3. Weatherstripped
- C. Entranceways: Shall be designed with weatherstripping, hand-fastened to the door or frame.
- D. Composite Wood: Provide wood products that comply with CARB 93120 standard

**E. Applications:**

1. Water Management: Walls
  - a. Provide weather-resistive barrier/housewrap
  - b. Provide pathway for liquid water to exit exterior wall assembly.
  - c. Provide pan flashing, side flashing and head flashing.
  - d. Provide flashings at roof/wall intersections and at penetrations through the wall.

**BEST PRACTICE:**

For ASHRAE 90.1 2007 Climate Zones, select doors based on the ENERGY STAR MFHR National Prescriptive Path requirements.

	CLIMATE ZONE 1		CLIMATE ZONE 2		CLIMATE ZONE 3		CLIMATE ZONE 4	
<b>EXTERIOR DOORS</b>								
	Nominal R Value (minimum)	Assembly U-Value (maximum)	Nominal R Value (minimum)	Nominal U-Value (maximum)	Assembly R Value (minimum)	Nominal U-Value (maximum)	Nominal R Value (minimum)	Assembly U-Value (maximum)
<b>Opaque (all)</b>	R-2.0	U-0.5	R-2.0	U-0.5	R-2.0	U-0.5	R-2.0	U-0.5
<b>VERTICAL GLAZING (INCLUDING PARTIALLY GLAZED DOORS)</b>								
	Assembly U-Value (maximum)	Assembly SHGC (maximum)	Assembly U-Value (maximum)	Assembly SHGC (maximum)	Assembly U-Value (maximum)	Assembly SHGC (maximum)	Assembly U-Value (maximum)	Assembly SHGC (maximum)
<b>Metal framing (entrance door)</b>	U-1.20	SHGC-0.25	U-0.90	SHGC-0.25	U-0.90	SHGC-0.25	U-0.85	SHGC-0.40
	CLIMATE ZONE 5		CLIMATE ZONE 6		CLIMATE ZONE 7		CLIMATE ZONE 8	
<b>EXTERIOR DOORS</b>								
	Nominal R Value (minimum)	Assembly U-Value (maximum)	Nominal R Value (minimum)	Nominal U-Value (maximum)	Assembly R Value (minimum)	Nominal U-Value (maximum)	Nominal R Value (minimum)	Assembly U-Value (maximum)
<b>Opaque (all)</b>	R-2.0	U-0.5	R-2.0	U-0.5	R-2.0	U-0.5	R-2.0	U-0.5
<b>VERTICAL GLAZING (INCLUDING PARTIALLY GLAZED DOORS)</b>								
	Assembly U-Value (maximum)	Assembly SHGC (maximum)	Assembly U-Value (maximum)	Assembly SHGC (maximum)	Assembly U-Value (maximum)	Assembly SHGC (maximum)	Assembly U-Value (maximum)	Assembly SHGC (maximum)
<b>Metal framing (entrance door)</b>	U-0.80	SHGC-0.40	U-0.80	SHGC-0.40	U-0.80	SHGC-0.40	U-0.80	SHGC-0.40

**PART 3 – EXECUTION****A. Installation**

1. Flashing to be installed at exterior doors per 07 60 00 [07600] Metal Flashing.

**Recommendations:**

Algoma Hardwoods (WI) [www.algomahardwoods.com](http://www.algomahardwoods.com)

VT Industries (IA) [www.vtindustries.com](http://www.vtindustries.com)

Unit Cost: \$150 to \$500

Executive Door Company (AZ) 30% pre-consumer [www.executivedoor.com](http://www.executivedoor.com)

Liberty Valley Doors (CA) Made from 100% reclaimed wood [www.libertyvalleydoors.com](http://www.libertyvalleydoors.com)

**Regional Considerations:**

[BA] HH: Follow ASTM Standard Practice for Installation of Exterior Windows, Doors, and Skylights

**08 50 00 / WINDOWS / 08520**

Energy Efficiency 5.1d: Building Performance Standard [Mandatory]

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

Healthy Living Environment 7.12: Water Drainage [Mandatory, when replacing particular assemblies called out in Criterion.]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A. Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”

**1.2 Related Sections**

- A. Coordinate with 07 27 00 [07270] Air Barrier Systems

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A. Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  1. Multipurpose Construction Adhesives: 70 g/L
  2. Structural Glazing Adhesives: 100 g/L
- B. Applications:
  1. Water Management: Walls, Exterior Windows
    - a. Provide weather-resistive barrier/housewrap.
    - b. Provide pathway for liquid water to exit exterior wall assembly.
    - c. Provide pan flashing, side flashing, and head flashing.

**BEST PRACTICE:**

For ASHRAE 90.1 2007 Climate Zones, select windows based on the ENERGY STAR MFHR National Prescriptive Path requirements.

	Assembly U-Value (maximum)	Assembly SHGC (maximum)	Assembly U-Value (maximum)	Assembly SHGC (maximum)	Assembly U-Value (maximum)	Assembly SHGC (maximum)	Assembly U-Value (maximum)	Assembly SHGC (maximum)
	CLIMATE ZONE 1		CLIMATE ZONE 2		CLIMATE ZONE 3		CLIMATE ZONE 4	
VERTICAL GLAZING (INCLUDING PARTIALLY GLAZED DOORS)								
Metal framing (all)	U-0.60	SHGC-0.25	U-0.60	SHGC-0.25	U-0.50	SHGC-0.25	U-0.40	SHGC-0.40
	CLIMATE ZONE 4		CLIMATE ZONE 5		CLIMATE ZONE 6		CLIMATE ZONE 7	
VERTICAL GLAZING (INCLUDING PARTIALLY GLAZED DOORS)								
Metal framing (all)	U-0.40	SHGC-0.40	U-0.40	SHGC-0.40	U-0.40	SHGC-0.40	U-0.40	SHGC-0.40

**PART 3 – EXECUTION****A. Water Drainage System:**

1. Flashing to be installed at exterior doors per 07 60 00 [07600] Metal Flashing.

**Recommendations: Fiberglass windows**

Accurate Dorwin Company (CA) [www.accuratedorwin.com](http://www.accuratedorwin.com)

Comfort Line (OH) [www.fiberframe.com](http://www.fiberframe.com)

Serious Materials (CA) [www.seriousmaterials.com](http://www.seriousmaterials.com)

Unit Cost: \$390 to \$580

**Regional Considerations:**

[BA] HH: Follow ASTM Standard Practice for Installation of Exterior Windows, Doors, and Skylights

## Division 09: Finishes

### 09 22 16 / NON-STRUCTURAL METAL FRAMING / 09100

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- B. *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. *Recycled Content: Provide steel with minimum 25% post-consumer or 50% post-industrial recycled content.*
- B. *Regional Materials: Provide steel products manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*

#### PART 3 – EXECUTION (No Comments)

### 09 29 00 / GYPSUM BOARD / 09290

*Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]*

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

*Healthy Living Environment 7.9c Mold Prevention: Tub and Shower Enclosures [Mandatory]*

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. *Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”*
- B. *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- C. *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*
- D. *Product data for Criterion 7.9c: For products used in bathrooms, documentation indicating moisture-resistant materials in wet areas are utilized.*

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
1. Drywall and Panel Adhesives: 50 g/L
- B.** *Recycled Content: Provide drywall with minimum 25% post-consumer or 50% post-industrial recycled content.*
- C.** *Regional Materials: Provide drywall products manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*

**PART 3 – EXECUTION**

- A.** Mold Prevention: Provide non-paper-faced backing materials in wet areas such as the following:
1. Bathrooms
  2. Mechanical Shafts
  3. Elevator Shafts
- B.** Compartmentalization of Individual Dwelling Units. Refer to part A.3.2 in Specification 07 27 00, Air Barrier Systems.

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**Recommendations:**USG (IL, PA) [www.usg.com](http://www.usg.com)

Unit Cost: 5/8" No finish = \$0.82 sf

G-P Gypsum Corp (IN, WA) [www.gp.com](http://www.gp.com)

Unit Cost: 5/8" Taped and level 4 finish = \$1.41 sf

National Gypsum Company (PA, NC, FL) [www.nationalgypsum.com](http://www.nationalgypsum.com)

Unit Cost: 5/8" Mold-resistant, taped and level 4 finish = \$1.65 sf

Temple-Inland Forest Products Corp (TN, AR, TX, OK) [www.templeinland.com](http://www.templeinland.com)Unit Cost: 5/8" Fire-resistant, taped and level 4 finish = \$2.55 sf

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**Regional Considerations:**[BA] HH: Do not cover interior partitions with plastic vapor retarders or vinyl wallpaper

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**09 30 00 / TILING / 09300**

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

Healthy Living Environment 7.9b Mold Prevention: Surfaces [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B.** *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- C.** *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*
- D.** Product data for Criterion 7.9b: For grout sealants in wet areas, documentation indicating product will be sealed.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Ceramic Tile Adhesives: 65 g/L
  - 2. Grout Sealer: 200 g/L
- B.** *Recycled Content: Provide tile with 25% post-consumer or 50% post-industrial recycled content.*
- C.** *Regional Materials: Provide tile manufactured and of primary raw materials extracted or recovered within 500-mile radius of project site.*

**PART 3 – EXECUTION**

- A.** Mold Prevention:
  - 1. Grout Sealant: Provide epoxy grout on surfaces exposed to water such as the following:
    - a. Kitchen
    - b. Bathroom
  - 2. Provide water-resistant grout sealer

**Recommendations:**

EcoCyle by Crossville (made from 40% in house industrial scrap) [www.crossvilleinc.com](http://www.crossvilleinc.com)

Terragreen Ceramics – Terra Traffic series (55% recycled content) [www.terragreenceramics.com](http://www.terragreenceramics.com)

Debris by Fireclay Tile (made from 25% recycled granite dust, 19% broken window panes, and 8.5% recycled brown and green glass bottles) [www.fireclaytile.com](http://www.fireclaytile.com)

Unit Cost: 12" x 12" tile: \$23.50 to \$28.00 sf

**09 60 00 / FLOORING / 09600**

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

Healthy Living Environment 7.2: Environmentally Preferable Flooring [Mandatory]

*Healthy Living Environment 7.3: Environmentally Preferable Floor Coverings: Alternative Sources [Optional]*

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B.** *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- C.** *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*
- D.** Product data for Criterion 7.2: For resilient flooring, documentation including printed statement of compliance with the Resilient Floor Covering Institute’s (RFCI) FloorScore Program.
- E.** *Product data for Criterion 7.3: For flooring systems, documentation indicating that all flooring is in compliance with section 7.2: Alternative compliance paths as follows:*
  - 1. NSF/ANSI 332.
  - 2. Alternative Flooring: [natural linoleum, ceramic tile, bamboo, cork, hardwood].
  - 3. No Floor Treatments.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Wood Flooring Adhesives: 100 g/L
  - 2. Rubber Floor Adhesives: 60 g/L
  - 3. VCT and Asphalt Tile Adhesives: 50 g/L
  - 4. Cove Base Adhesives: 50 g/L
  - 5. Cove Base Installation: 150 g/L
  - 6. Perimeter Bonded Sheet Vinyl Flooring Installation: 660 g/L
  - 7. Indoor Floor Covering Installation: 150 g/L
  - 8. Outdoor Floor Covering Installation: 250 g/L
- B.** *Recycled Content: Provide flooring material with minimum 25% post-consumer or 50% post-industrial recycled content.*
- C.** *Regional Materials: Provide flooring products manufactured of primary raw materials extracted or recovered within 500-mile radius of project site.*
- D.** Resilient Flooring System (vinyl, linoleum, laminate, wood, rubber, and wall base): Comply with RFCI FloorScore Program.
- E.** Flooring systems: Give preference to systems compliant with NSF/ANSI 332 [Alternative Flooring].



**PART 3 – EXECUTION (No Comments)****Recommendations:**

Rubber Stair Treads: Flexco (PVC free) Recycled content [www.flexco.com](http://www.flexco.com)

Linoleum: Armstrong “Commission Plus or LVT” (FloorScore certified) [www.armstrong.com](http://www.armstrong.com)

Unit Cost: \$6.30 sf

Forbo Flooring Systems—Marmoleum Click (FloorScore certified) [www.forbolinoleumna.com](http://www.forbolinoleumna.com)

Alternative to Vinyl: Amtico “Spacia” (FloorScore certified) [www.amtico.com](http://www.amtico.com)

Unit Cost: \$4.80 sf

**09 68 00 / CARPET / 09680**

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

Healthy Living Environment 7.2: Environmentally Preferable Flooring [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B.** *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- C.** *Product data for Criterion 6.7: For products having regional material content, documentation indicating location of extraction, processes, and manufacturer of primary raw materials.*
- D.** Product data for Criterion 7.2: For carpet, documentation including printed statement of compliance with the Carpet and Rug Institute’s (CRI) Green Label Plus (GLP) Program.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Carpet Adhesives: 50 g/L
  - 2. Carpet Pad Adhesives: 50 g/L
  - 3. Outdoor Carpet Adhesives: 150 g/L
  - 4. Cove Base Adhesives: 50 g/L
- B.** *Recycled Content: Provide flooring material with minimum 25% post-consumer or 50% post-industrial recycled content.*
- C.** *Regional Materials: Provide flooring products manufactured of primary raw materials extracted or recovered within 500-mile radius of project site.*
- D.** Carpet and Cushion: Comply with the CRI Green Label Plus Program.

**PART 3 – EXECUTION (No Comments)****Recommendations:**

Shaw—Cleartouch BCF PET (fiber contains post-consumer recycled content) [www.shawfloors.com](http://www.shawfloors.com)

InterfaceFLOR [www.interfaceflor.com](http://www.interfaceflor.com)

Mohawk Carpet SmartStrand (a corn-based fiber carpet manufactured by Mohawk) [www.themohawkgroup.com](http://www.themohawkgroup.com)

Lees Carpets [www.leescarpets.com](http://www.leescarpets.com)

Unit Cost: Carpet Tile: \$27.50 sy / Sheet Carpeting: \$35.50 to \$48.50 sy

**09 72 00 / WALL COVERINGS / 09700**

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

Healthy Living Environment 7.9b: Mold Prevention: Surfaces [Mandatory]

Healthy Living Environment 7.10: Vapor Barrier Strategies [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B.** Product data for Criterion 7.9b: Documentation indicating moisture-resistant material is utilized in wet areas.
- C.** Product data for Criterion 7.10: Documentation stating vinyl wallpaper was not installed on below-grade walls.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Drywall and Panel Adhesives: 50 g/L
- B.** Interior below-grade walls: Do not use materials that trap moisture in the walls, including the following:
  - 1. Polyethylene Sheeting.
  - 2. Vinyl Wallpaper.
  - 3. Foil-Faced Insulation.

**PART 3 – EXECUTION**

- A.** Installation
  - 1. Avoid installing materials capable of absorbing moisture in wet areas.
  - 2. Do not install vinyl wallpaper on basement walls.

**09 91 23 / INTERIOR PAINTING / 09921**

Materials Beneficial to the Environment 6.1: Low/No VOC Paints and Primers [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 6.2: For paints and coatings, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Paints and Coatings: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
1. Flat: 50 g/L
  2. Non-Flat: 50 g/L
  3. Floor Coating: 100 g/L
  4. Anti-Corrosive: 250 g/L

**PART 3 – EXECUTION**

- A.** Installation:
1. Avoid epoxy-based paints, even those that comply with VOC standards, as these contain the chemical Bisphenol A.
  2. Use low-VOC stains, instead of paint, on basement slabs.

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**Recommendations:**

Sherwin Williams: Harmony Interior Latex (VOC 0 g/L) *www.sherwin-williams.com*

Unit Cost: \$35.00 gal

Behr: Premium Plus Interior Semi-Gloss Ultra Pure White (VOC 46g/L) *www.behr.com*

Unit Cost: \$19.97 gal

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## Division 10: Specialties

### 10 14 00 / SIGNAGE / 10140

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

*Materials Beneficial to the Environment 6.5: Recycling Storage for Multifamily Building [Optional]*

*Healthy Living Environment 7.16: Smoke-free Building [Optional]*

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B. *Product data for Criteria 6.5/7.16: For signage, documentation, and location of sign notices.*

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Multipurpose Construction Adhesives: 70 g/L

#### PART 3 – EXECUTION

- A. *Recycling Storage and Collection Signage: Provide signage in English [Spanish, Vietnamese, etc.] and graphics to indicate recycling procedure.*
- B. *No Smoking Signage: Provide signage in English [Spanish, Vietnamese, etc.] and graphics to indicate locations where smoking is permitted or prohibited.*

### 10 44 16 / FIRE EXTINGUISHERS / 10523

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#### Recommendations:

Recommend certified halon-free equipment

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## Division 11: Equipment

### 11 31 00 / RESIDENTIAL APPLIANCES / 11310

Energy Efficiency 5.4: ENERGY STAR Appliances [Mandatory]

Healthy Living Environment 7.7: Clothes Dryer Exhaust [Mandatory]

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product data for Criterion 5.4: For clothes washers, dishwashers, and refrigerators, documentation indicating ENERGY STAR certification.

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Appliances: Comply with current ENERGY STAR program criteria for the following, and see [www.energystar.gov](http://www.energystar.gov) for list of products meeting current ENERGY STAR program criteria:
  - 1. Clothes Washers
  - 2. Dishwashers
  - 3. Refrigerators

#### PART 3 – EXECUTION

- A. Clothes Dryer Installation: Exhausted directly to the outdoors using rigid-type duct work.

## Division 12: Furnishings

### 12 35 30 / KITCHEN CABINETS / 12320

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

*Materials Beneficial to the Environment 6.7: Regional Material Selection [Optional]*

*Materials Beneficial to the Environment 6.8 Certified, Salvaged and Engineered Wood Products [Optional]*

Healthy Living Environment 7.1 Composite Wood Products that Emit Low or No Formaldehyde [Mandatory]

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B. Product data for Criterion 7.1: For composite wood products, documentation indicating CARB 93120 compliance.

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Multipurpose Construction Adhesives: 70 g/L
- B. Composite Wood: Provide wood products that comply with CARB 93120 standard.

#### PART 3 – EXECUTION (No Comments)

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##### Recommendations:

Neil Kelly Cabinets “Naturals Collection” (formaldehyde-free wheatboard case material; low-VOC finishes; FSC-certified lumber doors/drawers [www.neilkellycabinets.com](http://www.neilkellycabinets.com))

Green Leaf Cabinetry (Cabinet King’s Green Leaf series uses PrimeBoard® agrifiber particleboard made from agricultural residue fibers and a formaldehyde-free binder; FSC-certified wood) [www.greenleafcabinetry.com](http://www.greenleafcabinetry.com)

Unit Cost: Formaldehyde-free wood, 5%–25% premium

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**12 48 13 / ENTRANCE FLOOR MATS AND FRAMES / 12481**

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**Recommendations:**

Arden Architectural Specialties “EnvironTread II” (PVC-free) 800-521-1826 [www.ardenarch.com](http://www.ardenarch.com)

Unit Cost: \$21.00 sf

EcoPath [www.ecopathmats.com](http://www.ecopathmats.com)

Unit Cost: \$12.60 sf

Construction Specialties, Inc.—PediTred [www.csgroup.com/entrance-flooring](http://www.csgroup.com/entrance-flooring)

Unit Cost: \$21.00 sf

- Available with recycled rubber
  - Available with bamboo and cork
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## Division 14: Conveying Equipment

### (Division 14: Conveying Systems)

#### 14 24 00 / ELEVATORS / 14240

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde [Mandatory]

Healthy Living Environment 7.2: Environmentally Preferable Flooring [Mandatory]

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B. Product data for Criterion 7.1: For composite wood products, documentation indicating CARB 93120 compliance.
- C. Product data for Criterion 7.2: For resilient flooring, documentation including printed statement of compliance with the Resilient Floor Covering Institute’s (RFCI) FloorScore Program.

##### 1.2 Reference Standards

- A. Ventilation Openings referenced standards:
  - 1. ENERGY STAR MFHR National Prescriptive Path Requirements.
  - 2. ASME A17.1, Safety Code for Elevators and Escalators.

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Multipurpose Construction Adhesives: 70 g/L
- B. Composite Wood: Provide wood products that comply with CARB 93120 standard.
- C. Resilient Flooring System [vinyl, linoleum, laminate, wood, rubber, and wall base]: Comply with Scientific Certification Systems’ FloorScore Program.
- D. Ventilation Openings: Meet the requirements of ASME A17.1, Safety Code for Elevators and Escalators

#### PART 3 – EXECUTION (No Comments)



## Division 22: Plumbing

### (Division 15: Mechanical)

#### 22 10 00 / PLUMBING/PIPING / 15420

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

Healthy Living Environment 7.1: Composite Wood Products that Emit Low or No Formaldehyde [Mandatory]

Healthy Living Environment 7.2: Environmentally Preferable Flooring [Mandatory]

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- B. Pipe Insulation: Meet ENERGY STAR MFHR National Prescriptive Path Requirements.

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Multipurpose Construction Adhesives: 70 g/L
- B. Pipe Insulation: Pipes carrying water or steam with temperatures under 55°F or over 105°F must provide the following:
  - 1. Pipes less than 1.5 inches in diameter: 1 inch insulation.
  - 2. Pipes greater than 1.5 inches in diameter: 1-1/2 inch insulation.

#### PART 3 – EXECUTION

- A. Piping Design and Layout:
  - 1. Locate piping within conditioned spaces or grouped and properly insulated to prevent freezing.

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##### Recommendations:

Insulate exposed hot and cold water mains with closed-cell polyethylene slip-on pipe insulation, sized to fit the pipe's diameter. Seal seams and butt joints with either 5 mil pipe insulation sealing tape or closure clips. Miter all angled junctions.

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##### Regional Considerations:

[BA] CVC: Do not locate piping in exterior walls.

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**22 14 00 / STORM DRAINAGE / 02630**

*Site Improvements 3.6: Surface Stormwater Management [Optional]*

**PART 1 – GENERAL (No Comments)****PART 2 – PRODUCTS**

**A.** Provide permanent labeling for storm drains or storm inlets.

**PART 3 – EXECUTION (No Comments)****Recommendations:**

See EPA Storm Drain Marking

[cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=15](https://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=15)

**22 33 00 / DOMESTIC WATER HEATERS / 15485**

*Energy Efficiency 5.7b: Photovoltaic (PV)/Solar Hot Water Ready [Optional]*

Healthy Living Environment 7.9a: Mold Prevention: Water Heaters [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** *Product data for Criterion 5.7b: Provide documentation stating that infrastructure to support future solar hot water system has been installed.*
- B.** Water Heating: Provide documentation stating that equipment is dedicated or indirect fired, with or without storage.

**PART 2 – PRODUCTS**

If applicable, confirm that hot water tank is compatible with future solar hot water system.

**A. Water Heaters:**

1. Provide with drain pans and condensate lines.
2. Domestic water heating equipment shall be specified as dedicated or indirect fired, with or without storage. Atmospherically vented gas water heaters, tankless coils, and side-arm water heaters shall not be specified. The maximum storage tank capacity shall be specified based on occupancy.
3. Water Heater Efficiency
  - a. In-Unit Electric OR Gas Water Heaters (storage or instantaneous)
    - 1) Gas (EF): 40 Gal = 0.61 | 60 Gal = 0.57 | 80 Gal = 0.53
    - 2) Electric (EF): 40 Gal = 0.93 | 50 Gal = 0.92 | 80 Gal = 0.89
  - b. Hot Water Supply Boiler: Oil or Gas: 85% Et
4. Alternate: Install tankless hot water heaters [If installed, disregard Part 3 requirements].

**PART 3 – EXECUTION****A. Location:**

1. Rooms with non–water-sensitive floor coverings.

**B. Installation:**

1. Slope corrosion-resistant drain pans with drains at the low point.
2. Drain condensate lines to drainage system, to building exterior, and not deposit under slab [drain directly to sewer line if local code does not permit draining to the exterior].
3. The temperature of the stored Domestic Hot Water (DHW) shall be just sufficient to deliver DHW to apartments within a temperature range of 120–125°F.
4. Self-contained or electronic mixing valves shall be used to control hot water temperature for central domestic water heating systems.

**C. Future Solar Hot Water Infrastructure:**

1. *Piping: Provide two 1/2-inch pipes from the water heater up to the prospective solar hot water collectors.*
  - a. *Terminate in the attic [on the roof].*
  - b. *Provide a minimum of 1/2-inch foam insulation when in a conditioned space and 1-inch foam insulation when outside of the building envelope.*
  - c. *Test: Pressure tested at 50 psi prior to installing wall finish.*
2. *Thermostat Wire: Provide between water heater and the attic [the roof; terminate in a sealed junction box].*

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**Recommendations:**

Polaris Heating Systems: Gas-fired unit has a submerged stainless steel flue that transfers combustion energy to the water with 95+% efficiency. Available in 34-, 50-, and 100-gal. sizes with outputs of 100,000 to 199,000 Btu/hr and energy factors of 0.86. [www.americanwaterheater.com](http://www.americanwaterheater.com)

Bosch ProTankless: Gas-fired, tankless water heaters offer efficiencies up to 87%. ProTankless 635ES and 635ESO water heaters supply two hot water outlets simultaneously at a combined rate of 6 gpm. [www.protankless.com](http://www.protankless.com)

Rheem HP-50 Heat Pump Water Heater: Energy Star-listed, heat-pump water heater with an integral 50-gallon tank. [www.rheem.com](http://www.rheem.com)

**Unit Cost:**

Residential Gas Domestic Water Heaters, 50 gal: \$1,775

Tankless, Gas Domestic Water Heaters: \$900

Residential Electric Domestic Water Heaters, 50 gal: \$1,075

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**22 40 00 / PLUMBING FIXTURES / 15410**

Water Conservation 4.1: Water-Conserving Fixtures [Mandatory]

*Water Conservation 4.2: Advanced Water-Conserving Appliances and Fixtures [Optional]*

*Water Conservation 4.3: Water Reuse [Optional]*

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criteria 4.1/4.2: For toilets and urinals, documentation indicating flush rate in gallons per flush (gpf); for faucets and showerhead, documentation indicating flow rate in gallons per minute (gpm).
  - 1. For projects pursuing optional Criterion 4.2, documentation can be submitted for one or more of the following fixture types: **toilets, urinals, faucets, and showerheads.**
- B.** Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Plumbing Fixtures: Flush and flow rates not to exceed the following (tub faucets are exempt from this measure): (Verify flow rates with project team.)
  - 1. Toilets, including dual-flush toilets and pressure-assisted toilets **1.28 GPF [1.20 GPF]** (gallons per flush) maximum.
  - 2. Urinals, **0.5 GPF [0 GPF/waterless]** maximum.
  - 3. Showerheads, **2.0 GPM [1.5 GPM]** (gallons per minute) maximum.
  - 4. Kitchen faucets, **2.0 GPM [1.5 GPM]** maximum.
  - 5. Bathroom faucets, **1.5 GPM [0.5 GPM]** maximum.
- B.** Adhesives and sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Multipurpose Construction Adhesives: 70 g/L

**PART 3 – EXECUTION**

- A.** Installation: Refer to Specification 07 27 00, Air Barrier Systems. Seal around plumbing penetrations in all exterior surfaces, surfaces that border on unconditioned spaces, between floors, and through the exterior of building.
- B.** Water Fixture Tests
  - 1. Reference Standard: EPA WaterSense Inspection and Verification Guidance for WaterSense Labeled New Homes, 2009.
  - 2. Water Fixture Leak Tests: Confirm no leaks in water-using fixtures, appliances, equipment, and connection points through pressure-loss testing and visual inspection post-installation or during commissioning.
    - a. Toilets
      - 1) Check angle valve and connections for leaks.
      - 2) Conduct dye tablet test to ensure that flapper is not leaking.
        - a) Drop dye tablet into tank and wait four minutes.
        - b) Check bowl for tablet color; if color is evident, flapper valve is leaking and must be replaced.
        - c) Flush upon completion to avoid staining.

- 3) Check water level setting to ensure that water does not overflow from overflow tube.
- b. Faucets
  - 1) Confirm maximum flow rates and ensure that aerator is installed as specified.
    - a) Use bucket or attach flow-measuring bag to faucet spout.
    - b) Turn both handles on completely and start stopwatch.
    - c) Turn water off after 10 seconds and measure volume of water.
  - 2) Check faucet for leaks after water flow is turned off.
  - 3) Check faucet hot/cold water connection hoses and valves for leaks.
- c. Showerheads
  - 1) Check for leaks at the shower arm and showerhead threaded connection.
  - 2) If shower/bath combination, check shower diverter for minimum water seepage.
  - 3) Confirm maximum flow rate.
    - a) Use bucket or attach flow-measuring bag to faucet spout.
    - b) Turn both handles on completely and start stopwatch.
    - c) Turn water off after 10 seconds and measure volume of water.
3. Performance Tests
  - a. Toilets
    - 1) Select toilets that meet the MaP Toilet Fixture Performance Testing Protocol (See “References,” VV).

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**Recommendations: Select Toilets, Bathroom Sinks, and Showerheads that are WaterSense labeled**
**Water Closets** (*Unit Cost: Installed: \$495 to \$535*)

 American Standard—FloWise (1.28 gpf) \$304 [www.americanstandard-us.com](http://www.americanstandard-us.com)

 American Standard—H2Option Dual-Flush Toilet (1.0/1.6 gpf) \$284.67 [www.americanstandard-us.com](http://www.americanstandard-us.com)

 Crane—Eco Saratoga (1.1/1.6 gpf) \$314 [www.cranepumbing.com](http://www.cranepumbing.com)

 Crane—Eco Opus 3 (1.28 gpf) \$252 [www.cranepumbing.com](http://www.cranepumbing.com)
**Showerheads** (*Unit Cost: Installed: \$184 to \$244*)

 Bricor Elite Series (1.5 gpm) \$85 [www.bricor.com](http://www.bricor.com)

 Delta Transitional Water Efficient Showerhead (1.6 gpm) \$60 [www.delta.com](http://www.delta.com)

 Niagara Earth Massager (1.5 gpm) \$30 [www.niagaraplumbing.net](http://www.niagaraplumbing.net)
**Kitchen Faucets**

 Moen 316711 1.5 gpm Aerator Flow Restrictor (1.5 gpm) \$4.24 [www.moen.com](http://www.moen.com)
**Lavatory** (*Unit Cost: Installed: \$233 to \$300*)

Requirement for 1.5 gpm

 Recommended Manufacturers: Kohler [www.kohler.com](http://www.kohler.com), Toto [www.totousa.com](http://www.totousa.com), Moen [www.moen.com](http://www.moen.com)
**Greywater Systems**

 Brae Rain Harvesting Systems [www.braewater.com](http://www.braewater.com)

 Aquadra Systems—Rainwater Tanks [www.aquadrasystems.com](http://www.aquadrasystems.com)


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## Division 23: HVAC

### (Division 15: Mechanical)

#### 23 30 00 / HVAC AIR DISTRIBUTION

Energy Efficiency 5.1d: Building Performance Standard [\[Mandatory\]](#)

Energy Efficiency 5.3: Sizing of Heating and Cooling Equipment and Ducts [\[Mandatory\]](#)

Materials Beneficial to the Environment 6.2: Low/No VOC Adhesives and Sealants [\[Mandatory\]](#)

Healthy Living Environment 7.6a: Ventilation: New Construction and Substantial Rehabilitation [\[Mandatory\]](#)

*Healthy Living Environment 7.6b: Ventilation: Moderate Rehabilitation [Optional]*

Healthy Living Environment 7.13: Garage Isolation [\[Mandatory\]](#)

As a reminder, these recommendations should supplement, not replace, the section prepared by the design team.

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product data for Criterion 5.3: Heating and cooling equipment in compliance with Air Conditioning Contractors of America (ACCA) Manuals, Parts J, S, and D. Alternative compliance paths are as follows:
  - 1. ASHRAE Handbooks
- B. Product data for Criterion 6.2: For adhesives and sealants, documentation in compliance with Division 01 “Indoor Air Quality Requirements.”
- C. Product data for Criterion 7.6a [\[7.6b\]](#): In-unit ventilation system in compliance with ASHRAE 62.2-2010 requirements.
- D. Per Criterion 7.13: Provide garage containment isolation measures in compliance with ASHRAE 62.2-2010.
- E. Determine Climate Zone for each building site per by [ASHRAE 90.1–2007 \[Title 24\]](#).
- F. System has been designed to meet the following:
  - 1. Design Ventilation Rates for Common Area:
    - a. Minimum: ASHRAE 62.1-2007
    - b. Maximum: Not to exceed ASHRAE 62.1-2007 by more than 50%
  - 2. Design Ventilation Rates for In-Unit (supply and exhaust)
    - a. Minimum: ASHRAE 62.1-2007
    - b. Maximum: Not to exceed ASHRAE 62.1-2007 by more than 20%

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Adhesives and Sealants: VOC content not to exceed the following [g/L; less water and less exempt compounds]:
  - 1. Multipurpose Construction Adhesives: 70 g/L
- B. Thermostat: One per apartment
  - 1. Programmable thermostats.

**C. Heating and Cooling Distribution:**

1. Size according to the latest editions of ACCA Manuals J and S, ASHRAE 2009 Handbook of Fundamentals, or an equivalent computation procedure.
2. Installed capacity cannot exceed design by more than 20%, except when smaller sizes are not available.
3. Temperatures:
  - a. Outdoor temperatures: 99.0% design temperatures as published by the ASHRAE Handbook of Fundamentals.
  - b. Indoor temperatures: 75°F for cooling.
4. Outdoor-air supplied to the heating/cooling distribution system: Provide motorized damper control of outside air damper; provide for shutoff of outside air when distribution system is not actively providing space conditioning or ventilation.

**D. Insulation**

1. Supply Ducts: R-6
2. Return Ducts: R-6

**PART 3 – EXECUTION****A. Installation**

1. Heating and Cooling System:
  - a. Verify the performance of heating and cooling equipment with the mechanical engineer and/or energy analyst.
2. Ventilation System:
  - a. *Multifamily, 4 stories or greater: Install for dwelling units per ASHRAE 62.2-2010 for all dwelling units, and ASHRAE 62.1-2010 for all hallways and common spaces.*
3. Flex Duct: Follow Sheet Metal and Air Conditioning Contractors' (SMACNA) installation standards for flex ducts.
4. Garage Isolation Air Barrier:
  - a. Do not install ductwork or air handling equipment in garage space.
5. Ventilation System Sealant:
  - a. Follow UL181-approved water-based mastic and materials. Seal at all transverse joints and connections, including boot to wall/ceiling connections through drywall.
  - b. Seal drywall connections with caulk or foam sealant.
  - c. Seal ductwork penetrations at the roof curb to prevent air leakage through the duct system and/or the building envelope.

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**Regional Considerations:**

[BA] HH: Supplemental dehumidification is likely necessary to maintain comfort during times of high ambient relative humidity. Additionally, design the system to meet the ASHRAE requirements and then provide for additional accommodations to adjust the amount of outside air flow being introduced.

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**23 34 00 / VENTILATION FANS / 15830**

Energy Efficiency 5.5a: Efficient Lighting: Interior Units [\[Mandatory\]](#)

Healthy Living Environment 7.4a: Exhaust Fans – Bathroom:

New Construction and Substantial Rehabilitation [\[Mandatory\]](#)

*Healthy Living Environment 7.4b: Exhaust Fans – Bathroom: Moderate Rehabilitation [Optional]*

Healthy Living Environment 7.5a: Exhaust Fans – Kitchen:

New Construction and Substantial Rehabilitation [\[Mandatory\]](#)

*Healthy Living Environment 7.5b: Exhaust Fans – Kitchen: Moderate Rehabilitation [Optional]*

**As a reminder, these recommendations should supplement, not replace, the section prepared by the design team.**

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 5.5: Provide documentation showing that exhaust fans meet ENERGY STAR efficacies.
- B.** Product data for Criteria 7.4a**[b]** and 7.5a**[b]**: Exhaust system in compliance with ASHRAE 62.2-2010 requirements.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Bathroom Fans:
  - a. Intermittent (controlled by tenant switch): ENERGY STAR–labeled with exhaust rate of 50 cfm to exterior.
  - b. Continuous (in-unit): **ENERGY STAR–labeled continuous bathroom fans with exhaust rate of 20 CFM to exterior.**
  - c. Continuous (rooftop):
    - i. Roof fans up to 300 design CFM: Provide either direct-drive or variable-speed control.
    - ii. Roof fans from 300–2,000 design CFM: Provide either direct-drive, variable-speed control, or environmental control measures.
- B.** Kitchen Fans:
  - a. Intermittent power vented or range hoods (controlled by tenant switch): Exhaust rate of 100 cfm to exterior.
  - b. Continuous (in-unit): Exhaust rate of 5 air changes per hour (ACH) kitchen volume to exterior).
  - c. Continuous (rooftop):
    - i. Roof fans up to 300 design CFM: Provide either direct-drive or variable-speed control.
    - ii. Roof fans from 300–2,000 design CFM: Provide either direct-drive, variable-speed control, or environmental control measures.
- C.** Common laundry exhaust greater than 500 CFM: Provide variable-speed demand control.
- D.** Ceiling Fans: Meet or exceed ENERGY STAR efficacies.

**PART 3 – INSTALLATION****A. Installation:**

1. Install appropriate sized multi-port exhaust fans for local exhaust in bathrooms and kitchens.
  - a. Connect bathroom fans to a light switch and equip with a humidistat sensor, timer, or other control; alternate compliance paths as follows:
    - 1) Continuously operating bathroom fans.
2. Ensure that placement of the exhaust grille meets code requirements.

**B. Exhaust Fan Flow Meter Test**

1. Reference Standard: ASHRAE 62.2-2010, Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings.
2. Provide exhaust fan flow test post-installation or during commissioning to confirm rated amount CFM.
  - a. Utilize exhaust fan meter along with a pressure gauge to provide 0.1 Pascals of resolution in the range of 1 to 8 Pascals.
  - b. With power on, place meter directly over the exhaust fan grille to create air-tight seal.
  - c. Test results within 10% of rated CFM considered acceptable.

**23 52 00 / BOILERS / 15510**

Healthy Living Environment 7.8: Combustion Equipment [\[Mandatory\]](#)

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 7.8: Combustion equipment in compliance with Enterprise Green Communities 2011 Criteria.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Combustion Equipment: Provide power-vented or closed equipment.
- B.** Carbon Monoxide: Provide one hard-wired carbon monoxide alarm for each sleeping area, minimum one per floor.
- C.** HVAC Piping: Piping carrying water or steam with temperatures under 55°F or over 105°F provide the following:
  1. Pipes less than 1.5 inches in diameter: 1 inch insulation.
  2. Pipes greater than 1.5 inches in diameter: 1.5 inch insulation.
- D.** Atmospherically Vented Boilers: Not permitted.

**PART 3 – EXECUTION****A. HVAC Piping:**

1. Location:
  - a. Within conditioned spaces or grouped and insulated.
2. Terminal heating and cooling distribution equipment:
  - a. Separate from the riser or distribution loop by control valve or terminal distribution pump.
3. Outdoor-air supply to heating/cooling distribution system:
  - a. Provide motorized damper control of outside air damper.
  - b. Provide shutoff of outside air when distribution system is not actively providing space conditioning or ventilation.
4. Hydronic distribution systems:
  - a. Supply/return headers:
    - 1) Designed in “reverse return” configuration.
    - 2) Sized based on a water velocity of less than 4 ft/s.
  - b. Provide calculations and assumptions for sizing circulating pumps in compliance with [Chapter 43 of the ASHRAE Handbook, HVAC Systems and Equipment](#) [equivalent industry accepted standard].

**23 56 00 / SOLAR HEATING EQUIPMENT / 13600**

*Energy Efficiency 5.7a: Renewable Energy [Optional]*

**As a reminder, these recommendations should supplement, not replace, the section prepared by the design team.**

**PART 1 – GENERAL****1.1 Informational Submittals**

- A. Training Certification:** NABCEP for Installers.

**PART 2 – PRODUCTS**

- A. Solar Thermal:** Provide site, design, engineer, wiring, and plumbing to accommodate [Evacuated Tube, Flat Plate, Direct, Indirect] Solar Hot Water system.

**PART 3 – EXECUTION****A. Installation of Piping and Wiring:**

1. Install piping straight and true to bear evenly on hangers and supports.
2. Do not hang piping from sheetrock or suspended ceilings.
3. Keep interior and ends of new piping thoroughly cleaned of foreign matter.
4. Keep piping systems clean during installation by means of plugs or other approved methods.
5. Discharge storage tank pressure and temperature relief valves into floor drains.
6. Provide air vents with threaded plugs or caps.
7. Install control and sensor wiring in conduit.

**B. System Flushing and Disinfection:**

1. Flush and disinfect the piping system.

**C. Collector Array:**

1. Install solar collector array at the proper tilt angle, orientation, and elevation above roof. Install the solar collectors with the ability to be removed for maintenance, repair, or replacement.
2. Install collector array piping in a reverse-return configuration so that path lengths of collector supply and return are of approximately equal length. Install air vents in the high points of the collector array piping. Provide proper pitch for draining of collector array.
3. Install array supports in accordance with the recommendations of the collector manufacturer and the roofing manufacturer. In existing roofing situations, carefully cut back existing assembly to supporting materials. Provide new roofing materials to match existing materials, and seal any penetrations through roofing materials per roofing manufacturer's recommendations so as not to invalidate any current roofing warranties.
4. Provide for the expansion and contraction of supply and return piping with changes in the direction of the run of pipe or by expansion loops. Do not use expansion joints in the system piping.
5. Valves:
  - a. Install ball valves at the inlet and outlet of the bank of manifolded collectors.
  - b. Install balancing valves at the outlet of the collector bank, and mark final settings on the valve. Install a union adjacent to the ball valve.
  - c. Balance flow through the collector piping with at least one balancing valve left in the open position.
  - d. Locate tempering mixing valve downstream of auxiliary water heater to control hot water delivery temperature.
6. All roof penetrations shall be made permanently waterproof.
7. Contractor shall coordinate work with the current warranty of the existing new roof.

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**Recommendations:**

Schüco: Slim Line Package 11-80 (solar panel collector) [www.schueco.com](http://www.schueco.com)

Solar Energy, Inc.: SUN HoM Solar Hot Water System (solar panel collector) [www.solarenergy.com](http://www.solarenergy.com)

Viessmann: Vitosol 300/Vitocell B 100 Solar Water Heating System (evacuated-tube solar collector) [www.viessmann.ca](http://www.viessmann.ca)

Unit Cost: Solar Thermal System with 80-gal tank: \$6,500 to \$7,500

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## Division 26: Electrical

### (Division 16: Electrical)

#### 26 05 00 / BASIC ELECTRICAL MATERIALS AND METHODS / 16000

*Energy Efficiency 5.7b: Photovoltaic (PV)/Solar Hot Water Ready [Optional]*

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. Product Data for Criterion 5.7b: Install infrastructure to accommodate future Photovoltaic (PV) [and/or Solar Hot Water] system in compliance with Enterprise Green Communities 2011 Criteria.

#### PART 2 – PRODUCTS (No Comments)

#### PART 3 – EXECUTION

- A. Refer to Specification 07 27 11, Air Barrier Systems. General contractor should coordinate sealing of electrical penetrations between trades.
- B. Refer to Specification 07 21 00, Thermal Insulation. Electrician should coordinate with insulation installer to assure quality installation of the insulation.
- C. Electrical Boxes: Provide as follows:
  - 1. Interior Walls between Units:
    - a. Provide gasket to create air and fire-resistive seal.
  - 2. Exterior Walls:
    - a. Provide air/water-tight seal.
    - b. Provide installation around full perimeter of boxes to prevent thermal conductance through wall.
- D. Future PV Infrastructure:
  - 1. Electrical Main Panel: Reserve space for future 240V breaker.
  - 2. Inverter: Reserve space for future 35-inches-tall by 25-inches-wide inverter. Location options as follows:
    - a. Locate adjacent to the electrical main panel.
    - b. If space is not available near the electrical main panel, provide metal conduit from the main panel to the proposed inverter location.
  - 3. Conduit: Provide conduit from the inverter location to the attic through the roof.
    - a. If underside of the roof will not be accessible, extend conduit through the roof and to a sealed junction box.
- E. Future Solar Hot Water Infrastructure:
  - 1. Electrical Main Panel: Reserve space for future 240V breaker.
  - 2. Conduit: Provide conduit from the inverter location to proposed solar tank location.
    - a. If underside of the roof will not be accessible, extend conduit through the roof and to a sealed junction box.

**26 27 13 / ELECTRICITY METERING**

Energy Efficiency 5.6a: Electricity Meter [Mandatory]

*Energy Efficiency 5.6b: Electricity Meter [Optional]*

*Energy Efficiency 5.8: Advanced Metering Infrastructure [Optional]*

**PART 1 – GENERAL****1.1 Informational Submittals**

- A. Product Data for 5.6a, [5.6b]: Sub-meter electricity in compliance with Enterprise Green Communities 2011 Criteria.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A. Metering: Provide individual sub-meter in dwelling units.
- B. *Future Smart Meters/Smart Grid System: Coordinate with Electrical Engineer.*

**PART 3 – EXECUTION (No Comments)****26 31 00 / PHOTOVOLTAIC COLLECTORS / 16500**

*Energy Efficiency 5.7a: Renewable Energy [Optional]*

As a reminder, these recommendations should supplement, not replace, the section prepared by the design team.

**PART 1 – GENERAL****1.1 Informational Submittals**

- A. Training Certification: NABCEP for Installers.

**PART 2 – PRODUCTS**

- A. Renewable energy: Provide photovoltaic panels for 5 [10, 20, 30, 40] percent of energy demand.

**PART 3 – EXECUTION**

- A. Installation of Piping and Wiring:
  - 1. Install piping straight and true to bear evenly on hangers and supports.
  - 2. Do not hang piping from sheetrock or suspended ceilings.
  - 3. Keep interior and ends of new piping thoroughly cleaned of foreign matter.
  - 4. Keep piping systems clean during installation by means of plugs or other approved methods.
  - 5. Discharge storage tank pressure and temperature relief valves into floor drains.
  - 6. Provide air vents with threaded plugs or caps.
  - 7. Install control and sensor wiring in conduit.

**B. System Flushing and Disinfection:**

1. Flush and disinfect the piping system.

**C. Collector Array:**

1. Install solar collector array at the proper tilt angle, orientation, and elevation above roof. Install the solar collectors with the ability to be removed for maintenance, repair, or replacement.
2. Install collector array piping in a reverse-return configuration so that path lengths of collector supply and return are of approximately equal length. Install air vents in the high points of the collector array piping. Provide proper pitch for draining of collector array.
3. Install array supports in accordance with the recommendations of the collector manufacturer and the roofing manufacturer. In existing roofing situations, carefully cut back existing assembly to supporting materials. Provide new roofing materials to match existing materials, and seal any penetrations through roofing materials per roofing manufacturer's recommendations so as not to invalidate any current roofing warranties.
4. Provide for the expansion and contraction of supply and return piping with changes in the direction of the run of pipe or by expansion loops. Do not use expansion joints in the system piping.
5. Valves:
  - a. Install ball valves at the inlet and outlet of the bank of manifolded collectors.
  - b. Install balancing valves at the outlet of the collector bank, and mark final settings on the valve. Install a union adjacent to the ball valve.
  - c. Balance flow through the collector piping with at least one balancing valve left in the open position.
  - d. Locate tempering mixing valve downstream of auxiliary water heater to control hot water delivery temperature.
6. All roof penetrations shall be made permanently waterproof.
7. Contractor shall coordinate work with the current warranty of the existing new roof.

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**Recommendations:**

Schüco Solar (180 watt panel) [www.schueco.com](http://www.schueco.com)

Evergreen Solar (180 watt panel) [www.evergreensolar.com](http://www.evergreensolar.com)

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**26 32 23 / WIND ENERGY SYSTEMS / 13660**

*Energy Efficiency 5.7a: Renewable Energy [Optional]*

**PART 1 – GENERAL****1.1 Informational Submittals**

- A. Training Certification: NABCEP for Installers.

**PART 2 – PRODUCTS**

- A. Renewable energy: Provide wind turbines for 5 [10, 20, 30, 40] percent of energy demand.

**PART 3 – EXECUTION (No Comments)****26 51 00 / INTERIOR LIGHTING / 16511**

Energy Efficiency 5.5a: Efficient Lighting: Interior Units [Mandatory]

Energy Efficiency 5.5b: Efficient Lighting: Common Areas and Emergency Lighting [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A. Product data Criterion 5.5a: All new light fixtures are required to meet or exceed ENERGY STAR efficiency levels [meet ENERGY STAR MFHR program guidelines]. If reusing existing features in a rehab, projects must install screw-in compact fluorescent light bulbs (CFLs).
- B. Product data Criterion 5.5b: New light fixtures in compliance with [ENERGY STAR labeled fixtures] emergency lighting in compliance by exceeding LED efficiencies.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A. Light Fixtures: Provide ENERGY STAR–compliant hard-wired lighting fixtures in all inhabited spaces; provide ENERGY STAR–labeled fixtures [LEDs, T8 Fixtures] in all common areas.
- B. Ceiling Fans: Provide ENERGY STAR–compliant hard-wired ceiling fans in all inhabited spaces.
- C. Emergency Lighting: Provide LED [photoluminescent] exit signs that conform to local building code; fixtures above stairwell and exit doors have battery back-up, and conform to local building code.

**PART 3 – EXECUTION**

- A. Installation:
  1. Installed interior lighting shall meet minimum illumination levels (footcandles) by space type as recommended by the Illumination Engineering Society of North America (IESNA) standard 90.1 <http://lpd.ies.org/cgi-bin/lpd/ShowSpaceTypes.pl>.
  2. Total specified lighting power for the combined non-apartment spaces not to exceed ASHRAE allowances for those combined spaces by more than 20%.



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**Recommendations: For non-emergency common area lighting, consider installing motion sensors.**

Good Earth Lighting—Neptune Item #: 51017 Model: G2021WHI [www.goodearthlighting.com](http://www.goodearthlighting.com)

Unit Cost: \$25; Installed: \$82.50

Progress Lighting Bedford Collection Model P3186-09EBWB [www.progresslighting.com](http://www.progresslighting.com)

Unit Cost: \$81.75; Installed: \$194

American Fluorescent—Item #: 184346 Model: PLW432RC [www.americanfluorescent.com](http://www.americanfluorescent.com)

Unit Cost: \$50.54; Installed: \$161

Leviton Decora Manual-ON Occupancy Sensor: [www.leviton.com](http://www.leviton.com)

Unit Cost: \$30; Installed: \$89

Watt Stopper—CS-50 PIR Wall Switch Vacancy Sensor [www.wattstopper.com](http://www.wattstopper.com)

Unit Cost: \$30

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**26 53 00 / EXIT SIGNS / 16530**

Energy Efficiency 5.5b: Efficient Lighting: Common Areas and Emergency Lighting [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data Criterion 5.5b: Exit Signs

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Emergency Lighting: Provide **LED [photo luminescent with 15 year brightness guarantee]** exit signs that conform to local building code; fixtures above stairwell and exit doors to have battery back-up, and conform to local building code.

**PART 3 – EXECUTION (No Comments)**

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**Recommendations:**

LED Exit Sign Retrofit: Carpenter Emergency Lighting [www.carpenterlighting.com](http://www.carpenterlighting.com)

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**26 56 00 / EXTERIOR LIGHTING / 16521**

Energy Efficiency 5.5c: Efficient Lighting: Exterior [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A. Product data for Criterion 5.5c: Lighting fixtures [ENERGY STAR compact fluorescents or LEDs with 45 lumens/watt minimum] [ENERGY STAR–compliant fixtures per guidelines].
- B. Lighting: Allowances cannot exceed ASHRAE 90.1-2007 levels.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A. Light fixtures: Provide ENERGY STAR [compact fluorescents or LEDs with 45 lumens/watt minimum]; provide full cut-off fixtures for non-security operations; provide daylight sensors on all exterior lighting.

**PART 3 – EXECUTION (No Comments)**

- B. Lights with integral daylight sensors (also called photo sensors) are installed in the same manner as conventional light fixtures. Daylight sensors detect the quantity of light and send a signal to a main controller to adjust the lighting.

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**Recommendations: Consider installing motion sensors on all non–security-related lighting and including full cut-off shading for exterior fixtures to reduce light trespass and glare.**

Heath Zenith—Twin 150 Watt Quartz *www.heath-zenith.com*

Item #182159, Model SL-5512-BZA from Home Depot: Unit Cost: \$160 each

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**28 31 49 / CARBON MONOXIDE DETECTION SENSORS / 13850**

Healthy Living Environment 7.8: Combustion Equipment [Mandatory]

Healthy Living Environment 7.13: Garage Isolation [Mandatory]

**PART 1 – GENERAL (No Comments)****PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A. Carbon Monoxide: Provide hard-wired carbon monoxide (CO) alarm.

**PART 3 – EXECUTION**

- A. CO Alarm: Install as follows:
  1. If combustion equipment is installed, install one CO alarm per sleeping area.
  2. If combustion equipment is installed, install one CO alarm per floor.
  3. Place CO alarm as directed by state law requirements.
  4. Project teams should consider incorporating the testing procedures found in Appendix A before finalizing scope and starting work, as the results may inform the work scope.
  5. Where garage exhaust is required by code, install CO sensors that control exhaust fan operation.

**Combustion Safety and Carbon Monoxide Inspection**

1. Reference Standards:
  - a. Building Performance Institute Technical Standards for the Building Analyst Professional.
  - b. Building Performance Institute Home Energy Auditing Standard, Section 7, 2009.
2. Provide preliminary and post-installation safety inspection of all combustion appliances and connections for newly installed equipment.
3. Carbon Monoxide Tests
  - c. Conduct CO test on all sealed-combustion and power-vented appliances (without atmospheric chimneys).
  - d. Measure undiluted flue gases in the throat or flue of the appliance using a digital gauge and measured in parts per million (ppm).
  - e. Measure CO at steady-state operating conditions.
  - f. If ambient levels exceed 35 ppm at any time during test, turn off the appliance immediately and make appropriate repair.
  - g. If gas oven produces more than 200 ppm of CO (or 400 ppm air-free measurement) in undiluted flue gases tested in the oven vent, specify service or replacement.
  - h. Action Levels: Refer to Building Performance Institute Technical Standards for the Building Analyst Professional for Combustion Safety Test Action Levels Table:

**COMBUSTION SAFETY TEST ACTION LEVELS**

CO test result (CO measurements for undiluted flue gases at steady state) <b>AND/OR</b> spillage and draft test results	Retrofit action.
0–25 ppm <b>AND</b> passes	Proceed with work.
26–100 ppm <b>AND</b> passes	Recommend that the CO problem be fixed.
26–100 ppm <b>AND</b> fails at worst case only	Recommend a service call for the appliance and/or repairs to the home to correct the problem.
100–400 ppm <b>OR</b> fails under natural conditions	<b>STOP WORK:</b> Work may not proceed until the system is serviced and the problem is corrected.
>400 ppm <b>AND</b> passes	<b>STOP WORK:</b> Work may not proceed until the system is serviced and the problem is corrected.
>400 ppm <b>AND</b> fails under any condition	<b>EMERGENCY:</b> Shut off fuel to the appliance and have the homeowner call for service immediately.

## Division 31: Earthwork

### (Division 02: Site Work)

#### 31 21 13 / RADON MITIGATION

Healthy Living Environment 7.11 Radon Mitigation [Mandatory]

##### PART 1 – GENERAL

###### 1.1 Quality Assurance

- A. Provide a radon test and submit mitigation plan per ASTM E2121-09 Standard Practice for Radon Mitigation Systems in Existing Low-Rise Residential Buildings.

###### 1.2 Related Sections

- A. Coordinate with Division 07 Section 07 27 00 [07270] Air Barrier Systems.

##### PART 2 – PRODUCTS (No Comments)

##### PART 3 – EXECUTION

- A. Radon Mitigation:
  - 1. Provide radon mitigation steps as required if radon level is above 4 pCi/L (pico curies per liter).
  - 2. Radon Control Measures:
    - a. Use foundation air sealing with polyurethane caulk or the equivalent at all slab openings, penetrations, and control or expansion joints and sump covers.
    - b. Install passive radon-resistant features below concrete slab with a vertical vent pipe and junction box.
- B. Installation:
  - 1. Install a vertical vent pipe and junction box within 10 feet of electrical outlet.

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##### Regional Considerations:

[EPA] Zones 1 and 2 areas should be tested for the presence of radon.

Projects located on brownfields or proximate to industrial operations not in EPA Zone 1 or 2 areas: Consider testing for radon to determine if elevated levels exist on site.

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## Division 32: Exterior Improvements

### (Division 02: Site Work)

#### 32 13 00 / RIGID PAVING / 02751

*Materials Beneficial to the Environment 6.6: Recycled Content Material [Optional]*

*Materials Beneficial to the Environment 6.9b: Reducing Heat-Island Effect: Paving [Optional]*

Healthy Living Environment 7.12: Water Drainage [Mandatory, when replacing particular assemblies called out in Criterion.]

#### PART 1 – GENERAL

##### 1.1 Informational Submittals

- A. *Product data for Criterion 6.6: For qualified building products making up at least 90% of the building component by weight or volume, recycled content documentation indicating percentages by weight or volume of post-industrial and post-consumer recycled content.*
- B. *Product data for Criterion 6.9b: For hardscape areas, documentation indicating Solar Reflectance [open-grid pavement] over 50% of site hardscaped area.*
- C. *Product data for Criterion 7.12: For hardscape areas, documentation indicating pavement pitch.*

#### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. *Recycled Content: Provide paving with minimum 25% post-consumer or 50% post-industrial recycled content.*
- B. *Hardscape: Provide hard surfaced areas with a [minimum of 0.3 Solar Reflectance, open-grid pavement].*

#### PART 3 – EXECUTION

- A. *Installation:*
  - 1. *For hard surfaces: Install a 2% pitch (1/4 inch per foot).*
  - 2. *Radiant heating either wall or ceiling-mounted or within the garage floor (or sidewalks): May be used to prevent ice formation on the ground as a safety feature only and must comply with ASHRAE 90.1-2007 Section 6.4.3.8.*

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**Recommendations: Consider waterpermeable materials. Develop details to avoid failure during freeze/thaw cycles.**

Hanover—EcoGrid Porous Pavers (PA) [www.hanoverpavers.com](http://www.hanoverpavers.com)

Hanover—Permeable 4" x 9" Flyer (PA) [www.hanoverpavers.com](http://www.hanoverpavers.com)

Unit Cost: \$13.95 sf

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**32 80 00 / IRRIGATION / 02810**

Site Improvements 3.5: Efficient Irrigation and Water Reuse [Mandatory]

*Water Conservation 4.3: Water Reuse [Optional]*

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 3.5 [4.3]: Irrigation strategies utilized will include an efficient irrigation system [water reuse system].
- B.** Performance Requirements for Efficient Irrigation System:
  - 1. Drip irrigation for 50% of landscaping.
  - 2. Zone turf and bedding areas separately.
  - 3. Timer/controller for watering zones.
  - 4. Moisture sensor [rain delay] controller.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Efficient Irrigation System: Provide documentation for the following components:
  - 1. Drip irrigation for 50% of landscaping.
  - 2. Zone turf and type of bedding area separately.
  - 3. Timer/controller for watering zones.
  - 4. Moisture sensor [rain delay] controller.
- B.** Water Reuse System: Provide documentation that water reclaimed is from following sources:
  - 1. Treated greywater.
  - 2. Collected rainwater (total water needs include all exterior and interior water use).
  - 3. Recycled water from municipal system.

**PART 3 – EXECUTION**

- A.** Installation:
  - 1. Install high-efficiency irrigation nozzles with an average Distribution Uniformity (DU) of at least 0.70.
  - 2. Direct irrigation away from buildings and structures.
  - 3. Rainwater Harvesting:
    - a. Install system components in accordance with manufacturer's instructions and approved shop drawings.
    - b. Arrange equipment so that components requiring removal or maintenance are readily accessible without disturbing other components. Arrange for clear passage between components.
    - c. Connect to utility supplies and equipment.
    - d. Ground components in accordance with component manufacturer's instructions.
    - e. Install prefilters when the storage tanks are installed.
    - f. Do not bury vortex filters deeper than manufacturer's recommended depth unless a vault is installed.

---

**Recommendations:**

Brae Rain Harvesting Systems *www.braewater.com*

Unit Cost: 1000 gal: \$3,555 / 4000 gal: \$8,705 / 6000 gal: \$12,469

Aquadra Systems—Rainwater Tanks *www.aquadrasystems.com*

Unit Cost: 75 gal: \$485 (6+)

ReWater System *www.rewater.com*

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**32 90 00 / PLANTING / 02900**

Site Improvements 3.4: Landscaping [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 3.4: For plantings, documentation indicating native or adaptive species.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Plants: Provide at least 50% native or adapted plants to project site; do not provide any invasive species on project site.

**PART 3 – EXECUTION (No Comments)**

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**Recommendations:**

Select landscaping with native plants adapted to your local climate that does not require irrigation, fertilizers, or pesticides. Look for native plant nurseries in your immediate area, as they are likely to have specific genotypes best adapted to your region.

Strive to use only organic and non-toxic fertilizers, pesticides, herbicides, fungicides, and pre-emergents.

Locate plantings at least 18 inches from building.

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**Regional Considerations:**

In dry regions, consider using “xeriscaping,” a landscaping strategy that uses drought-resistant plants to significantly reduce or eliminate the need for irrigation.

In other regions, consider using “naturescaping,” a landscaping strategy that conserves water and reduces runoff while providing habitat for beneficial insects, birds, and other wildlife.

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**32 92 00 / LAWNS AND GRASSES / 02920**

Site Improvements 3.4: Landscaping [Mandatory]

**PART 1 – GENERAL****1.1 Informational Submittals**

- A.** Product data for Criterion 3.4: For plantings, documentation indicating native or adaptive species.

**PART 2 – PRODUCTS (Confirm that specified materials meet criteria)**

- A.** Plants: Provide at least 50% native or adapted plants to project site; do not provide any invasive species on project site.

**PART 3 – EXECUTION (No Comments)**

---

**Recommendations:**

Select landscaping with native plants adapted to your local climate that does not require irrigation, fertilizers, or pesticides. Look for native plant nurseries in your immediate area, as they are likely to have specific genotypes best adapted to your region.

Strive to use only organic and non-toxic fertilizers, pesticides, herbicides, fungicides, and pre-emergents.

Avoid the use of turf for landscaping, when possible. Turf is a grass that requires regular maintenance and irrigation.

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**Regional Considerations:**

In dry regions, consider using “xeriscaping,” a landscaping strategy that uses drought-resistant plants to significantly reduce or eliminate the need for irrigation.

In other regions, consider using “naturescaping,” a landscaping strategy that conserves water and reduces runoff while providing habitat for beneficial insects, birds, and other wildlife.

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## Division 33: Utilities

### (Division 02: Site Work)

#### 33 46 00 / SUBDRAINAGE / 02620

Healthy Living Environment 7.12: Water Drainage [Mandatory, when replacing particular assemblies called out in Criterion.]

##### PART 1 – GENERAL

###### 1.1 Informational Submittals

- A. Product data for Criterion 7.12: Provide documentation showing subsurface drainage system in accordance with the **Geotechnical Engineer's** [other qualified professional's] recommendations, to divert underground water away from the structure.

##### PART 2 – PRODUCTS (No Comments)

##### PART 3 – EXECUTION (No Comments)

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###### Recommendations:

Where a high water table exists, provide subsurface drain tile or other drainage system in strict accordance with the Geotechnical Engineer's or other qualified professional's recommendations, to divert underground water away from the structure.

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#### 33 49 00 / STORM DRAINAGE STRUCTURES / 02630

*Site Improvements 3.6: Surface Stormwater Management [Optional]*

##### PART 1 – GENERAL

###### 1.1 Informational Submittals

- A. Product data for Criterion 3.6:
1. Provide documentation showing the stormwater being retained and harvested/infiltrated on site.
  2. Provide permanent labeling of all storm drains [storm inlets] to indicate where the drain [inlet] leads.

## 1.2 Related Sections

- A. Coordinate with Division 07 Section 07 55 63 [07500] Vegetated Roof.

### PART 2 – PRODUCTS (Confirm that specified materials meet criteria)

- A. Stormwater Management:

1. *24-Hour Period: Provide techniques for retaining 0.5 inch of rainfall on-site. Strategies can include but are not limited to: [disconnected downspouts, permeable paving, swales, retention basins, green roofs, sidewalk planters, xeriscaping, naturescaping].*
2. *1-Year Storm: Provide site and building design to accommodate rainfall.*
  - a. Consider rainwater harvesting in addition to infiltrating.

### PART 3 – EXECUTION

- A. Installation:

1. Rainwater Harvesting:
  - a. Install system components in accordance with manufacturer's instructions and approved shop drawings.
  - b. Arrange equipment so that components requiring removal or maintenance are readily accessible without disturbing other components. Arrange for clear passage between components.
  - c. Connect to utility supplies and equipment.
  - d. Ground components in accordance with component manufacturer's instructions.
  - e. Install prefilters when the storage tanks are installed.
  - f. Do not bury vortex filters deeper than manufacturer's recommended depth unless a vault is installed.

## Appendix: Combustion Safety & Carbon Monoxide Inspection

Project teams should consider incorporating these testing procedures before finalizing scope and starting work, as the results may inform the work scope.

### 1. Reference Standards

- a. Building Performance Institute Technical Standards for the Building Analyst Professional.
- b. Building Performance Institute Home Energy Auditing Standard, Section 7, 2009.

### 2. Provide preliminary and post-installation safety inspection of all combustion appliances and connections whenever there are changes to the building envelope and/or heating system.

### 3. Combustion Appliance Zone (CAZ) Depressurization

- a. Measure Base Pressure
  - 1) Close exterior doors, windows, and fireplace damper.
  - 2) Set combustion appliances to pilot setting or disconnect service.
  - 3) Measure and record base pressure CAZ compared to outdoors.
- b. Establish Worst Case
  - 1) Activate clothes dryer, exhaust fans, and air handler to maximize negative pressure in CAZ.
  - 2) Open or close interior doors to maximize negative pressure in CAZ.
  - 3) Measure and record worst case in pressure in CAZ compared to outdoors.
  - 4) If the change in pressure is more than 5 Pa in the negative direction, specify measures to mitigate negative pressure in CAZ.

### 4. Carbon Monoxide Tests

- a. Conduct CO test on all sealed-combustion and power-vented appliances (without atmospheric chimneys).
- b. Measure undiluted flue gases in the throat or flue of the appliance using a digital gauge and measured in parts per million (ppm).
- c. Measure CO at steady-state operating conditions.
- d. If ambient levels exceed 35 ppm at any time during test, turn off the appliance immediately and make appropriate repair.
- e. If gas oven produces more than 200 ppm of CO (or 400 ppm air-free measurement) in undiluted flue gases tested in the oven vent, specify service or replacement.
- f. Action Levels: Refer to Building Performance Institute Technical Standards for the Building Analyst Professional for Combustion Safety Test Action Levels Table:

COMBUSTION SAFETY TEST ACTION LEVELS	
CO test result (CO measurements for undiluted flue gases at steady state) <b>AND/OR</b> spillage and draft test results	Retrofit action.
0–25 ppm <b>AND</b> passes	Proceed with work.
26–100 ppm <b>AND</b> passes	Recommend that the CO problem be fixed.
26–100 ppm <b>AND</b> fails at worst case only	Recommend a service call for the appliance and/or repairs to the home to correct the problem.
100–400 ppm <b>OR</b> fails under natural conditions	<b>STOP WORK:</b> Work may not proceed until the system is serviced and the problem is corrected.
>400 ppm <b>AND</b> passes	<b>STOP WORK:</b> Work may not proceed until the system is serviced and the problem is corrected.
>400 ppm <b>AND</b> fails under any condition	<b>EMERGENCY:</b> Shut off fuel to the appliance and have the homeowner call for service immediately.

## 5. Spillage and Drafts Tests

- a. Complete spillage and draft tests for all natural and induced draft space heating systems and water heaters.
- b. When a chimney is shared by multiple appliances, first test the appliance with the smallest Btu input rating and test remaining appliances in order of increasing input rate.
- c. Measure vent draft pressure at steady-state operating conditions for all natural draft heating and hot water appliances.
- d. Locate draft test approximately 1 to 2 feet downstream of the appliance draft diverter.
- e. Seal the test hole with an appropriate plug after the test.
- f. Acceptable draft test results are as follows:
  - 1) Outside Temperature: less than 10°F; Minimum Draft Pressure: –2.5 Pascal
  - 2) Outside Temperature: between 10–90°F; Minimum Draft Pressure: –2.75 Pascal
  - 3) Outside Temperature: above 90°F; Minimum Draft Pressure: –0.5 Pascal
- g. Acceptable Appliance Spillage Periods: No more than 60 seconds after startup.

## 6. Gas Supply Safety

- a. Inspect entire gas/propane line particularly at joints, shutoff valves, and pilot lines, and repair all leaks.
- b. Gas Leak Detector: Accurately locate leak source using soap bubble solution.
- c. Flexible Gas Lines: Replace all kinked or corroded lines; lines manufactured before 1973; or lines with soldered connections.

## 7. Interim Gas / Propane Oven Testing Procedure

- a. Remove all items from oven and set to highest setting.
- b. Test oven for CO in flue before dilution of air.
- c. After 5 minutes of operation, check for steady state:
  - 1) If measurement is 100 ppm to 300 ppm provide service repair.
  - 2) If measurement is greater than 300 ppm, exhaust ventilation must be provided with capacity of 25 CFM continuous or 100 CFM intermittent.

**8. CO Detectors**

- a. For every home with an attached garage and/or combustion appliances: Confirm that one CO detector per floor level meeting UL-2034 has been installed.

**9. Furnace Inspection**

- a. Visually inspect the burner as the blower fan engages.
- b. If the flames burn differently when the blower engages, determine source of the flame interference.

**10. Attached Garages**

- a. Garage to living space connections: Test for air tightness using a smoke stick in conjunction with the blower door test.

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Columbia, MD 21044  
800.624.4298

**[www.greencommunitiesonline.org](http://www.greencommunitiesonline.org)**  
**[www.enterprisecommunity.org](http://www.enterprisecommunity.org)**